**Masaryk University**
**Faculty of Economics and Administration**
**Department of Finance**
**and**
**Institute for Financial Market**

# European Financial Systems 2019

## Proceedings of the 16th International Scientific Conference

**Editors:**

Josef Nešleha
Lukáš Marek
Miroslav Svoboda
Zuzana Rakovská

**June 24-25, 2019**

**Brno, Czech Republic**

**Suggested citation:**

AUTHOR, A. Title of the paper. In: *European Financial Systems 2019. Proceedings of the 16th International Scientific Conference,* Brno: Masaryk University, 2019, pp. xx-xx. ISBN 978-80-210-9337-9 (for print version Proceeding), ISBN 978-80-210-9338-6 (for on-line version Proceeding).

**Editors:**

Josef Nešleha
Lukáš Marek
Miroslav Svoboda
Zuzana Rakovská



ISBN 978-80-210-9337-9

ISBN 978-80-210-9338-6 (online : pdf)

**Program Committee of the Conference**

**Chair:**

Assoc. Prof. Ing. Eva Vávrová, Ph.D. (Masaryk University, Czech Republic)

**Members:**

Ing. Petr Valouch, Ph.D. (Masaryk University, Czech Republic)

Prof. Dr. Ing. Dana Dluhošová (VŠB – Technical University of Ostrava, Czech Republic)

Prof. Ing. Eva Horvátová, CSc. (University of Economics in Bratislava, Slovak Republic)

Prof. Ing. Danuše Nerudová, Ph.D. (Mendel University Brno, Czech Republic)

Prof. Ing. Juraj Nemec, CSc. (Matej Bel University, Slovak Republic)

Prof. Dr. Svend Reuse, MBA ( FOM Hochschule für Oekonomie und Management, Federal Republic of Germany)

Assoc. Prof. Ing. Petr Dvořák, Ph.D. (University of Economics, Prague, Czech Republic)

Lecturer Univ.-Doz. Mag. Dr. Peter R. Haiss (Vienna University of Economics and Business, Republic of Austria)

Assoc. Prof. Ing. Peter Krištofík, Ph.D. (Matej Bel University, Slovak Republic)

Assoc. Prof. Antonin Rusek, PhD. (Susquehanna University, USA)

Assoc. Prof. Ing. Jaroslav Sedláček, CSc. (Masaryk University, Czech Republic)

Assoc. Prof. Ing. Jitka Veselá, MBA, Ph.D. (University of Economics, Prague, Czech Republic)

Assoc. Prof. Ing. Jana Vodáková, Ph.D. (Masaryk University, Czech Republic)

**Organizing Committee of the Conference**

**Chair:**

Ing. Josef Nešleha

**Members:**

Ing. Lukáš Marek

Mgr. Zuzana Rakovská

Mgr. Miroslav Svoboda

Ing. Martina Sponerová

**Conference website:** www.efs.econ.muni.cz

# PREFACE

Dear readers,

it is my pleasure to introduce a collection of papers from the 16th annual international scientific conference **European Financial Systems 2019** organized annually by the Department of Finance of the Faculty of Economics and Administration, Masaryk University in Brno, Czech Republic. This year's conference focused especially on the current issues related to financial markets, accounting, banking sector, insurance, financial literacy, financial law, different tax systems, corporate finance, international finance, public finance and financing of non-profit organizations.

Since the collection of papers presents the latest scientific knowledge in this area, I believe you will get a number of new insights usable for your scientific, educational and practical activities.

I wish you pleasant reading!

Eva Vávrová

Chairwoman of the Program Committee

## CONTENTS

# Time-based Fee for Vehicles in the Czech Republic: New Model and Challenge?

**Břetislav Andrlík[1], Lucie Zborovská[2]**

[1] Mendel University in Brno
Faculty of Business and Economics, Department of Accounting and Taxes
Zemědělská 1, 613 00 Brno, Czech Republic
E-mail: bretislav.andrlik@mendelu.cz

[2] Mendel University in Brno
Faculty of Business and Economics, Department of Accounting and Taxes
Zemědělská 1, 613 00 Brno, Czech Republic
E-mail: xzborov@mendelu.cz

***Abstract:*** *Road motor traffic in the European Union member states is priced not only through tax instruments, but also through various charges and fees related to the operation of a motor vehicle. This article examines fees based on a time period, applied to vehicles of the maximum weight of 3.5 t. It focuses on the analysis of the current application of time-based fees in individual countries of the EU. The goal of the contribution is designing a new model of time-based pricing of road motor vehicles in the territory of the Czech Republic. The contribution also includes the analysis of legal standards regulating the issue in the Czech Republic and in the EU countries. The outcome of the contribution is a constructed model of a time-based fee, based on pre-defined assumptions which were determined by needs ensuing from the current conditions that affect the operation of chargeable passenger cars and light commercial vehicles. In conclusion, a comparison of receipts from the current system of time-based fees with receipts resulting from the proposed model of time-based fees for the Czech Republic is made.*

*Keywords: vignette, model of time-based fees, Czech Republic, road motor vehicle, motorcycle*

*JEL codes: H20, H23*

## 1 Introduction

Public budgets and special-purpose funds obtain substantial financial amounts through various forms of road pricing (Andrlík et al., 2014). These receipts are mostly directed to central funds and used to build and maintain motorways and other roads. Another possibility is to allocate such resources to budgets of self-governing territorial units – municipalities and regions, where the place of the vehicle or the owner's registration is decisive for determining the final recipient. Road motor traffic in the modern systems of public budgets is priced not only through tax instruments, but also through various charges and fees related to the operation of a motor vehicle.

The most typical forms of non-tax pricing are tolls, fees based on time and registration fees Radvan (2007). This article deals with the time-based fee in the form of a vignette. Time units are used for the determination of the amount of the fee. Most of the EU countries uses the intervals of one week, one month and one year. This form of time-based fee is mostly used for passenger cars and light commercial vehicles (N1 category). Two forms of vignettes are currently used in the European Union: paper and electronic.

In the former case (paper form), the user physically buys a sticker to be placed on the windshield of the vehicle. Of all the eight countries that apply vignettes for the vehicle category of up to 3.5 t, this form is only used in Slovenia and the Czech Republic. Other EU member states use electronic vignettes through the application of microwave or satellite technologies.

## 2 Methods and data

The achievement of the pre-set goal is based on the study of a number of specialized texts, including legal regulations related to the topic both in the Czech Republic and the European Union. The most important data are numerical characteristics available in official statistics prepared by public authorities in the Czech Republic. All the sources used in this article are listed in the bibliography section below. The underlying research is based on the methods of description and analysis in particular concerning the section dealing with vignettes in the Czech Republic and EU countries.

The construction of the model uses mathematical methods for the formulation of sub-processes leading to the design of the model of time-based pricing of road motor traffic in the Czech Republic. This includes namely the determination of shares of the different types of vehicles in the total number of vehicles traveling along charged sections of the infrastructure. Such shares are used for the determination of vignette prices for the new suggested category, i.e. motorcycles. The expected receipts from the sale of vignettes are subsequently calculated for all included categories and are compared with the current amount of receipts from vignettes.

## 3 Vignettes in the Czech Republic and EU countries

Vignettes were introduced in the Czech Republic in 1995 by Act No. 134/1994 Coll., changing and amending Act No. 135/1961 Coll., Road Act. Until the year 2006, it was compulsory to buy the vignette for all categories of road motor vehicles (except motorcycles). For the following three years, this obligation applied to vehicles with the maximum permitted weight of 12 t; since the year 2010, the vignettes apply only to vehicles with the maximum permitted weight of 3.5 t (SFDI, 2018).

The use of vignettes is regulated by Act No. 13/1997 Coll., Road Act, as amended by subsequent regulations. Section 20 (2) Act No. 13/1997 Coll., as amended (hereinafter referred to as "Act No. 13/1997") stipulates two methods of pricing the selected roads. If the decisive factors are the vehicle type and distance traveled, a toll is paid. If the fee is based on a time period, it is in the form of a vignette. One and the same road motor vehicle cannot be imposed both the toll payment and the vignette purchase. Vignettes are compulsory for all vehicles with at least four wheels and the maximum permitted weight of 3.5 t driving along roads that are subject to charges. Section 2 of Government Regulation No. 240/2014 Coll., on the amount of time-based fees, toll rates, toll discounts, and the procedure for applying toll discounts (hereinafter referred to as "Regulation No. 240/2014), the time-based fee may be paid for a calendar year, month or for 10 calendar days. The present system of paper vignettes will be replaced with electronic vignettes (MD ČR, 2019), which is supposed to save several millions CZK annually and at the same time to increase the receipts thanks to the camera systems utilizing the existing toll gates that have been built on charged roads. The new system should be introduced in the year 2021.

There are exemptions from the payment of fees for road motor vehicles which carry severely handicapped citizens who, under a special legal regulation, are disability card holders (ZTP), with the exception of those suffering from complete or practical deafness, or disability card holders with assistant (ZTP/P) in case the disabled person or a close person is the vehicle owner. The exemption also applies to vehicles of armed forces, police, fire brigades and other road motor vehicles listed in Section 20a Act No. 13/1997. Environmentally friendly vehicles not are exempt from the duty to pay the fee at present. The issues of benefits for environmentally friendly vehicles are examined by Andrlík (2012, 2014). It should be added that the obligation to have a vignette or pay a toll does not apply to motorcycles in the Czech Republic.

Czech government approved an amendment to Act No. 13/1997 on 4 February 2019, in which the introduction of electronic vignettes is encoded since 2021. Then, the Czech Republic will become one of the countries that apply the system of electronic vignettes, which works on the principle of registration of the license plate number in a mobile

application or on the Internet; payment in certain distribution points will also be possible. The physical sale of vignettes, existing nowadays, will end upon the introduction of the electronic system. According to MD ČR (2019) almost 100 million CZK could be saved thanks to the electronic system if compared with the current situation. Payments will be monitored by the customs administration and the police through stationary or mobile cameras. The system is used in Slovakia, Hungary, Austria, and pending in Germany. The process of electronization of vignettes in the Czech Republic will be implemented by the Austrian company ASFINAG, which has been administering electronic vignettes in Austria since their introduction in 2018.

As set out in Section 20 (4) Act No. 13/1997, funds obtained from time-based fees are an income of the State Fund of Transport Infrastructure (SFDI). Annex No. 2 of Decree No. 386/2017 Coll., amending Decree No. 306/2015 Coll., on the use of roads priced through a time-based fee, as amended by Decree No. 383/2016, mentions that vignettes must be used on 29 sections and approximately 968 km of motorways and expressways.

As mentioned above, the Czech Republic currently imposes vignettes for all road motor vehicles with at least four wheels and the maximum permitted weight of 3.5 t passing along roads that are subject to charges. This duty does not apply to motorcycles, which are not subject to any other charges on operation, either. The prices of vignettes are set uniformly for all types of vehicles and are listed in Table 1.

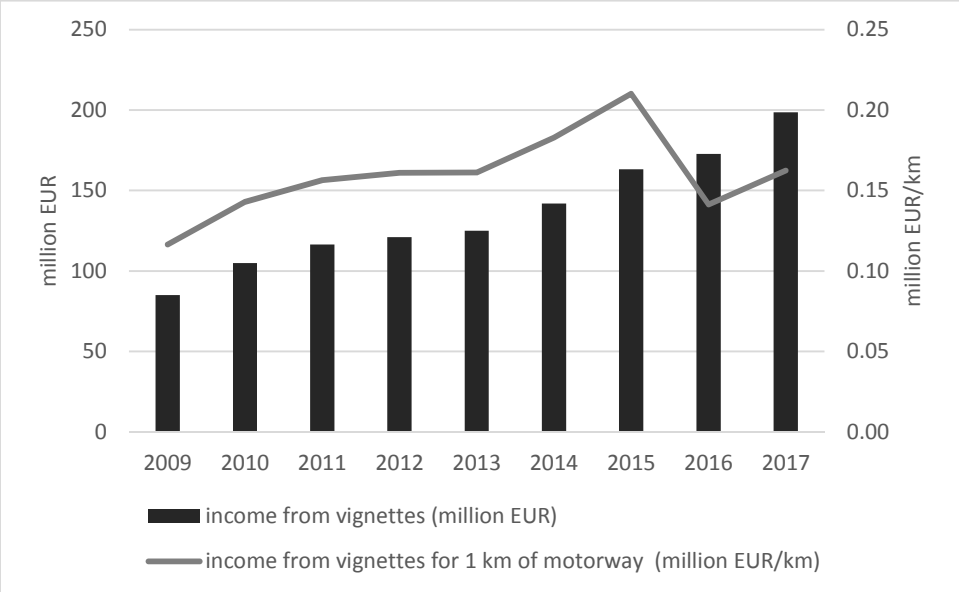
**Table 1** Vignette prices in CR in 2019

| | **10 days (in CZK)** | **30 days (in CZK)** | **1 year (in CZK)** |
|---|---|---|---|
| **Vehicles up to 3.5 t** | 310 | 440 | 1 500 |

Source: Government Regulation No. 240/2014 Coll.

Figure 1 below shows receipts of a public budget from vignettes; namely the income of the SFDI from 2009 to 2017.

**Figure 1** Receipts from Vignettes in the CR in 2009-2017



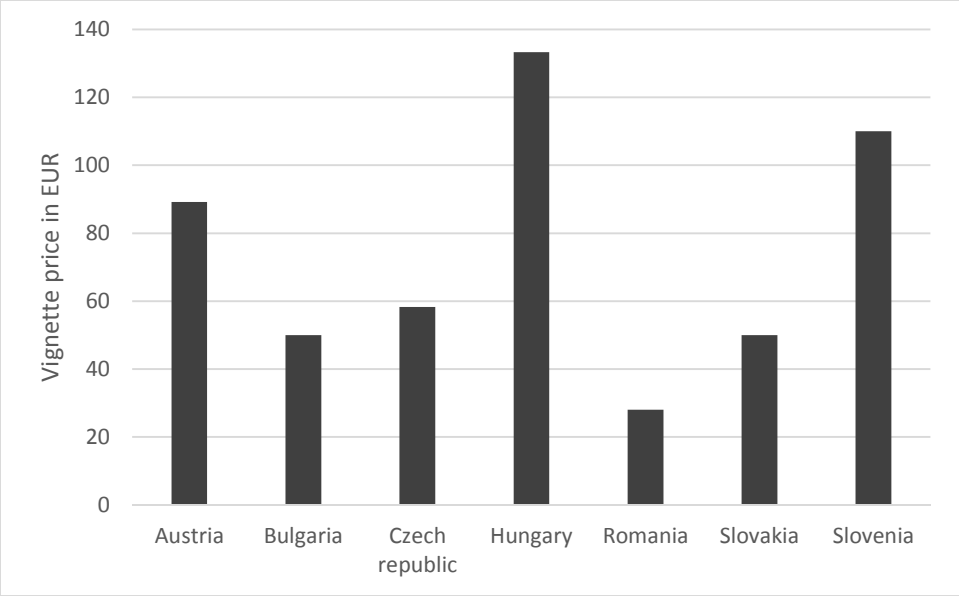

Source: authors, SFDI (2019) and PORDATA (2019)

It is apparent from Figure 1 that the receipts collected through the sale of vignettes have been growing. This tendency is confirmed by the growing number of vehicles paying this fee for the use of transport infrastructure and it is also related to the growing number of vehicles registered in the Czech Republic.

Only 17 countries of the European Union (Bulgaria, Czech Republic, France, Croatia, Ireland, Italy, Lithuania, Latvia, Hungary, Poland, Portugal, Austria, Romania, Greece, Slovak Republic, Slovenia and Spain) assess fees for the use of infrastructure by vehicles with the maximum permitted weight of up to 3.5 t. 8 of the 17 countries (Bulgaria, Czech Republic, Lithuania, Hungary, Austria, Romania, Slovakia and Slovenia) apply a time-based fee in the form of a vignette. In Bulgaria, Romania and Lithuania, the vignettes are the only form of road pricing. On the other hand, vignettes are compulsory for all vehicles except motorcycles in Bulgaria and Romania. Lithuania imposes the purchase of a vignette on vehicles of up to 3.5 t as well as on vehicles weighing more than 3.5 t. However, in the case of vehicles of up to 3.5 t, this fee is only mandatory for M2 category buses and coaches, heavy duty vehicles and their combination in N1 category and special vehicles of categories N1 and M2. The duty does not apply to motorcycles and passenger cars in Lithuania. In vehicles over 3.5 t, the charges are imposed on buses and coaches of M3 category, heavy duty vehicles and their combinations of categories N2, N3 and special road vehicles in M3, N2 and N3 categories. The Czech Republic, Hungary, Austria, Slovakia and Slovenia have introduced vignettes only for vehicles with the maximum permissible weight of 3.5 t. Motorcycles are also subject to vignette purchase in Hungary, Austria and Slovenia. On the contrary, in the Czech Republic and the Slovak Republic (as well as in Bulgaria, Romania and Lithuania) motorcycles are not required a vignette when traveling on charged roads (ACEA, 2019).

The amount of fee is contingent only on the duration of the vignette validity in the Czech Republic and Slovakia. In Bulgaria, Hungary, Austria, Romania, Slovenia and Lithuania, the amount is determined on the basis of a unit of time, but also according to the vehicle category. Besides, the role of the EURO standard, which affects the amount paid for the vignette, is also decisive in Bulgaria (only for vehicles over 3.5 t) and Lithuania.

**Figure 2** Prices of Annual Vignette for Passenger Cars in EUR, year 2019




Source: own work based on Tolls.eu (2019)

The prices of annual vignettes for passenger cars are shown in Figure 2 in all countries except Lithuania, where passenger cars are not subject to this duty. Conversion of Czech and Hungarian currencies to Euro was made using the exchange rate as of 2 January 2019. For Czech crown, this is 25.75 EUR/CZK, for Hungarian forint it is 322.35 EUR/HUF (Kurzy.cz, 2019). The prices in other countries are listed in Euro. The lowest price of a vignette is in Romania, 28 EUR. The highest price is in Hungary, amounting to 133.3 EUR. The Czech Republic has the annual vignette rate similar to Bulgaria and Slovakia.

Charges for vehicles below 3.5 t are virtually unregulated on the European level. Their assessment is only based on the Treaty on the Functioning of the European Union (European Union, 2012) and on the Communication from the Commission COM 199 on the application of national road infrastructure charges levied on light private vehicles (European Commission, 2012). It follows from the Communication that the member states are entitled to introduce any system of charges that respects the principle of non-discrimination and proportionality in connection with citizenship, as set out in the European Union (2012).

In view of the currently discussed environmental impacts of transport and the related efforts to include environmental elements to the design of charges levied on the operation of motor vehicles, it is only Lithuania that has introduced such element for vehicles of up to 3.5 t (in the form of factoring the EURO standard applicable to the vehicle), and it only applies to buses and coaches of M2 category, heavy duty vehicles and their N1 category combinations and special vehicles in N1 and M2 categories. None of the EU countries takes into account the important EURO standard relevant for the vehicle, nor any other environmental aspect (ACEA, 2019).

## 4 Vignette model in the CR

The model of a new system of time-based pricing using vignettes has been inspired by systems applied in Slovenia, Austria and Hungary, where the rates differ according to individual categories of vehicles of up to 3.5 t, including motorcycles. Motorcycles are currently allowed to drive free of charge on roads and motorways in the Czech Republic. The reason for including motorcycles is that motorcycles participate in the traffic and thus the infrastructure wear and burden similarly to passenger cars and N1 light commercial vehicles. That is why the proposed system of pricing includes motorcycles. The determination of the "motorway fee" will differentiate among the categories of included vehicles. Its rates will depend on the degree of the supposed impact of the given category on the transport infrastructure. As mentioned by SFDI (2011), two wheels wear down the infrastructure much less that four wheels of passenger and light commercial vehicles. Moreover, light commercial vehicles carry heavier load than passenger cars and have larger impact on the infrastructure.

SFDI (2011) also mentions that fees for motorcycles should have been imposed as early as in 1995, when this form of time-based fee was introduced. The fact is that there were much less motorcycles driving on Czech roads and motorways at that time. The situation is different nowadays, as the number of motorcycles registered and operated in the Czech Republic has been rapidly growing. According to the Car Importers Association (SDA), the number of newly registered motorcycles increased by 64.3 % from the year 2004 to 2018 (SDA, 2019). SFDI (2011) mentions that the number of traffic accidents caused by motorcycles has increased, too. Interventions and liquidation of such accidents are costly, and therefore, such costs can be settled from funds obtained from the sale of vignettes for motorcycles. As mentioned below, accidents where motorcycles are involved are often very serious and require deployment of a large number of rescue units. This fact is evidenced by statistics of accidents, which show that the indicators of accident gravity were the worst for motorcycles in the years 2007 to 2018 (PČR, 2019).

**Table 2** Vehicle numbers on charged roads for selected vehicle categories in 2016

| | LCV | Passenger vehicles | Motorcycles | Total |
|---|---|---|---|---|
| **Vehicle numbers in pieces** | 604 327 | 5 496 938 | 19 950 | 6 121 215 |
| **share in %** | 9.8 | 89.8 | 0.4 | 100 |

Source: ŘSD ČR (2016), own calculation

Table 2 shows that the share of motorcycles in total number of vehicles is relatively low if compared with passenger cars and LCVs (light commercial vehicles). The data are from

2016, the year of the last national traffic census. Another survey will be conducted in 2021 (data are collected on a five-year basis). The model designed as a result of the present research uses the data from 2016 as the latest source of information on number of vehicles. Therefore, the proposed model relates to the year 2016.

As mentioned above, the system of electronic vignettes will be introduced in the Czech Republic since 2021, whereas the rates should remain the same as under the present legal regulation (MD ČR, 2019). However, the prepared amendment to Act No. 13/1997 Coll., Road Act, proposes the increase in the maximum price of annual vignette from 1 500 CZK to 2 000 CZK. The Czech Ministry of Transport is therefore preparing for the increase in rates in order to avoid another amendment in the near future. Nevertheless, in February 2019, the Czech government approved the introduction of electronic vignettes with the amount of CZK 1 500 CZK for the annual vignette (MD ČR, 2019).

The present design of the new system of vignettes will be based not only on systems applied in Slovenia, Austria and Hungary, but also on the assumption that the government will reconsider its current view and the annual price will increase from 1 500 CZK to 2 000 CZK, as contemplated in the prepared amendment. Another assumption in designing the new model is that the total receipts from vignettes will not exceed the present receipts by more than 5 %. This assumption has been included due to the frequently mentioned efforts of the Czech Ministry of Finance not to increase current taxes and charges levied in the Czech Republic. The design of the model is also based on the fact that the vignette prices should reflect the degree of the infrastructure wear in connection with the vehicle category. For this reason, the currently applied annual price of 1 500 CZK will be assigned to the category of passenger cars whose counts on charged roads predominates; see Table 2. Thus, the largest part of entities paying this fee will not be affected by the increase in its price. In the proposed amendment to Act No. 13/1997 Coll., the maximum price of the annual vignette in the amount of 2 000 CZK is assigned to the category of light commercial vehicles due to the fact that this type of vehicles is the worst burden for roads of all the categories charged. The price of a vignette for motorcycles is determined with the help of a ratio derived from the determined prices of vignettes for passenger cars and light commercial vehicles. The vignette price is calculated as follows: Because the vignette for LCVs is by 500 CZK more expensive than for passenger cars, the price for passenger cars is by 500 CZK higher than for motorcycles. The result of such calculation is that the prices of vignettes for passenger cars are by 50 % higher than for motorcycles, and vignettes for LCVs are by 100 % more expensive than for motorcycles. The distribution of annual vignette prices thus corresponds to the assumption on reflecting the degree of transport infrastructure wear by the given category of vehicles to which the time-based fee applies.

At present, the price of the monthly vignette equals to 29.3 % of its annual value and the 10-day vignette costs 20.7 % of its annual value. These ratios have been maintained in the determination of new prices, as shown in Table 3.

**Table 3** Vignette prices according to new model by vehicle categories

| | **10 days (in CZK)** | **1 month (in CZK)** | **1 year (in CZK)** |
|---|---|---|---|
| **Motorcycles** | 207 | 293 | 1 000 |
| **Passenger vehicles** | 310 | 440 | 1 500 |
| **Light commercial vehicles** | 414 | 586 | 2 000 |

Source: own calculation

It follows from Table 3 that there is no change in the case of passenger vehicles if compared with the current state. In the new category of motorcycles, the prices have been determined by the above method, which respects the present ratios of vignette prices depending on the period of validity. For instance, the 10-day vignette costs 207 CZK, the monthly vignette 293 CZK and the one-year vignette 1 000 CZK. For the category of LCVs, the price of annual vignette has increased by 33.33 % if compared with the current situation. The higher rates for this category have been determined in

accordance with the initial assumption and taking into account the prepared amendment of Act No. 13/1997 Coll., Road Act. The proposed model envisages the exemption of environmentally friendly vehicles (electric and hydrogen-powered vehicles) from the payment of fees on roads that are subject to charges. The support for such vehicles is based on the National Action Plan for Clean Mobility (MPO, 2015); such vehicles do not pollute the environment with harmful emissions unlike conventional petrol or diesel vehicles.

Table 4 lists the receipts of the State Fund of Transport Infrastructure from vignettes in the Czech Republic in 2016. The total income from the sale of vignettes reached the amount of 4 757.96 million CZK in 2016.

**Table 4** Receipts from the system of vignettes in 2016

| Vignette type | Number of vignettes sold (in pcs) | Rate (in CZK) | Receipts (in CZK) |
|---|---|---|---|
| 1 year | 2 315 432 | 1 500 | 3 473 148 000 |
| 1 month | 602 448 | 440 | 265 077 120 |
| 10 days | 3 289 472 | 310 | 1 019 736 320 |
| **Total** | **6 207 352** | **-** | **4 757 961 440** |

Source: SFDI (2016)

The receipts from the sale of vignettes according to the proposed model for the individual categories of vehicles is as follows:

1. The numbers of vignettes sold in a certain category have been determined from the total number of vignettes sold, multiplied by the number of vehicles in the percentages for the vehicle categories (see Table 2), rounded up to whole pieces.
2. The resulting numbers of vignettes sold are multiplied by the vignette price calculated in Table 3 for the individual periods of the vignette validity.

**Table 5** Receipts from new model of vignettes in 2016

| Vignette type | Vehicle category | Share in % | Number of vignettes sold (in pcs) | Price (in CZK) | Receipts (in CZK) |
|---|---|---|---|---|---|
| 1 year | Motorcycles | 0.4 | 9 262 | 1 000 | 9 262 000 |
| | Passenger vehicles | 89.8 | 2 079 258 | 1 500 | 3 118 887 000 |
| | LCV | 9.8 | 226 912 | 2 000 | 453 824 000 |
| 1 month | Motorcycles | 0.4 | 2 410 | 293 | 706 130 |
| | Passenger vehicles | 89.8 | 540 998 | 440 | 238 039 120 |
| | LCV | 9.8 | 59 040 | 586 | 34 597 440 |
| 10 days | Motorcycles | 0.4 | 13 158 | 207 | 2 723 706 |
| | Passenger vehicles | 89.8 | 2 953 946 | 310 | 915 723 260 |
| | LCV | 9.8 | 322 368 | 414 | 133 460 352 |
| **Total** | | | **6 207 352** | | **4 907 223 008** |

Source: own calculation

Table 5 lists the numbers of vignettes sold and determines the receipts from each included category of vehicles that are obliged to have a vignette when driving on charged sections of roads in the proposed model. The receipts according to the new model are by 3.14 % higher than those based on the current system (using data from the year 2016). In absolute terms, this is the amount of 149 262 million CZK.

## 5 Conclusions

At present, the Czech Republic applies vignettes for vehicles of up to 3.5 t, similarly to another seven countries of the European Union: Bulgaria, Lithuania, Hungary, Austria, Romania, Slovakia and Slovenia. Vehicles whose weight exceeds 3.5 t are subject to charges based on traffic performance, which apply in another 22 EU countries (all member states except for Bulgaria, Finland, Lithuania, Cyprus, Malta and Romania). Vignettes in the Czech Republic are compulsory for all vehicles with at least four wheels and the maximum permitted weight of up to 3.5 t driving along priced roads. The current system of vignettes does not differentiate among vehicles whose weight is below 3.5 t and the vignette price is uniform in the amount of 1 500 CZK.

The goal of this contribution was, on the basis of pre-defined assumptions, to create a model of time-based fees paid for the operation of various categories of vehicles of up to 3.5 t. The results stated in the text may be summarized into the following conclusions regarding the designed model of vignettes in the Czech Republic. A substantial change was made in the system of time-based fees: the single category of vehicles below 3.5 t was divided into the groups of passenger vehicles and light commercial vehicles. Another group of motorcycles, which have not been subject to road charges up to now, was added. This fact reflects the first assumption defined before the design of the new model. The prices of annual, monthly and 10-day vignettes were calculated for each category of the vehicles. Vignette prices were determined depending on another assumption of the proposed model, i.e. reflecting the degree of transport infrastructure wear attributable to the operation of a certain type of vehicles. Another pre-defined assumption was that the total receipts from the sale of vignettes will not exceed 5 %. This assumption was also met and the amount of total receipts based on the model year 2016 was by 3.14 % higher. The data from 2016 were used due to the availability of comprehensive information enabling the design of a time-based fee model. The proposed model also assumes that the range of exemptions under Section 20a Act No. 13/1997 Coll., will be expanded to include "green" vehicles, i.e. electric and hydrogen-powered vehicles, thereby contributing to the fulfillment of goals set out in the National Action Plan for Clean Mobility.

The designed model of a time-based fee in the Czech Republic is definitely a challenge that, if put to practice, would effectively address the existing imperfections of the current system of pricing the operation of road motor vehicles in the Czech Republic.

## Acknowledgments

This paper was supported by the Technology Agency of the Czech Republic – TACR ETA TL01000308.

## References

ACEA (2019). *Tax Guide 2019.* Retrieved from: https://www.acea.be/uploads/news_docu docum/ACEA_Tax_Guide_2019.pdf.

Act No. 134/1994 Coll., changing and amending Act No. 135/1961 Coll., Road Act.

Act No. 13/1997 Coll., Road Act, as amended.

Andrlík, B. (2012). Taxation of passenger motor vehicles with environmental aspect. *Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis,* vol. 60(7), pp. 9-18.

Andrlík, B. (2014). Carbon dioxide emissions as an indicator of reduction of negative externalities related to road motor vehicle operation. *Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis,* vol. 62(4), pp. 613-621.

Andrlík, B., Misařová, P., Vrtalová, J. (2014). Preparedness of the Czech Republic for taxation of road motor vehicles based on CO2. *Procedia Economics and Finance,* vol. 12, pp. 10-19.

Annex No. 2 of Decree No. 386/2017 Coll., amending Decree No. 306/2015 Coll., on the use of roads priced through a time-based fee, as amended by Decree No. 383/2016.

European Commission (2012). *Communication from the Commission on the application of national road infrastructure charges levied on light private vehicles.* Retrieved from: https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1559300280663&uri=CELEX%3A52012DC0199.

European Union (2012). *Treaty on European Union and the Treaty on the Functioning of the European Union.* Retrieved from: https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1559119014253&uri=CELEX%3A12012E%2FTXT.

Government Regulation No. 240/2014 Coll., on the amount of time-based fees, toll rates, toll discounts, and the procedure for applying toll discounts, as amended.

KURZY.CZ (2019). *Převod měn-Převodník měn online.* Retrieved from: https://www.kurzy.cz/kurzymen/kurzy.asp?a=X&mena1=CZK&mena2=EUR&c=1500&d=02.01.2019&convert=P%F8eve%EF+m%ECnu.

MD ČR (2019). *Vláda podpořila zavedení elektronických dálničních známek, zdražovat se nebude*. Retrieved from: https://www.mdcr.cz/Media/Media-a-tiskove-zpravy/Vlada-podporila-zavedeni-elektronickych-dalnicnich?returl=/Media/Media-a-tiskove-zpravy.

MPO (2015). *Národní akční plán čisté mobility*. Retrieved from: https://www.mpo.cz/cz/prumysl/zpracovatelsky-prumysl/automobilovy-prumysl/narodni-akcni-plan-ciste-mobility--167456/.

PČR (2019). *Statistika nehodovosti.* Retrieved from: https://www.policie.cz/CLANEK/STATISTIKA-NEHODOVOSTI-900835.ASPX.

PORDATA (2019). *Length of Motorways.* Retrieved from: https://www.pordata.pt/en/DB/Europe/Search+Environment.

Radvan, M. (2007). *Zdanění majetku v Evropě*. Praha: C.H. Beck, Beckova edice právo a hospodářství.

ŘSD ČR (2016). *Celostátní sčítání dopravy 2016*. Retrieved from: https://www.rsd.cz/wps/portal/web/Silnice-a-dalnice/Scitani-dopravy.

SDA (2019). *Registrace nových vozidel kategorie L v ČR 3/2019.* Retrieved from: http://portal.sda-cia.cz/stat.php?n#rok=2019&mesic=3&kat=L&vyb=cel&upr=&obd=m&jine=false&lang=CZ&str=nova.

SFDI (2011). *Dálniční poplatky pro motorky – letos ještě ne.* Retrieved from: https://www.rozhlas.cz/zelenavlna/motorkari/_zprava/dalnicni-poplatky-pro-motorky-letos-jeste-ne--941639.

SFDI (2016). *Závěrečná zpráva k hospodářským výsledkům dálničních kupónů emise 2016*. Retrieved from: https://www.sfdi.cz/dalnicni-kupony/zaverecne-zpravy/.

SFDI (2018). *Vývoj cen dálničních kuponů.* Retrieved from: https://www.sfdi.cz/dalnicni-kupony/dalnicni-kupony-2018/vyvoj-cen-dalnicnich-kuponu/.

SFDI (2019). *Výroční zprávy a účetní závěrky.* Retrieved from: https://www.sfdi.cz/rozpocet/vyrocni-zpravy-a-ucetni-zaverky/.

TOLLS.EU (2019). *Dálniční známky a poplatky v Evropě 2019.* Retrieved from: https://www.tolls.eu/cs/.

# Financial Bilingualism as a Success Factor for Effective Business Combination Project: The Case of US Investors

**Alexandra Bagiová1, Jitka Meluchová2, Martina Mateášová3**

[1] University of Economics in Bratislava
Faculty of Business Informatics, Department of Accounting and Auditing
Dolnozemská cesta 1/b, 852 35 Bratislava, Slovakia
E-mail: alexandra.bagiova@euba.sk

[2] University of Economics in Bratislava
Faculty of Business Informatics, Department of Accounting and Auditing
Dolnozemská cesta 1/b, 852 35 Bratislava, Slovakia
E-mail: jitka.meluchova@euba.sk

[3] University of Economics in Bratislava
Faculty of Business Informatics, Department of Accounting and Auditing
Dolnozemská cesta 1/b, 852 35 Bratislava, Slovakia
E-mail: mateasova.martina@gmail.com

***Abstract:*** *Many of the world's capital markets require some version of IFRS for financial statements of listed entities. With IFRS covering 87% of the world´s biggest jurisdictions, it is a key success factor for a US capital market participant to be financially bilingual, as they continue to look for global investment opportunities. In this paper we identify the key issues evolving in the decision-making process when engaging in business combinations with IFRS preparers. Using detailed textual analysis of the current IFRS and US GAAP provisions, the paper identifies the set of factors to consider in any merger or acquisition made between US company and a company reporting under IFRS. We concluded that despite of the global harmonization of accounting reporting in the area of business combinations there are still implication differences causing significant changes in the value of shares, equity or goodwill that might imperil the success of investment decisions of US investors. Therefore, the aim of the submitted paper is to provide guidelines on reduction risks resulting from a lack of knowledge of the differences between the IFRS and the US GAAP and to create information basis for both, investors primarily using US GAAP but also those preferring the IFRS, to become financially bilingual.*

*Keywords: IFRS, US GAAP, business combinations, investment decision, goodwill, merger and acquisition*

*JEL codes: F36, F65, M40, M41*

## 1 Introduction

Globalization of the world economy beginning in the second half of the 20th century led to a rapid increase in international economic transactions and so it has prompted the idea of creating global accounting standards. Their purpose was to harmonize information presented in financial statements of transnational companies operating all around the world. By doing so, not only transparency of accounting and financial reporting was to be increased, but also the likelihood of maintaining the stability of global financial markets.

In 1973 accounting organisations of eleven world leading economies (incl. Australia, Canada, France, Germany, Japan, Mexico, Netherland, United Kingdom, Ireland and the USA) established the International Accounting Standards Committee (IASC), the predecessor of the International Accounting Standards Board (IASB), which nowadays operates as an independent team of experts that develops and approves International Financial Reporting Standards (IFRS). In 2018 IFRS was, at least in some extend required in 144 jurisdictions worldwide (IFRS Foundation, 2019).

While in the most of these jurisdictions the one-sided process of convergence of national accounting standards to the IFRS has been launched, in case of the USA, national

US Generally Accepted Accounting Standards (US GAAP) were dominating the process of convergence first. Even though the relationship between US GAAP and IFRS is much more balanced today, the deep-rooted US economy's social imperatives has had a huge impact on revising existing or creating new interrelated IFRS and US GAAP standards (Bagiová, 2018). According to the US GAAP, information needs of investors are superior to the information needs of other external entities (Meluchová, 2016), which was also transferred to the IFRS under the revised Conceptual Framework, as following: *"The objective of the financial reporting is to provide financial information about the entity that is useful to existing and potential investors, banks, statutory bodies and other entities in the process of making resources decisions."* (Flood, 2018)

The US has long been the country with the highest inflow and outflow of foreign direct investments (FDI) in the world and the country where most of the biggest companies have their origin (UNCTAD, 2019). With such a volume of investment, the US investors are those, whose decisions are crucial for the stability of international financial markets. Since IFRS covers 87% of the world economies (IFRS Foundation, 2019), for US investors to understand financially bilingual transactions is very important. They should not only have enough knowledge to identify differences between US GAAP and IFRS, but also the ability to prepare financial statements under both. Main reasons for this need emerge from factors such as following:

- mostly it is mandatory to comply with IFRS requirements when US investors look for global investment opportunities abroad,
- cross-border mergers and acquisitions or other capital-raising activities mostly require the use of IFRS when processed outside the USA,
- demand of non-US stakeholders in US companies to use of IFRS is rising,
- as US companies have many non-US subsidiaries, they consolidate financial statements prepared under IFRS and transform them according to the requirements of US GAAP,
- the decision of SEC (The Security and Exchange Commission) from December 2007 to accept IFRS-compliant financial statements for non-US companies on the US regulated market without the need to transform them made IFRS the internal part of US financial market.

All these situations require the investor to be able to consider in its decisions-making process that, when applying IFRS, the value of assets and liabilities may be different than it would be under US GAAP.

## 2 Methodology and Data

The aim of the submitted paper is to identify key issues evolving in the decision-making process of a company reporting under US GAAP that engage in a business combination with an IFRS preparer, and to help potential investors reduce risks of making unprofitable decisions considering such a transaction. Research that precedes meeting this goal is based on the US GAAP Accounting Standards Codification (ASC) 805 – Business Combinations provisions on one hand and the IFRS 3 – Business Combinations on the other.

Since analysing all the differences evolving from the comparison of IFRS and US GAAP provisions would be very extensive, our approach is to begin by narrowing the issue. We look at the process of cross-border business combinations from the perspective of US investors reporting under the US GAAP, who make an investment decision on a cross-border M&A (merger and acquisition) transaction, where the target is a company reporting under the IFRS.

Based on the hypothesis that accounting for acquisitions of assets differs significantly from that of acquisition of business, first we focus on proper identification of the transaction. This we consider essential for any further discussion on how investor should decide about engaging in such a transaction or not. By synthesis of our acquired knowledge we create the basic tool for classifying the transaction correctly.

As a next step, we analyse the phases of a business combination. It allows us to identify that part of the process, when it is important to collect information on applied IFRS accounting standards and how their application differ from US GAAP and assess the importance of the identified differences.

At last, we analyse which differences in reporting assets, liabilities and equity under IFRS and under US GAAP have the most significant impact on investor´s decision-making process. On those points we identify as the riskiest to omit in we provide a guidance and explanation, why the difference is present and how to handle it when transforming IFRS financial statements to the reporting under the US GAAP. Identified differences that are related to the formal or structural aspects of accounting and financial reporting are excluded. We only deal with those affecting the value of the assets, liabilities and equity. Special focus is placed on the value of noncontrolling interest and goodwill.

## 3 Results and Discussion

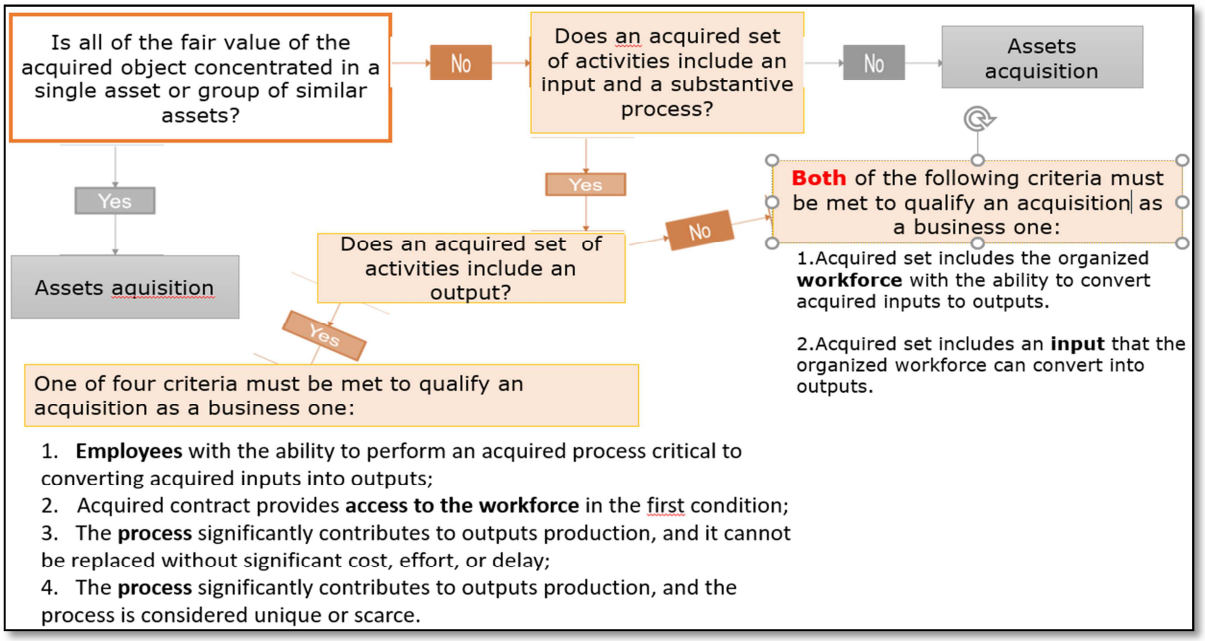
Under the existing guidance for business combinations, in both ASC 805 and IFRS 3, an entity determines whether a transaction is a business combination based on whether the acquired subject meets the definition of a "business". In this context, both standards have been amended in 2017 with similar intentions. According to the FASB (Financial Accounting Standards Board), because the previous definition was applied too broadly, ASC 805 has been amended *"to clarify the definition of a business with the objective of adding guidance to assist entities with evaluating whether transactions should be accounted for as acquisitions of assets or businesses"* (FASB, 2017).

Business remained to be considered as an integrated set of activities capable of providing a return (further as "a set"), but the amended standard provides investors a screen to determine whether a set is or is not a business. The screen operates with three elements – inputs, processes and outputs (for their definition see ASC 805-10-55-4). Based on our analysis, we created the decision tree that simplifies the issue of distinction between assets and business acquisitions (see Figure 1). It follows the essential assumption of the standard that while inputs and processes are necessary elements of the business, outputs may not be present. Even when we are not able to identify outputs as the part of the target of the acquisition, it can be considered as a business, when two conditions are fulfilled (FASB, 2017):

- Employees formed in an organized workforce have all the skills, knowledge or experience to transform inputs into outputs and thereby ensure the production. The process performed by workforce must be substantive, which means the process that significantly contributes to the ability to continue producing outputs and cannot be replaced without significant cost, effort, or delay in production.
- Present inputs could be developed or converted into outputs (f.e. intellectual property used to develop a good or service, resources to create outputs, technology, mineral interests, real estate or in-process research and development).

When there is no presumption that acquired entity can transform inputs to outputs itself, there is no relevant reason to classify such an acquisition as the one concerning business.

**Figure 1** Decision tree for differencing acquisitions types




Source: Own arrangement based on the data retrieved from the ASC 805

**Phases of the business combination transaction**

When investors conclude that planned transaction meet the criteria for classify them as business transactions, from that moment on we can discuss the process of business combination transaction. In both, theory and practice, we were faced with several approaches on how to divide this process. We prefer a division into three phases, as described below:

- *Deal preparation* – also known as pre-combination phase is where the idea of transactions comes out. This is the phase where information about the target company is collected and the strategic planning take place. When finding the right target for a M&A transaction that is compliant with available sources and strategic objectives of the investor, this is followed by the process of understanding differences in financial issues of the target company. These are mainly tax requirements of its home country, M&A conventions on national and international level, market specifications for the certain region, and legal practice of the country. Assessment of accounting information and information about applied financial reporting standards starts here. Putting the investor and potentially acquired company on common financial terms is advisable. Optimally, audited financial statements of a potential acquiree should be used as the source of information on financial situation of the company, but due to increased costs and information unavailability that does not happen usually. To lower the costs, acquiring companies do the analysis in-house, while not all items are translated, but mainly those most relevant for the decision-making or those where some unusual values are detected.
- *Due diligence* –reasonable steps are taken in order to satisfy legal requirements of transaction. At this stage, differences between US GAAP and IFRS are considered mostly in terms of formal and structural differences of financial statements and in terms of preparing opening consolidation statements or initial valuations of assets and liabilities.
- *Reporting* – at this stage the deal is made, and the investor looks at how to report the acquired company in its consolidated financial statements. First, the process of translating financial statement under IFRS to the US GAAP must be set and

then the methodology of involving these statements into the companies consolidated accounting, reporting and financial statements.

Many cross-border transactions take place outside the USA, even if US investors are engaged. These investors first operate with IFRS individual financial statements of the potential acquire, which is usually transposed into the consolidated financial statement under the ASC 805. But to meet international requirements, also the consolidated financial statement under the IFRS should be prepared. Therefore, in the next part of presenting our results we discuss the change in value of selected items comparing the ASC 805 and IFRS 3 provisions. Financial statements are prepared in the final stage of business combination *Reporting*, but the discussed differences presented below should be considered much sooner, advisably in the first stage *Deal preparation*.

**Measurement of noncontrolling interest (NCI)**

According to the ASC 805-20-25-1 and IFRS 3.10, as of the acquisition date, the acquirer shall recognize, separately from goodwill, the identifiable assets acquired, the liabilities assumed, and any noncontrolling interest in the acquire. Under ASC 805, the acquirer is required to record any noncontrolling interest at their acquisition-date fair values (ASC 805-20-30-1). There is no other option to choose for setting the value of NCI under the US GAAP.

IFRS 3 gives two options. NCI ownership that entitle the holder to a proportionate share of net assets in a liquidation may be measured at either fair value or as the NCI's proportionate share of the acquiree's aggregate identifiable net assets. While measurement at fair value includes goodwill, in the second the goodwill is excluding. As a result, the value of NCI and goodwill under the IFRS may be lower under if an investor selects the second option. We illustrate this on the Figure 2 bellow. The accounting election related to the measurement of the noncontrolling interest in a partial acquisition can impact the amount of goodwill recognized under IFRS. However, goodwill is the same for a full or partial acquisition under US GAAP.

**Figure 2** Example on measuring NCI under the IFRS 3

| | NCI BASED ON FAIR VALUE | NCI BASED ON PROPORTIONAL INDENTIFIED NET ASSETS |
|---|---|---|
| Consideration transferred for a 90% interest | 90 | 90 |
| NCI | 10 (assumed proportional fair value of the 10% NCI) | 7 (10% of the fair value of net assets of 70) |
| Total consideration | 100 | 97 |
| Net assets | (70) | (70) |
| Goodwill | 30 (100 minus 70) | 27 (97 minus 70) |

Source: Own arrangement based on the provisions of IFRS 3

**Contingent assets and liabilities**

Contingent assets and liabilities are existing conditions or sets of circumstances, but they result in certain uncertainty about a possible gain or loss. The approach of IFRS and US GAAP to their recognition and measurement differs significantly. Under ASC 805, both contingent assets and liabilities are recognized, while under the IFRS 3 contingent liabilities are recognized at the acquisition, but contingent assets never.

Under the ASC 805, both the assets and liabilities are measured at fair value, if the acquisition-date fair value can be determined during the measurement period. If it cannot be determined, there are two criteria should be met. One considers existence of one or more future events confirming the existence of the asset or liability and the other

is that the amount of asset or liability can be reasonably estimated. That estimate is subsequently used for setting the value of contingent asset or liability.

Under the IFRS 3, contingent liabilities are initially recognized at fair value if they meet the definition of a present obligation and are reliably measurable. Subsequently, at the end of each period they are recognized at the higher of the best estimate to the date of subsequent recognition and of an acquisition-date fair value lowered by amortization.

**Previously held equity interest in an acquire**

In recent years, many companies are much more cautious in making investment decisions, so the acquisition is preceded by obtaining minor equity interest in a target company. Later, when investor decides to make a business acquisition, the recognition and measurement of its prior equity interest must be considered. On the acquisition date, the acquirer exchanges its status as an owner of an investment in the acquiree for a controlling financial interest of the acquire. Gain or loss is recognized based on the remeasurement of this previously held equity interest in the acquiree to fair value. If there are any prior adjustments to the fair value of this equity interest recognized directly in equity through the comprehensive income, here the treatments under US GAAP and IFRS differs. Under US GAAP this should be reclassified and included in gain or loss. Under IFRS it should be recognized on the same basis that would be required if the acquirer had.

## 4 Conclusions

Many of the world's capital markets require some version of IFRS for financial statements of listed entities. IFRS has become international language of accounting and financial reporting

Despite the ongoing convergence process of IFRS and US GAAP, investors should continue to perceive the differences between the application of these two sets of standards in both the impact of accounting methods and disclosure requirements. Understanding these differences and their impact on key deal metrics will lead to a more informed decision-making process and more accurate purchase price setting. On the opposite, omission of relevant differences between US GAAP and IFRS may pose risks not only to the transaction itself, but when omitted market-wide it may destabilise the whole financial market.

That is the reason why financial bilingualism is becoming one of the main features of a successful investor. Since getting enough knowledge from direct comparison of US GAAP and IFRS is very time intensive, the aim of submitted paper, based on the previous research, was to present key issues evolving in the decision-making process of US investors that engage in a business combination with an IFRS preparer. To do so, we placed focus on the basic information an US investor should consider before engaging in the cross-border M&A transaction with a company reporting under IFRS.

First result of our work is a practical decision tree we created for an easier classification of the character of acquisition transactions. It clearly distinguishes between an acquisition of assets and a business acquisition. Business acquisitions are further analyzed in terms of their process. We identified three stages of the business combination, while emphasis the first one, where the decision on whether to invest or not is made. Even the phase of financial reporting under certain set of standards comes much later when the business combination is processed, we underline the importance of financial bilingualism in early stages. Lack of information on how transforming financial statements from IFRS to US GAAP or backward impact value of the acquired business can put an investor at risk.

The third area in which we present the results of our work is comparison of differences in presenting value of specific items characteristic for business combinations under the ASC 805 and the IFRS 3. We focused on noncontrolling interests, contingent liabilities and assets measurement and goodwill, where we identified significant differences in

setting the value of these items that must be considered when investor decides the profitability of the transactions.

Measuring NCI at fair value can not only to different value of NCI but also the value of goodwill is affected. Both can be lower when applying IFRS method based on proportional identified net assets.

Considering contingencies there are not also measurement differences, but the most significant point for the investor is, that under IFRS there are no contingent assets recognized, which means that the net amount of contingencies can differ significantly and thereby it may affect the overall value of the business presented to stakeholders.

## Acknowledgments

The paper was elaborated in the framework of the internal grant project of the Economic University in Bratislava (Faculty of Economic Informatics) no. I-19-107-00 called "Globalization of Accounting Standards in context of the Development of Foreign Direct Investment".

## References

ASC 805. *Business Combinations*. FASB, 2017. Retrieved from: https://asc.fasb.org/imageRoot/94/108336194.pdf.

Bagiová, A. (2018). The Impact of US GAAP and IFRS Convergence on Accounting Information Quality. In: Hornická, R., Mokošová, D., Meluchová, J., Blahušiaková, M., Tumpach, M. et al., eds., *The Need for Improving of Accounting Information Disclosure Using International Arrangements, particularly IFRSs, in the Legislative Conditions of the Slovak Republic.* Bratislava: Vydavateľstvo EKONÓM, pp. 7-13.

FASB (2017). *FASB Accounting Standards Update No. 2017-01, January 2017 - Business Combinations (Topic 805).* Retrieved from: https://www.fasb.org/jsp/FASB/Document_C/DocumentPage?cid=1176168739996&acceptedDisclaimer=true.

Flood, J. (2018). *Wiley GAAP 2018: Interpretation and Application of Generally Accepted Accounting Principles Set*. New Jersey: John Wiley & Sons Inc.

IFRS 3. *Business Combinations*. IASB, 2018.

IFRS Foundation (2019). *Who uses IFRS Standards?* Retrieved from: https://www.ifrs.org/use-around-the-world/use-of-ifrs-standards-by-jurisdiction/#filing.

Meluchová, J. (2016). Elimination of the risk and its impact on the reliability of the information presented in financial reporting. In: Čulík, M., ed., *Managing and modelling of financial risks: proceedings: 8th international scientific conference*. Ostrava: VŠB - Technical University of Ostrava, pp. 599-607.

UNCTAD (2019). *World Investment Report 2018*. Retrieved from: https://unctad.org/en/PublicationsLibrary/wir2018_overview_en.pdf.

# Evaluation of the Policies Supporting Cultural and Creative Industries in the Slovak Republic

**Mária Kmety Barteková[1], Helena Majdúchová[2]**

[1] University of Economics in Bratislava
Faculty of Business Economy, Department of Business Economy
Dolnozemska cesta 1, 852 35 Bratislava, Slovakia
E-mail: maria.bartekova@euba.sk

[2] University of Economics in Bratislava
Faculty of Business Economy, Department of Business Economy
Dolnozemska cesta 1, 852 35 Bratislava, Slovakia
E-mail: helena.majduchova@euba.sk

***Abstract:*** *The aim of this paper is to evaluate the various policies supporting the cultural and creative industries development at the national level. Cultural and creative industries operate partly on different principles compared to traditional sectors, so the governmental support takes into account these specificities. The regulatory framework is important in boosting the entrepreneurial activity of cultural and creative industries. Granting fiscal reductions or incentives to investors in the cultural and creative industries can enable greater investment. The investment of the European Structural Funds should be encouraged, with special support to regional networking initiatives and platforms for cultural and creative industries. EU Cohesion and Structural funds could function as part of the resources allocated to Cultural and Creative industries at a European level as well as at the regional level. Cultural and creative entrepreneurs rely heavily on the use of networks within highly innovative and risk-oriented environments. However, the lack of access to finance and to market can hinder their development.*

*Keywords: cultural and creative industries, public finance, government support, public policy, EU Structural funds*

*JEL codes: L39, L53, L59, Z18, Z19*

## 1 Introduction

Support to the culture sector aims to both protect and promote European cultural heritage while supporting the cultural and creative industries, enabling them to act as a driver for growth and job creation (Boix and Soler, 2017). The culture sector has, for some time, remained underdeveloped and relatively ignored in terms of its potential contribution to society. Protecting Europe's cultural heritage from human and environmental threats is essential if it is to survive (Cerisola, 2019).

The European Commission is engaged in various activities in support of the culture sector, ranging from discussions with stakeholders to the funding of culture sector initiatives. Examples of the Commission's activities in the sector include:

- Actions and initiatives such as the Capitals of Culture or Heritage Days,
- Framework programmes, such as Creative Europe,
- International policy cooperation,
- Stakeholder consultations and dialogue.

In addition to this, the European Commission represents the interests of the European Union in international initiatives, such as those headed by the United Nations Educational, Scientific and Cultural Organization (UNESCO).

The man milestone has been the implementation of the Culture programme from 2007-2013. The European Commission has also established a network of culture experts and has published reports, studies, and policies on support to the culture sector. The European Commission will continue to provide support to the culture sector, notably through the Culture strand of the Creative Europe programme.

In addition to this, the European Commission intends to:

- carry out an extensive mapping of the culture sector,
- focus on new and innovative ways to prevent the trafficking of cultural goods,
- identify and implement new measures to promote and protect cultural heritage.

In terms of supporting research infrastructure, we can divide projects into 8 types:

- Centers of Excellence (support for excellent basic research),
- R&D centers (industry - academia),
- Competence Centers (relatively huge connecting of academic institutions and industry),
- Applied research and technology transfer projects within established research centers;
- Infrastructure renewal projects at universities,
- Upgrading of instrumentation,
- National projects,
- University science parks and research centers - stage I.

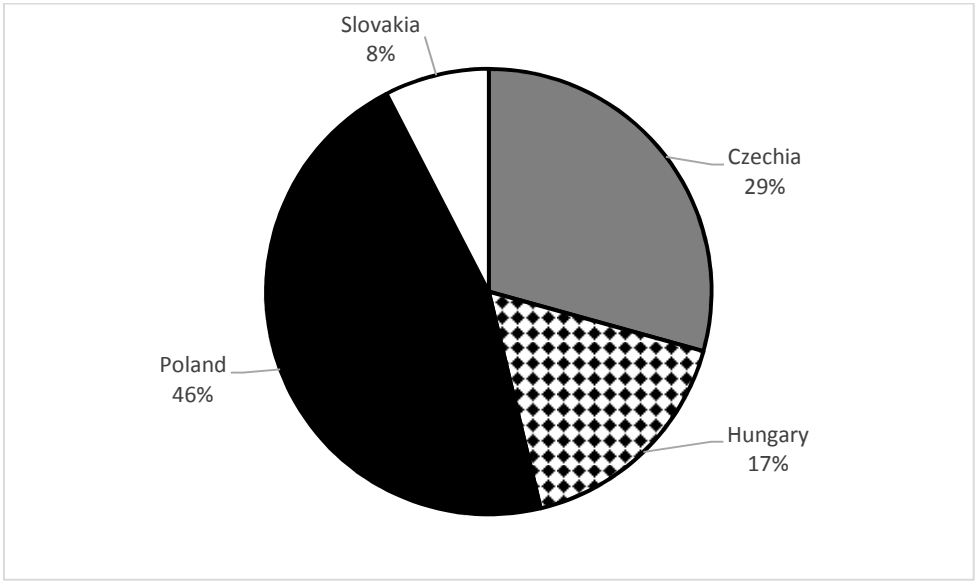
None of the forms of R&D support within the different types of research centers meant the emergence of separate legal entities. It was the creation of partnerships on the asis of contracts between the parties organizations (Domenech et al., 2014).

## 2 Creative and Cultural Industry in the Visegrad Group

Section 2 describes creative and cultural industry in the Visegrad Group countries. Section 3 discusses methodology used in this paper and the main sources of used data. The results of used analysis and evaluation of the policies supporting creative and cultural industry is a part of section 4. Section 5 concludes.

Figure 1 illustrates distribution of the enterprises in creative and cultural industry within the Visegrad group. Almost half of the cultural and creative enterprises in the Visegrad group were operating in Poland in 2015. The smallest amount of the cultural and creative enterprises were recorded in Slovakia (Eurostat, 2019a). Data for year 2016 – 2018 were not available.

**Figure 1** Distribution of Creative Industries in V4 countries (2015)




Source: own processing, data extracted from Eurostat

Sectors of the cultural and creative industry are mentioned in table 1. The following sectors are sorted by NACE rev. 2 codes.

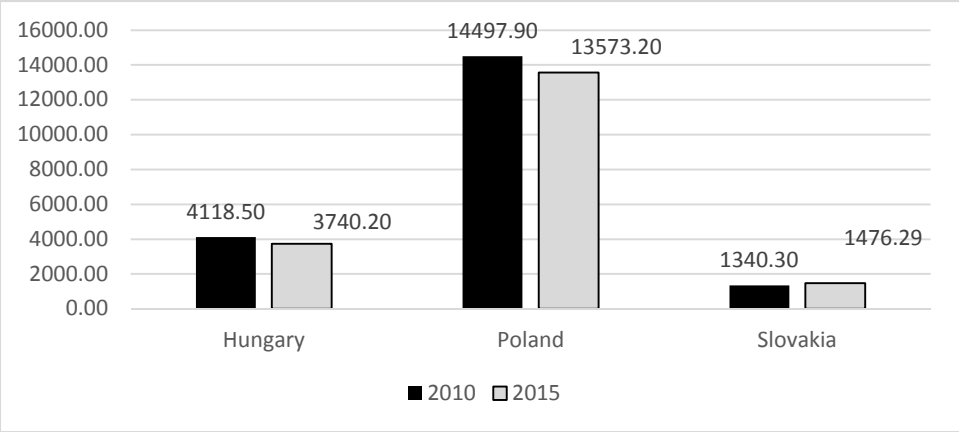
**Table 1** Sectors of the cultural and creative industry

| NACE Rev. 2 codes | Description |
|---|---|
| **C18** | Printing and reproduction of recorded media |
| **C32.12** | Manufacture of jewellery and related articles |
| **C32.2** | Manufacture of musical instruments |
| **G47.61** | Retail sale of books in specialised stores |
| **G47.62** | Retail sale of newspapers and stationery in specialised stores |
| **G47.63** | Retail sale of music and video recordings in specialised stores |
| **J58.11** | Book publishing |
| **J58.13** | Publishing of newspapers |
| **J58.14** | Publishing of journals and periodicals |
| **J58.21** | Publishing of computer games |
| **J59** | Motion picture, video and television programme production, sound recording and music publishing activities |
| **J60** | Programming and broadcasting activities |
| **J63.91** | News agency activities |
| **M71.11** | Architectural activities |
| **M74.1** | Specialised design activities |
| **M74.2** | Photographic activities |
| **M74.3** | Translation and interpretation activities |
| **N77.22** | Renting of video tapes and disks |
| **R90** | Creative, arts and entertainment activities |
| **R91** | Libraries, archives, museums and other cultural activities |

Source: data extracted from Eurostat

Figure 2 shows turnover of the enterprises in the creative and cultural industry in the Visegrad group. The data for the Czech Republic were not available. As one can see, the increase of the turnover was recorded only in the Slovak Republic (Eurostat, 2019b).

**Figure 2** Turnover of the Enterprises in the Creative and Cultural Industry in the Visegrad Group in Million (EUR)




Source: own processing, data extracted from Eurostat

Support for creative and cultural industries in the European Union is funded through the various programmes, mostly from the European Regional Development Fund. The following programmes, supporting the cultural and creative industry in the Slovak Republic, are further mentioned in the contribution:

- Slovak Arts Council,
- Slovak Film Commission, and
- Creative Europe Desk.

Slovak Arts Council is a self-governing public institution guaranteeing support of art activities, culture and creative industry, which was established according to Act No. 284/2014 Coll. Slovak Arts Council replaced the substantial part of the former grant system of the Ministry of Culture of the Slovak Republic and is independent of central bodies of state administration. Its main mission is the support of "live" arts and culture with a special focus on diversity (Act no. 284/ 2014 Coll. on the Slovak Arts Council and the amendment and supplement to Act no. 434/2010 Coll. on granting subsidies within the competence of the Ministry of Culture of the Slovak Republic, as amended by Act no. 79/2013). Slovak Arts Council provides grants especially for creation, production, distribution and presentation of works of art; support of international cooperation; educational programmes in the fields of art, culture and creative industry; grants for individuals who contribute to development of arts and culture in creative way or by research. Slovak Arts Council provides grants financial support for artistic activities, culture and creative industry, as follows:

a) creation, production, distribution and presentation of art objects and their reflections,
b) support of international cooperation in the field of artistic activities, culture and creative industry,
c) educational programmes in the fields of art, culture and creative industry,
d) grants for individuals who contribute to development of art and culture in creative or research way in the Slovak Republic,
e) projects that are supported within the programmes of European Union supporting the cultural sector and cultural and creative industry, if such projects contribute to achieve goals relevant for European Union and the Slovak Republic,
f) protection and development of cultural heritage and making it accessible for the public, besides areas of monumental funds (The Slovak Arts Council, 2019b).

Slovak Film Commission was established in 2009 to support audiovisual production in the Slovak Republic and promote the country to international filmmakers as one of the world's top destinations for international film productions. It provides:

- development, creation and production of Slovak audiovisual works, including European co-productions,
- distribution, promotion and marketing support for audiovisual works,
- presentation of Slovak cinematography abroad,
- digitalization of cinemas and technological development in the audiovisual sector,
- film festivals and shows,
- research and publishing of professional literature
- education, workshops and trainings for audiovisual professionals.

The Slovak Film Commission's resources consist of public finances (state budget) and contributions from non-state actors using audiovisual works in their business:

- public television (5% of advertising and teleshopping revenue),
- private television (2% of advertising and teleshopping revenue)
- cinemas (1% of each ticket sold),
- distributors of audiovisual works (1% of revenue from the distribution of audiovisual works other than cinema revenue),
- retransmission operators (1% of retransmission revenue).

The state contribution is at least 6 million euros per year (Act no. 516/2008 Coll. on the Slovak Film Commission as amended).

Creative Europe Desk helps the cultural and creative sectors to seize the opportunities of the 'digital age' and globalization. The programme enables the sectors to reach their potential so that they can contribute to the Europe 2020 goals for sustainable growth, jobs and social cohesion. Creative Europe Desk opens up new international opportunities, markets and audiences and builds on the success of the MEDIA and Culture programmes.

## 3 Methodology and Data

In this section, we describe the data collection procedures, we present the platform used in the study and we present the empirical strategy that we adopted. We used comparative research to analyse the financial support policy across the most established programmes in the Slovak Republic. A major problem in comparative research is that the data sets in different countries may define categories differently (for example by using different definitions of the creative and cultural industry) or may not use the same categories. To eliminate the possible differences in the definition of the creative and cultural sectors, we compared the creative and cultural industry among the similar countries (the Visegrad group).

In our paper, we focused on the following indicators:

- number of the rejected applications,
- number of the applications approved,
- total requested amount of the financial support,
- total approved amount of the financial support, and
- average approved amount per 1 application.

We draw on data from:

- Database of The Slovak Film Commission,
- Eurostat Database,
- Database of the Slovak Arts Council to evaluate the policies supporting the creative and cultural industry in the Slovak Republic.

## 4 Results and Discussion

This session introduces financial support policy of the various programmes in the Slovak Republic and provides detailed information about approved financial support for the cultural and creative industry.

The first analyzed grant scheme is provided by the Slovak Arts Council. Applicants may apply for funding on the bases of open calls for particular programmes of the Slovak Arts Council funding structure according to criteria, conditions and rules of officially adopted

regulations. Table 1 contains the maximum amount of the financial support. Organizers of the festivals may apply for the highest financial support – up to EUR 200 000.

**Table 1** Scheme of the Financial Support Policy of the Slovak Arts Council

| Sectors of the Creative and Cultural Industry | Maximum Amount of Financial Support |
|---|---|
| **Arts** | EUR 30 000 |
| **Magazines** | EUR 65 000 |
| **Gaming** | EUR 100 000 |
| **Cultural centers** | EUR 150 000 |
| **Festivals** | EUR 200 000 |
| **Research & Educational activities** | EUR 30 000 |
| **Libraries** | EUR 15 000 |
| **Museums & Galleries** | EUR 30 000 |
| **Collection funds** | EUR 30 00 |
| **Arts** | EUR 30 000 |

Source: data extracted from the Slovak Arts Council

The structure of the received and approved applications in 2018 is conclude in table 2 (The Slovak Arts Council, 2019a). The highest number of the received application and the highest requested amount of financial support were in the category Art. As one can see, average amount of the financial support per 1 application was approved in category Events, Cultural Centers and Magazines.

**Table 2** Received vs. Approved Applications in 2018 (the Slovak Arts Council)

| Sectors of the Creative and Cultural Industry | Received Applications | Requested Amount in EUR | Approved Applications | Approved Amount in EUR | Average amount per 1 application |
|---|---|---|---|---|---|
| **Art** | 2 372 | 25 934 781 | 1 401 | 8 227 918 | 5 872,9 |
| **Events, Cultural Centers and Magazines** | 174 | 6 661 559 | 114 | 4 087 465 | 35 855,0 |
| **Research and Education Activities** | 358 | 3 583 770 | 210 | 1 055 203 | 5 024,8 |
| **Traditional Culture, Cultural and Educational Activities** | 1 068 | 8 780 330 | 654 | 2 780 330 | 4 251,3 |
| **Memorial and Funding Institutions** | 896 | 6 708 330 | 663 | 3 003 418 | 4 530,0 |
| **City of Culture** | 62 | 1 677 315 | 26 | 483 115 | 18 581,3 |
| **Total** | 4 930 | 53 346 085 | 3 068 | 19 637 449 | 6 400,7 |

Source: The Slovak Arts Council

Financial support policy of the Slovak Arts Council shows that the total biggest amount is dedicated for the enterprises operating in the category Art (figure 3). Average amount per 1 application did not overdraw the limit set by the Slovak Arts Council.

**Figure 3** Financial Support Policy of the Slovak Arts Council in 2018


Source: own calculations, The Slovak Arts Council

The results of financial support policy set by the Slovak Film Commission are included in table 3. Number of the approved application varied between 243 and 350 per year (The Slovak Film Commission, 2019). The Slovak Film Commission provides the highest average amount of financial support per 1 application (EUR 17 863 – 35 320).

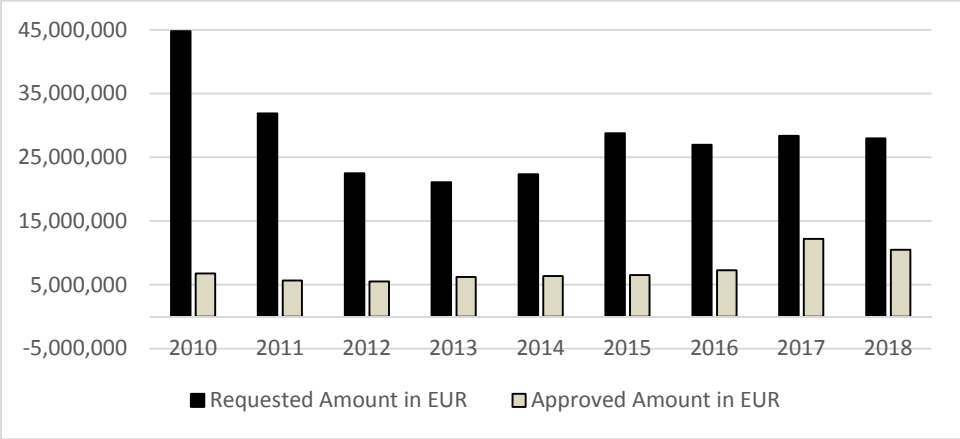
**Table 3** Financial Support Policy of the Slovak Film Commission

| Financial Support | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 |
|---|---|---|---|---|---|---|---|---|---|
| **Received Applications** | 508 | 518 | 483 | 668 | 602 | 548 | 594 | 523 | 527 |
| **Approved Applications** | 260 | 243 | 249 | 349 | 329 | 331 | 350 | 346 | 333 |
| **Average amount per 1 application** | 26 160 | 23 284 | 21 168 | 17 863 | 19 456 | 19 682 | 20 798 | 35 320 | 31 524 |

Source: own calculations, data extracted from the Slovak Film Commission

As one can see, the approved financial support is insufficient from the establishment of the Slovak Film Commission (Figure 4). The interest in the financial support provided by this programme is still unbelievably high. The result cased by the lack of the financial support is the slowly decreasing total requested amount.

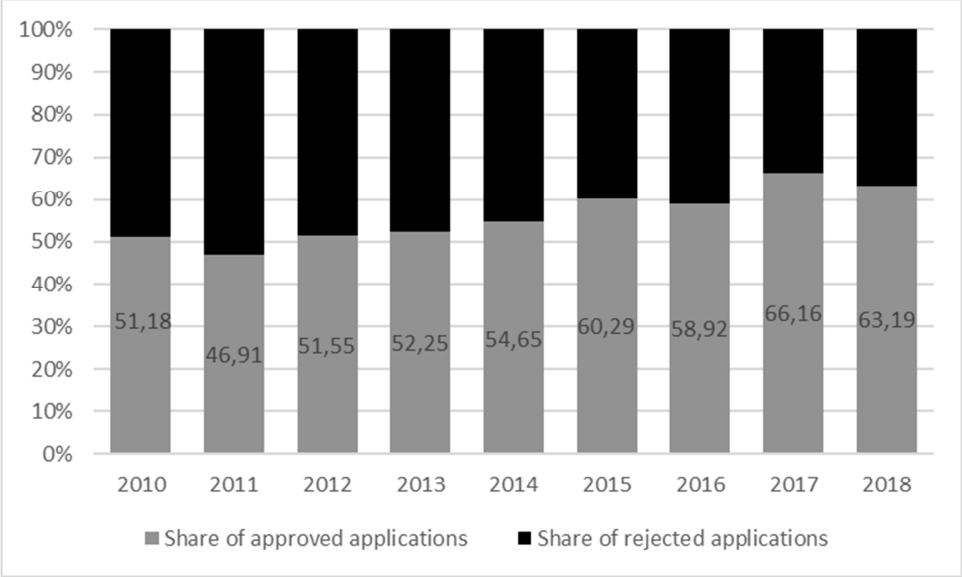
**Figure 4** Requested Amount vs. Approved Amount of Financial Support (the Slovak Film Commission)




Source: own calculations, data extracted from the Slovak Film Commission

Figure 5 confirms the high share of the applications rejected by the Slovak Film Commission. The share of the approved applications moves between 46.91% and 66.16%. In fact, the Slovak Film Commission has insufficient financial sources to support all applicants.

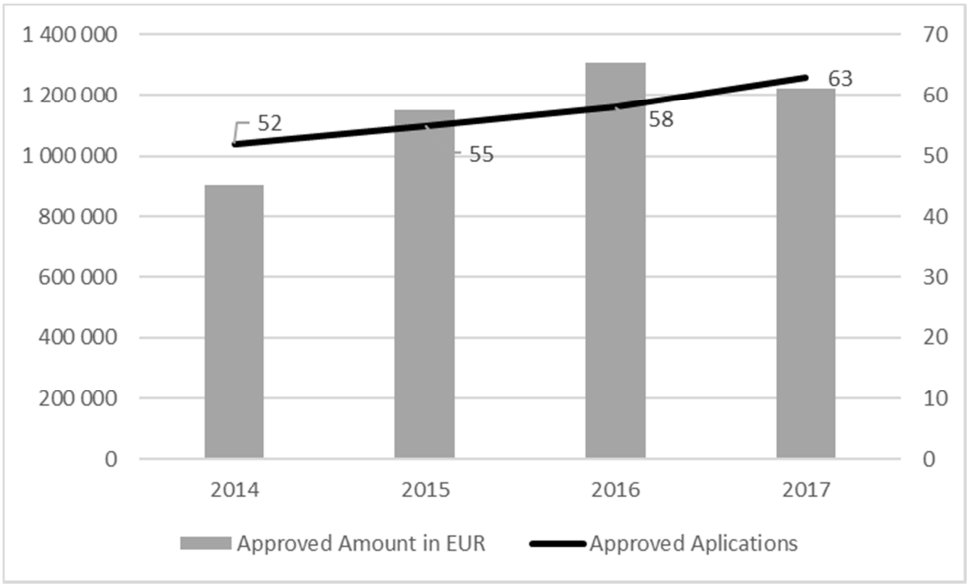
**Figure 5** Share of the Approved and Rejected Applications for the Financial Support




Source: own calculations, data extracted from the Slovak Film Commission

Creative Europe Desk as a programme supported the lowest number of the cultural or creative enterprises in comparison with the other mentioned programmes. Figure 6 demonstrates the overall number of the approved applications and total approved amount of the financial support. The latest data were not available (Creative Europe Desk, 2018).

**Figure 6** Results of the Financial Support Policy between 2014 and 2017(Creative Europe Desk)




Source: own calculations, data extracted from Creative Europe Desk

In fact, one of our conclusions of this paper would be that the evidence on the access of the financial support for the creative and cultural industry in the Slovak Republic is still very limited and needs much more systematical changes.

## 5 Conclusions

The Slovak Republic as a part of the European union needs to invest more in its cultural and creative sectors because they significantly contribute to economic growth, employment, innovation and social cohesion.

The Slovak Arts Council in accordance with the Law decided to provide the following financial support: 294 grants in the amount of EUR 1 420 896, 2 774 endowments amounting to EUR 18 216 553. The Slovak Film Commission decided to support the highest amount of applications in 2017. The decrease of the approved amount of the financial support were recorded in 2018.

Creative Europe Desk will provide funding for at least 250 000 artists and cultural professionals, 2 000 cinemas, 800 films and 4 500 book translations. It will also launch a new financial guarantee facility enabling small cultural and creative businesses to access up to €750 million in bank loans.

Supporting programmes mentioned in the contribution will safeguard and promote cultural and linguistic diversity and strengthen the competitiveness of the cultural and creative sectors.

## Acknowledgments

This paper is an outcome of the research project VEGA n. 1/0340/19 "The Entrepreneurial Dimension of Creative industries in the Context of Innovation and Smart Growth" in the range of 100%.

## References

Act no. 516/2008 Coll. on the Slovak Film Commission as amended.

Act no. 284/2014 Coll. on the Slovak Arts Council and the amendment and supplement to Act no. 434/2010 Coll. on granting subsidies within the competence of the Ministry of Culture of the Slovak Republic, as amended by Act no. 79/2013.

Boix, R., Soler, V. (2017). Creative service industries and regional productivity. *Papers in Regional Science*, vol. 96(2), pp. 261–279.

Cerisola, S. (2019). A new perspective on the cultural heritage–development nexus: the role of creativity. *Journal of Cultural Economics*, vol. 43(1), pp. 21-56.

Creative Europe Desk (2018). *Creative Europe Desk 2018 Slovakia.* Retrieved from: http://www.cedslovakia.eu/uploads/ckeditor/attachments/368/Newsletter_MEDIA_Info_2018_web.pdf.

Domenech, R., Capone, F., Propris, L., Lazzeretti, L., Sanchez-Serra, D. (2014). Comparing creative industries in Europe. *European Urban and Regional Studies*, vol. 23 (4), pp. 1-6.

Eurostat (2019 a). *Number and average size of enterprises in the cultural sectors by NACE Rev. 2 activity.* Retrieved from: http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=cult_ent_num&lang=en.

Eurostat (2019 b). *Value added and turnover of enterprises in the cultural sectors by NACE Rev. 2 activity.* Retrieved from: http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=cult_ent_val&lang=en.

The Slovak Arts Council (2019 a). *Annual report of the Slovak Arts Council 2018.* Retrieved from: https://www.fpu.sk/attachments/article/169/Vyrocna%20sprava%202018_14032019_final.pdf.

The Slovak Arts Council (2019 b). *Financial Support.* Retrieved from: https://www.fpu.sk/en/financial-support.

The Slovak Film Commission (2019). *Annual report of the Slovak Film Commission 2018.* Retrieved from: http://www.avf.sk/Libraries/V%C3%BDro%C4%8Dn%C3%A9_spr%C3%A1vy/Vyrocna_sprava_2018_final.sflb.ashx.

# The Divergence between the EU and non-EU Fiscal Councils

**András Bethlendi[1], Csaba Lentner[2], András Póra[3]**

[1] Budapest University of Technology and Economics
Faculty of Economic and Social Sciences, Department of Finance
Magyar tudósok körútja, 1117 Budapest, Hungary
E-mail: bethlendi@finance.bme.hu

[2] National University of Public Service
Faculty of Science of Public Governance and Administration, Public Finance Research Institute
Ludovika tér, 1083 Budapest, Hungary
E-mail: Lentner.Csaba@uni-nke.hu

[3] Budapest University of Technology and Economics
Faculty of Economic and Social Sciences, Department of Finance
Magyar tudósok körútja, 1117 Budapest, Hungary
E-mail: pora@finance.bme.hu

***Abstract:*** *The European sovereign crisis that followed the 2008 crisis showed that rules-based fiscal policy is insufficient in itself in order to avoid fiscal alcoholism and excessive sovereign debt. Nevertheless, these policies have become more and more widespread in order to limit indebtedness. This article deals with one of the most important elements of rules-based systems: the fiscal council. The key question imposed was: is it mostly a European phenomenon, or rather a global standard? Is there a divergence between the EU and non-EU fiscal councils, or not? As a method, we employed descriptive statistics, then a hierarchical cluster analysis, based on the data of the IMF Fiscal Council Dataset. In conclusion, an EU and a non-EU cluster were formed, thus our working hypothesis was mostly underpinned. Our results have thus contributed to the literature and advanced the case that the increased number of fiscal councils can be attributed to European regulations or internal political issues rather than strengthening of fiscal prudency.*

*Keywords: rules-based fiscal policy, fiscal council, independent fiscal institutions, fiscal prudency*

*JEL codes: E02, E62, F36, H61, H68*

## 1 Introduction: establishment of Independent Fiscal Institutions

The European sovereign crisis that followed the 2008 crisis shed light on the fact that rules-based fiscal policy, which contains an explicit rule on the current deficit and the debt limit (adopted by the Stability and Growth Pact at the European Union level), is insufficient in itself (Calmfors and Wren-Lewis, 2011). It became broadly clear that fiscal rules alone are insufficient, as they cannot ensure fiscal discipline and its sustainability. For this reason, experts started to look for new methods to enforce budgetary discipline. Extensive attention was paid to the establishment and reinforcement of independent fiscal institutions (IFI).

In a European context, a specific proposal was raised in the early 2000s. Already at that time, Wyplosz (2002) predicted that rules-based budgets would never solve the fundamental economic policy problem and the consequent inclination to generate deficit. He proposed that every Member State should be required to set up a fiscal policy committee independent of the government, under the control of people with the appropriate professional background, and with a mandate to maintain the sovereign debt over the medium term. Larch and Braendle (2018) also considered it logical to take fiscal macro-economic stability policy out of the hands of elected national governments. The concept was that independent fiscal institutions would determine the target deficit and the maximum allowed sovereign debt for the particular year. Elected politicians would be left with elbow room to determine the structure of fiscal revenues and expenditures, while observing the target deficit for the year. Short-term fiscal policy distortions could thus be eliminated. An additional argument regarding the euro area is that a better

coordinated fiscal stabilization policy would facilitate further economic and monetary integration, and could also increase the efficiency of the euro area's centralized monetary policy.

The initial, simple EU-level fiscal rules included in the Stability and Growth Pact have gradually been completed. Additions include, for example, the two amendments to the Stability and Growth Pact, and the "Treaty on Stability, Coordination and Governance" (TSCG), in force since 2013, which contains new and more detailed provisions on the national limitation of fiscal policy discretion and on increasing EU-level fiscal co-ordination. In 2011, all Member States of the EU was officially requested to set up IFIs.

The European Fiscal Board (EFB), which was established in 2015, is an independent body of the European Commission. It was set up for a fundamentally advisory function, and it assists the Commission in performing its multi-lateral fiscal supervisory functions for the euro area. The EFB's duty is to provide an independent evaluation of the fiscal processes all over Europe, and more specifically in the entire euro area. In this sense, this institution can already be considered to be a preliminary institution of fiscal union. The European Commission makes considerable efforts to promote fiscal union and Acharya and Steffen (2017) and others, believe that the three unions are interrelated, as there can be no single government securities market without a fiscal union.

The IMF papers are consistent with the EU's intentions: Berger et al. (2018) think that without at least some degree of fiscal union, the EU will face existential risks and, for this reason, at least some kind of simplified fiscal union will be needed following the earliest possible completion of the banking union and capital market union. However, there are sceptics as well: according to Herzog (2018), even if the EU Commission thinks that without a supranational fiscal capacity the EMU will fail, it is not really feasible because of the resistance of the member states. Therefore, it would be better to "stick to and enhance the rule-based architecture of Maastricht" (Herzog, 2018).

That said, a fiscal policy function independent of governments is not yet a political reality. For this reason, the fiscal councils that have been established so far have the following competences: forecasting, analysis, evaluation and consultation. A few countries have had independent institutions with fiscal control functions for a long time, actually for several decades. These include the Central Planning Bureau of the Netherlands, the Economic Council of Denmark and the High Council of Finance in Belgium. All of them are intended to supervise the discretional fiscal policies of the incumbent governments (watchdog function).

It must be highlighted that the US-model (a Budget Office working closely with the legislature) was adopted by some countries. Such cases include Canada and Mexico (which neighbor the US), Australia and South Africa (with a common cultural and legal heritage) and, finally, South Korea. The later adopted its system gradually after the Asian sovereign crisis of 1998.

IFIs have a highly heterogeneous practice. In some countries, IFIs have mandates exceeding the central government and covering all the other government sectors: decentralized agencies, local governments and state-owned companies. Consequently, IFIs have very different sizes: examples range from IFIs composed of a few persons (exclusively economists) to supervisory bodies with staffs of several hundreds. The latter are already fundamentally engaged in ex-post supervision and can be classified among audit offices/courts of auditors. IFIs are, fundamentally, fiscal institutions that perform ex-ante assessment, while ex-post evaluation is essentially conducted by courts of auditors (Kopits, 2016). The OECD summed up IFI good practices in one of their recommendations (OECD, 2014). Simultaneously, the IMF also developed its recommendations (IMF, 2013).

The majority of the authors engaged in this topic (Debrun and Kumar, 2007; IMF, 2013; Kopits, 2016 and Beetsma and Debrun, 2016) describe fiscal council operation and structure as highly heterogeneous. Below it is shown that, in fact, there are relatively homogeneous groups according to the individual considerations.

The fundamental question of our study is whether fiscal councils can be considered as a basically European model or whether what we are witnessing is the evolution of a global standard.

## 2 Methodology and Data

This analysis is based on the IMF's Fiscal Council Dataset (Debrun et al., 2017). This database contains data for 39 FCs in 37 countries as at the end of 2016. In addition to general information (the official name of the fiscal council, the date of its establishment or profound reform), the database includes the main features of the individual FCs' competences (specific duties and the means of influencing fiscal policy) and key institutional characteristics (independence, accountability requirements and human resources).

Our methodology seeks to find relatively homogenous groups in accordance with certain considerations. Our test hypothesis is that, in a breakdown by EU and non-EU, fiscal councils have different characteristics. As a first step, we will use descriptive statistical methods. In the second step, cluster analysis will be applied, the details of this analysis are based on the descriptive statistics, thus will be provided later.

It is a general problem to manage in countries (Belgium and the Netherlands) where there are 2 operative fiscal councils, and thus the competences and responsibilities are divided between the 2 organizations. As these are usually handled in consolidated way, this analysis includes 37 councils, and it is noted whenever the sample includes 39 councils.

## 3 Descriptive statistics: Results and Discussion

The structure adopted by Debrun et al. (2017) is followed for the data processing.

**General information**

The following indicators were analyzed for each fiscal council: region (EU vs. non-EU); the year of foundation; the year of major changes to its mandate; if it is a parliamentary organization or a separate institution; which level of government is covered by its mandate.

There was a major increase in the number of fiscal councils all over the world in response to the crisis. The major part of this increase can be linked to the EU's mandatory regulation. In the case of IFIs outside the EU, it is mainly the larger developed countries with federal structures (Australia, Canada and the USA) that have adopted these institutions and provided them with legal and operational independence. In addition to a federal structure, the establishment of IFIs may in many cases be clearly related to episodes of fiscal crisis. In the case of developing countries, IMF and OECD recommendations may have a significant role in the establishment of IFIs. The non-federal South Korea is a special case, as the National Assembly Budget Office was set up in 1994, and then it was re-organized in 2000, in response to the 1998 crisis, in the form of a Legislative Counselling Office and a Budget Policy Office, and made completely independent in 2003 under the name of the National Assembly Budget Office. In 1998-1999, as a result of a crisis, the federal state of Mexico also established its own institution under the name of the Center for Public Finance Studies. Naturally, the latter two are advisory bodies to parliaments, established to improve the fiscal authenticity of the given countries after the crises, and otherwise follow the organizational pattern of the U.S. Congressional Budget Office (Curristine et al., 2013). The Australian (2012) and South African (2014) Parliamentary Budget Offices were launched with similar motives and follow a similar example.

In Chile, the fiscal council established in 2013 was reformed in 2018 to increase its independence. However, the fiscal discipline policy was started in Chile in 2001 by the Fiscal Responsibility Law, which required that the structural balance must have a 1% surplus. Major changes were made to the mandate in 11 of the 39 councils (7 of them in

the EU). The overwhelming majority of the changes (8) were made after, and as a response to, the crisis.

An important question is how this role appears institutionally: as a parliamentary fiscal advisory body independent of the government or as a body separate from parliament. As the IMF database does not include the latter breakdown, we have completed the database. Clearly, the typical institutional form in the EU is to have separate councils, while the practice outside the EU is mixed. Note that in the EU the national audit offices are assigned this role (in Lithuania and in Finland).

**Table 1** Institutional form

| | EU | Non-EU |
|---|---|---|
| **Parliamentary organization** | 2 | 8 |
| **Organization separate from Parliament** | 24 | 5 |

Source: the authors, Note: In this case a sample of 39 councils were divided

Another important difference between the EU and non-EU groups is in the competences of the fiscal councils. Fiscal councils outside the EU usually (with the exception of 4) have mandates that only cover the central budget. In the EU they have a wider scope everywhere: they supervise the complete field of public finances.

**Key elements of the mandate**

Every IFI conducts positive and descriptive analyses. More than half of the IFIs are empowered to carry out normative analyses (i.e. recommend action to achieve the specific fiscal objectives). In non-EU countries, only 31 percent of them have a normative competence, while in EU Member States, this ratio is 67 per cent.

The most important activity IFIs perform is the predictive evaluation of the various aspects of fiscal developments. In an EU/non-EU breakdown, a significant difference is seen between the two groups.

**Table 2** Key mandate elements

| | Forecasting | Forecast Assesment | Recommendations | Long-term sustainability[1] | Consistency with objectives[2] | Costing of measures[3] | Monitoring fiscal rules |
|---|---|---|---|---|---|---|---|
| **EU** | 38% | 88% | 71% | 75% | 96% | 33% | 100% |
| **Non-EU** | 62% | 69% | 77% | 38% | 54% | 62% | 31% |

Source: IMF Fiscal Council Dataset, Notes: 1) "Long-term sustainability" is defined as the long-term forecast of government balance and debt level. 2) "Consistency with objectives (beyond fiscal rules)" is defined as the assessment of government budgetary and fiscal performance in relation to fiscal objectives and strategic priorities. 3) "Costing of measures" is defined as the quantification of either short-term or long-term effects, or both, of measures and reforms.

In the EU, every institution checks compliance with the various fiscal rules from a forward-looking perspective, including the evaluation of forecasts and longer-term sustainability. In non-EU countries, these aspects are considerably less significant, as the emphasis is basically on forecasts and on the assessment of the short- and/or long-term impacts of public finance actions. With the exception of 6 institutions (2 IFIs in the EU, and 4 in developing, non-EU countries), the majority conduct ex-post analyses.

**Responsibilities and means**

The following main instruments are used to influence the budget:

**Table 3** Fiscal councils' direct impact on the budget process (in %)

| | Forecasts used in the budget | Binding forecasts | Comply or explain | Formal consultation or hearings | Can stall the budget process |
|---|---|---|---|---|---|
| **EU** | 13% | 8% | 33% | 63% | 4% |
| **Non-EU** | 8% | 0% | 0% | 23% | 0% |

Source: IMF Fiscal Council Dataset

Overall, it is clear that fiscal councils' direct impact on the budget process is currently less significant; they are basically considered as advisory bodies. However, in the EU Member States, they have a set of relatively more powerful instruments.

The other basic method they use is pressure through public opinion, and the provision of objective information to the public about budgeting procedures. All but one of the fiscal councils make public reports. Six of the 37 fiscal councils did not have data available on the evaluation of media impact. According to the IMF's evaluation, 26 of 30 councils have a high media impact. In the EU Member States where data was available, 95 per cent of the IFIs had a significant media impact, and this ratio was 64 per cent in non-EU councils.

**Independence**

Independence can be considered from a legal and from an operational perspective. Legal independence is when the council's independence from political intervention is ensured by law or contract. However, de facto operational independence from politics may be implemented even in the absence of legal independence, due to the council's independent expertise. Note that in our opinion, in an undemocratic country (Iran) the term "independence" does not make any sense.

88 per cent of the EU IFIs can be considered legally and 81 per cent operationally independent. In non-EU countries, the corresponding ratios were 69 and 54 per cent, respectively. If the latter is further subdivided into developed and developing non-EU countries, we get two markedly different groups. Merely 33 per cent of IFIs in developing non-EU countries show operational independence, and if Iran is removed from this group, the ratio is only 22 per cent.

**Resources**

The IMF database characterizes the human resources related to IFI management by several groups of variables. One such group of variables relates to the composition and content of the IFI: the headcount, the number of years mandated, whether mandates are renewable or not, the members' backgrounds etc. This group has not been included in this analysis, as it is not considered a relevant indicator for our hypothesis. The other group of characteristics – which we consider relevant – concerns the selection and dismissal of IFI leaders.

Less than half (46%) of the IFIs can appoint their leaders independently of the government. In terms of dismissal, IFI leaders are slightly more protected from the government. The third group of variables shows the size of IFIs based on the number of non-executive employees. The majority of IFIs are small in size: those employing more than 15 persons are already considered large (there are 13 of them). For this reason, in the cluster analysis the sample is divided into two: small and medium-sized/large institutions (with an employee headcount exceeding 15).

## 4 Cluster analysis: Results and Discussion

This research uses the method of hierarchical cluster analysis, i.e. the classification of countries in different groups called clusters. The Euclidean square–distance indicator is

selected to determine the distance between countries. Ward's method is used for classification, as it reduces dispersion in groups and increases their homogeneity. The dissimilarity between two clusters is computed as the increase in the "error sum of squares" (ESS) after fusing two clusters into a single cluster. Ward's method chooses the successive clustering steps to minimize the increase in ESS at each step. For the calculation, we used Orange datamining software.

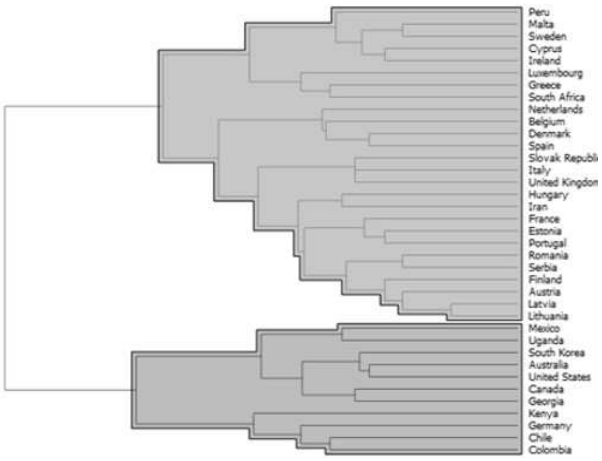
The explanatory variables are those detailed under the title "Descriptive statistics". Two constant variables (the year of establishment and the year of a major change) are omitted from the analysis for technical reasons (as during the cluster analysis they cannot be effectively used together with discrete variables) and, on the other hand, we wanted to form homogeneous groups of IFIs according to their operational characteristics at the end of 2016.

Each of the other variables is transformed into a discrete numerical value (which may be 0 or 1). The absence of data is marked by a separate variable (0 or 1). For example, the following 3 variables are defined for the selection of Governing / High-level Management Members: "Selected only by Government", "Selected not only by Government", and "Selected by n.a.". If any data is missing, the last variable may be 1 and the others may be 0. Based on the above, we have 34 variables for each country.

The results are depicted in a dendrogram. We also applied a multi-dimensional scaling (MDS) technique in our database. The primary result of the MDS analysis is a two-dimensional visualization of countries, expressed as distances between points displaying the similarity of objects.

The below two figures (Figure 1 and Figure 2) clearly show the two main clusters: in practice, an EU vs. non-EU breakdown. The cluster analysis includes South Africa, Iran and Peru in the EU group. Germany is transferred to the non-EU group. If the regional variable is removed a similar result is given, which underpins the robustness of our result. As we can also observe, the countries which adopted the US-model were in the same clusters, with the exception of South Africa.

**Figure 1** 1st Dendrogram



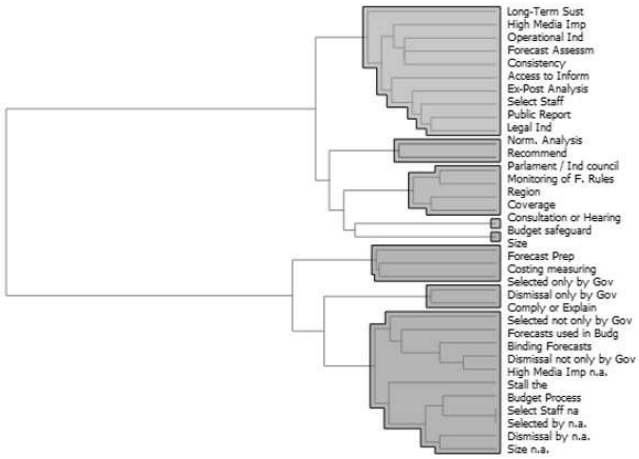

Source: the authors' cluster analysis

**Figure 2** MDS Two-dimensional Results


Source: the authors' cluster analysis

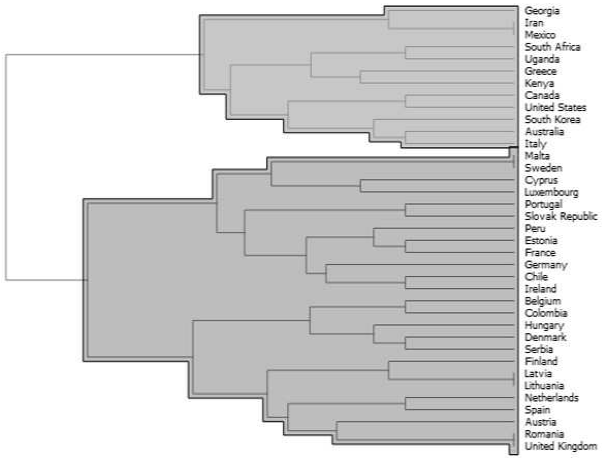
Below (Figure 3) is a cluster analysis of factors in order to use the factor characteristic of a cluster rather than a large number of factors. Factors are classified into the following 8 clusters. One factor was selected of each of the eight clusters (long-term sustainability; normative analysis; parliament or independent body; consultation or hearing; budget safeguard; forecast preparation; dismissal only by government; selected not only by government). Having selected these 8 factors, the cluster analysis was run again (see the results at Figure 4).

**Figure 3** Dendrogram of Factors




Source: the authors' cluster analysis

**Figure 4** 2nd Dendrogram




Source: the authors' cluster analysis

The EU vs. non-EU groups clearly separated in this case as well. Note that in this case the results are already sensitive to which of the 8 indicators are selected from among the above variable clusters, as the number of variables has been reduced considerably. Depending on this, the countries at the border of the two clusters may drift from one cluster to the other.

Overall, our cluster analysis and its sensitivity test has reinforced the experiences detailed in the descriptive part, namely that the characteristics of fiscal councils differ in an EU vs. non-EU breakdown. Another important phenomenon of the second dendrogram is that the US-model-adopting country-group has become clearly visible in the non-EU cluster.

## 5 Conclusions

In order to improve the regulation and methodology of fiscal surveillance, much has been done at the national and international level, but the ex-post control of public finances, the rule-based budget and fiscal controlling cannot fully prevent fiscal imbalances. Therefore, independent fiscal institutions (IFIs) have been established in many countries.

The literature emphasizes the heterogeneity of fiscal councils. In contrast, our cluster analysis confirms the hypothesis that there is a divergence between the EU and non-EU Fiscal Councils.

The separation between the two groups can be captured by the following features. Regarding the institutional form, EU IFIs are typically a body separate from the parliament, while outside the EU there are considerably more IFIs that may be linked to the parliament. In terms of the key mandate elements, in the EU every institution checks compliance with the various fiscal rules from a forward-looking perspective, while in non-EU countries IFIs have considerably less weight. In the latter, the stress falls primarily on forecasts and on the assessment of the short- and/or long-term impacts of major public finance actions. In an analysis of the influence on fiscal processes, it can be established that currently fiscal councils' direct impact on the budget process is less significant; they are basically considered as advisory bodies. Nevertheless, in the EU Member States, they have a set of relatively more powerful instruments in this area.

Practically everywhere (95%) in the EU, IFIs have an indirect impact, through the media, while not all non-EU IFIs have it (64%). Most IFIs have both legal and operational independence in the EU, while this ratio is also lower among non-EU IFIs. In non-EU developing countries, it is particularly low.

In our opinion, one of the main causes of divergence between IFIs in the EU and in non-EU countries is that, in the EU, the strengthening of IFIs is supported by an increase in fiscal cohesion and the longer-term objective of the fiscal union. This process is accelerated by the common European regulation and other integration policies (common crisis management mechanism, banking and capital market union). In contrast, outside the EU the establishment of IFIs is triggered by federal organization, on the one hand, and the need to respond to the reduction of fiscal authenticity caused by crises, on the other hand.

The IMF and the OECD have also contributed to the latter. An additional factor is the adoption of similar patterns (USA) operative outside the EU. For this reason, in normal circumstances central government politicians in non-EU countries may not be expected to voluntarily give up discretional fiscal policy or, even if they adopt a rules-based fiscal policy, to "voluntarily" establish genuinely independent supervisory institutions. Based on the above, IFIs can very much be considered a European solution rather than the evolution of a new global standard.

## References


Acharya V. V., Steffen S. (2017). The Importance of a Banking Union and Fiscal Union for a Capital Markets Union. 2017 *Fellowship Initiative Papers*. European Commission. Retrieved from: https://ec.europa.eu/info/sites/info/files/dp_062_en.pdf.

Beetsma, R., Debrun, X. (2016). Debunking 'fiscal alchemy': The role of fiscal councils. *VoxEU Article*. Retrieved from: http://voxeu.org/article/debunking-fiscal-alchemy-role-fiscal-councils.

Berger, H., Dell'Ariccia, G., Obstfeld M. (2018). Revisiting the Economic Case for Fiscal Union in the Euro Area. *IMF Departmental Paper No.18/03.* Retrieved from: https://www.imf.org/en/Publications/Departmental-Papers-Policy-Papers/Issues/2018/02/20/Revisiting-the-Economic-Case-for-Fiscal-Union-in-the-Euro-Area-45611.

Curristine T., Harris J., Seiwald J. (2013). *Case studies of fiscal councils—functions and impact.* IMF. Retrieved from: https://www.imf.org/external/np/pp/eng/2013/071613a.pdf

Debrun, X., Kumar, M.S. (2007). Fiscal Rules, Fiscal Councils and All That: Commitment Devices, Signalling Tools or Smokescreens? *Fiscal Policy: Current Issues and Challenges, Banca d'Italia.* Retrieved from: https://www.bancaditalia.it/pubblicazioni/altri-atti-convegni/2007-fiscal-policy/Debrun_Kumar.pdf?language_id=1.

Debrun, X., Kinda, T. (2014). Strengthening Post-Crisis Fiscal Credibility: Fiscal Councils on the Rise - A New Dataset, *IMF Working Paper*, WP/14/58.

Debrun, X., Zhang, X., Lledó, V. (2017). *The Fiscal Council Dataset: A Primer to the 2016 Vintage.* Retrieved from: https://www.imf.org/external/np/fad/council/pdf/note.pdf.

Herzog, B. (2018). Reforming the Eurozone: Assessment of the Reform Package by the European Commission – Treating Symptoms or Root Causes? *Economics and Sociology*, 11(3), pp. 59-77.

IMF (2013). *The functions and impact of fiscal councils.* Retrieved from: https://www.imf.org/external/np/pp/eng/2013/071613.pdf.

Kopits, G. (2016). The Case for an Independent Fiscal Institution in Japan. *IMF Working Paper WP/16/156*. Retrieved from: https://www.imf.org/external/pubs/ft/wp/2016/wp16156.pdf.

OECD (2014). *Recommendation of the Council on Principles for Independent Fiscal Institutions.* Retrieved from: https://www.oecd.org/gov/budgeting/OECD-Recommendation-on-Principles-for-Independent-Fiscal-Institutions.pdf.

Wyplosz, C. (2002). Fiscal Policy: Institutions vs. Rules. *HEI Working Paper No: 03/2002* Retrieved from: http://repec.graduateinstitute.ch/pdfs/Working_papers/HEIWP03-2002.pdf.

# Robust Optimization Methods in Modern Portfolio Theory

**Maroš Bobulský[1], Mária Bohdalová[2]**

[1] Comenius University in Bratislava
Faculty of Management, Department of Information Systems
Odbojárov 10, Bratislava, 820 05. Slovakia
E-mail: maros.bobulsky@fm.uniba.sk

[2] Comenius University in Bratislava
Faculty of Management, Department of Information Systems
Odbojárov 10, Bratislava, 820 05. Slovakia
E-mail: maria.bohdalova@fm.uniba.sk

***Abstract:*** *One of the main questions that an investor faces when investing, is how to allocate resources among the variety of different assets. Markowitz portfolio optimization problem as a part of modern portfolio theory (MPT) solve this problem. The main idea of the Markowitz model is to create such portfolio management strategies that lead to the biggest expected returns with minimal possible risk. The expected returns (represent profit) and the covariance matrix (represents risk measure) of assets of the investor's portfolio are his inputs. After solving the optimization problem. its direct outputs are the weights of the distribution of funds over specific assets in order to maximize expected profit. However, needed inputs are difficult to predict which causes low credibility of the results. Therefore, we will introduce a robust way to solve this problem. We define filter matrices that make the selection of the right parameters more uncertain. After that, we solve this problem by so-called worst-case optimization, when at every point of the domain of optimization problem we deliberately choose the worst possible parameter from the relevant uncertainty set of parameters. In our case, the set of uncertainty consists of filter matrices, which change the data slightly so also expected returns and covariance matrix will change. The main goal of this paper is to examine this problem in the real time portfolio modeling when at every point in time we recalculate weights for assets and adjust portfolio composition. Finally, we discuss variations of this model when the addition of the new parameter gives a minimization function that will enable us to use the Markowitz model in solving more difficult non-linear Hamilton-Jacobi-Bellman differential equation.*

*Keywords: Markowitz model, robust optimization, data filtering*

*JEL codes: C61, G11, G10, C65*

## 1 Introduction

The goal of this paper is to examine properties of investing models that maximize investor's returns. Especially, we deal with modification of the Markowitz portfolio allocation problem. We will propose so-called robust optimization that assume uncertain input parameters (such as expected returns and variance). Our main aim is to prove statistically that our model has better properties and it is more suitable for portfolio selection as classical Markowitz approach (Nawrockia and Viole, 2014). The problem of the optimal allocation of the assets was solved in many papers. Alexander and Baptista (2011) provided an analytical characterization of the existence and composition of the optimal portfolios within accounts and the aggregate portfolio. Lan et al. (2012) used BIC selection criterion to identify relevant stocks to allocate portfolio. (Pfiffelmann et al., 2016) examined the statistical method used to portfolio allocation. (Alexander et al., 2017) developed a model to portfolio selection that incorporates aspects of both behavioral and mean-variance approach.

Now, we introduce the portfolio optimization problem, from the investor's point of view. The ones are willing to buy some shares or bonds. His main problem is not only to make a decision about what to buy, but also how many of it to buy. Let's make an assumption that our original budget is one million euros. Also, we have decided exactly what kind of

shares we want to buy. Now, we have to develop a strategy, which will tell us how to divide our budget among these assets. This strategy is represented by weights. These weights are real values between zero and one. They represent the portion of the budget invested into a particular asset. We require, the number of these weights must equal to the number of companies and the sum of the weights equals to one. It means that we are willing to spend all of our money. These optimization problem, we consider as a portfolio optimization models. One of them is the Markowitz problem. We are interested in such combination of assets that leads to maximum returns. During this optimization, we can't forget that we also deal with risk potential of the assets. The measure of this risk can be represented by variance and covariance of the returns. So, the problem is not to maximize expected returns only, but also to minimize the potential risk of the portfolio.

Markowitz's approach offers the solution to this problem. The optimization scheme can be written as follows:

$$\max_{\boldsymbol{\theta}\in\mathbb{R}^N} \boldsymbol{\mu}^{\boldsymbol{T}}\boldsymbol{\theta}, \tag{1}$$

$$\boldsymbol{\theta}^{\boldsymbol{T}}\boldsymbol{\Sigma}\boldsymbol{\theta} \leq \sigma^2, \tag{2}$$

$$\sum_{i=1}^{N} \theta^i = 1\ , \tag{3}$$

$$\boldsymbol{\theta} \geq 0. \tag{4}$$

where vector $\boldsymbol{\mu} \in \mathbb{R}^N$ with $\mu^i = \mathbb{E}(\boldsymbol{X}^i)$ is a vector of expected returns and $\boldsymbol{\Sigma}$ is the covariance matrix, $\Sigma_{ij} = cov(\boldsymbol{X^i}.\boldsymbol{X^j})$. We denote by *N* the number of companies or types of shares. Matrix $\boldsymbol{X}$ consists of historical returns of the shares, where each column represents one asset. Vector $\boldsymbol{\theta} \in \mathbb{R}^N$ is our output variable, already mentioned weights. Formulas (3) and (4) set specific boundaries so the result has features that we defined earlier. Constant $\sigma^2$ is apriori chosen level of variance (risk) that is not supposed to be breached.

The formulas (1), (2), (3) and (4) describe maximization problem. We are looking for weights $\boldsymbol{\theta}$ that maximize expected returns, but on the other hand, we do not want to breach certain level of variance. The solution exists because we are looking for maximum value of linear plane over convex subset. In this case, our major problem isn't the existence, but relevancy of the solution. Before optimization, we should know the estimation of $\boldsymbol{\Sigma}$ and $\boldsymbol{\mu}$. But we don't. We can guess, make some assumptions, but in the end, we'll figure out that there is no such thing like the best approach of estimating them. For example, mean of returns calculated form historical data should be good choice of estimator for expected returns $\mu$. But who can tell us how long history of returns to consider? If we take into account too short time series, the results can't be trustworthy. Too long ones can contain information of economic trends that are no more real. So, the estimation of input parameters can be really tricky. And the thing is, even small changes in these calculations can cause the great differences in the portfolio.

In this paper we examine so called robust optimization. Suppose that we don't know what the real expected return $\mu$ is, but we know the set of its plausible realization. Let's denote the set $\mathrm{M}$. We can call it the *set of uncertainty* or just *uncertainty set*. Now we can adjust the formula (1) and change it this way:

$$\max_{\boldsymbol{\theta}\in\mathbb{R}^N} \min_{\boldsymbol{\mu}\in\mathrm{M}} \boldsymbol{\mu}^{\boldsymbol{T}}\boldsymbol{\theta}. \tag{5}$$

Now, the other three conditions (2), (3) and (4) remain the same. We can see that just right before maximization of (5) in $\boldsymbol{\theta}$, we minimize the formula in expected returns $\boldsymbol{\mu}$. It means that at every point of maximizing we deliberately choose the worst vector parameter $\boldsymbol{\mu}$ from the set of uncertainty or if we are not sure about what parameter to choose, we just take the worst one. This method is called worst-case optimization.

Of course, at first, we were confused of how to choose single one parameter and now we have to estimate the whole set (*uncertainty set*). On the other hand, it enables us to be

more creative. Furthermore, at the end, we will be able to show that this approach can be more efficient in controlling the portfolio.

Similar approach can be seen in Kilianová and Trnovská (2014). In their paper, they introduced various types of uncertainty sets. We will propose our own type of uncertainty using so-called *filter matrices*. We will simulate two different portfolios. The first one is calculated using filter matrices robust optimization. The second one is calculated using basic Markowitz way. Our goal is to show that our robust approach can lead to higher efficiency.

## 2 Theoretical background

We want to simulate and to compare the results of two different types of optimal portfolio strategies on the same data. Firstly, we need to write down exact formulas for both models. Bobulsky (2018) examined the portfolio optimization problem from slightly different point of view. Kilianová and Ševčovič (2013) discussed the problem of optimal portfolio allocation via solution to Hamilto-Jacobi-Bellman stochastic differential equation. If we denote expected return and variance in more general way, as a function of $\boldsymbol{\theta}$, and assume that logarithmic portfolio value follows stochastic differential equation:

$$\mathrm{dX}_\mathrm{t}^{\theta} = \left(\epsilon \mathrm{e}^{-\mathrm{X_t}} + \boldsymbol{\mu}(\theta) - \frac{1}{2}(\boldsymbol{\sigma}(\boldsymbol{\theta}))^2\right)\mathrm{dt} + \boldsymbol{\sigma}(\boldsymbol{\theta})\mathrm{dW_t}, \tag{6}$$

where $\mathrm{W_t}$ is Brownian motion and $\epsilon \geq 0$ is non-negative rate for inflow of money into the portfolio then we introduce portfolio optimization problem by so-called *Value function*:

$$\boldsymbol{V}(x,t) = \sup_{\boldsymbol{\theta}} \mathbb{E}\left(\boldsymbol{U}\left(X_t^{\boldsymbol{\theta}}\right) \middle| X_t^{\boldsymbol{\theta}} = x\right), \tag{7}$$

with marginal condition $\boldsymbol{V}(x,T) = \boldsymbol{U}(x)$, where $\boldsymbol{U}(x)$ is investor's utility function. The Hamilton-Jacobi-Bellman equation for logarithmic variable x can be written as:

$$\partial_t \boldsymbol{V} + \max_{\boldsymbol{\theta}}\left\{\left(\epsilon e^{-x} + \boldsymbol{\mu}(\boldsymbol{\theta}) - \frac{1}{2}(\boldsymbol{\sigma}(\boldsymbol{\theta}))^2\right)\partial_x \boldsymbol{V} + \frac{1}{2}\boldsymbol{\sigma}(\boldsymbol{\theta})^{\mathbf{2}}\partial_x^2 \boldsymbol{V}\right\} = 0. \tag{8}$$

Kilianová and Ševčovič (2013) showed that equation (8) can be rewritten also as:

$$\partial_t \boldsymbol{V} + (\epsilon e^{-x} - \alpha(\varphi))\partial_x \boldsymbol{V} = 0, \quad \boldsymbol{V}(x,T) = \boldsymbol{U}(x), \tag{9}$$

where they have denoted

$$\alpha(\varphi) = \min_{\boldsymbol{\theta}}\left\{-\boldsymbol{\mu}(\boldsymbol{\theta}) + \frac{\varphi}{2}\boldsymbol{\sigma}(\boldsymbol{\theta})^{\mathbf{2}}\right\}. \tag{10}$$

To transform the equation (8) to equation (9), they used so-called Riccati transformation

$$\varphi(x,t) = 1 - \frac{\partial_x^2 \boldsymbol{V}(x.t)}{\partial_x \boldsymbol{V}(x.t)}. \tag{11}$$

They also proved that function $\varphi(x,t)$ is a solution of the following quasi-linear parabolic equation:

$$\partial_t \varphi + \partial_x^2 \alpha(\varphi) + \partial_x[\epsilon e^{-x}\varphi + (1-\varphi)\alpha(\varphi)] = 0, \quad x \in \mathbb{R}.\, t \in [0,T), \tag{12}$$

where

$$\varphi(x,T) = 1 - \frac{\boldsymbol{U}''(x)}{\boldsymbol{U}'(x)}, \quad x \in \mathbb{R}.$$

The important thing about previous equations from (6) to (12) is that investor doesn't have to solve fully non-linear Hamilton-Jacobi-Bellman differential equation (8) to find optimal portfolio allocation $\boldsymbol{\theta}$ which is dependent on a current point in time $t$ and a logarithmic value of portfolio $x$. He just needs to solve quasi-linear equation (12) that can be numerically solved more easily.

When we look at the way $\varphi$ is defined, we can see that the solution $\varphi$ in equation (12) can be seen as coefficient of investor's risk aversion. As a function of $t$, we can watch its evolution in time. So, the last step in investor's optimization procedure is to put the final

$\varphi$ into the optimization problem (10) and solve it to obtain final weights $\boldsymbol{\theta}$ for his portfolio.

This is why we will choose our two portfolio models in very similar way as formula (10). Firstly, it is almost the same problem as already discussed Markowitz approach. You can see that we minimize negative returns and the variance at the same time. Secondly, the dependence on parameter $\varphi$ can help us to justify that our robust approach can be useful also for controlling the portfolio via far more sophisticated Hamilton-Jacobi-Bellman equation. The equation (12) gives to investor parameter $\varphi$ (or risk aversion) and therefore they need to calculate the strategy $\boldsymbol{\theta}$. Furthermore, if we manage to prove that our proposed optimization model is more efficient regardless of the chosen value of $\varphi$, we can show that robust worst-case approach is better choice for any level of investor's risk aversion.

**Model Specification**

Let's denote as

$$\begin{aligned} &\min_{\boldsymbol{\theta}} \left\{ -\boldsymbol{\mu}^{\boldsymbol{T}}\boldsymbol{\theta} + \frac{\varphi}{2}\boldsymbol{\theta}^{\boldsymbol{T}}\boldsymbol{\Sigma}\boldsymbol{\theta} \right\}, \\ &\sum_{i=1}^{N} \theta^i = 1, \\ &\boldsymbol{\theta} \geq 0 \end{aligned} \tag{13}$$

the basic portfolio optimization model. Vector of expected returns $\boldsymbol{\mu}$ is estimated as mean of historical returns and $\boldsymbol{\Sigma}$ is covariance matrix of these returns. We will use two years window of daily returns to calculate optimal weights. Then we use the output strategy $\boldsymbol{\theta}$ to divide one million euros into particular assets and watch how the portfolio evolves in time. After every day we move the window one day ahead. We repeat the calculations and adjust portfolio's $\boldsymbol{\theta}$. This procedure is repeated for two years. Then we check the results and compare them with results from the second model, the robust one.

The main properties of data and historical returns that we have used will be discussed in Section 3. At first, we propose our robust worst-case optimization method.

The first basic optimization model (13) can be rewritten as:

$$\begin{aligned} &\min_{\boldsymbol{\theta}} \left\{ -\boldsymbol{\mu}^{\boldsymbol{T}}\boldsymbol{\theta} + \max_{\boldsymbol{\Sigma}\in\mathbb{P}} \frac{\varphi}{2}\boldsymbol{\theta}^{\boldsymbol{T}}\boldsymbol{\Sigma}\boldsymbol{\theta} \right\}, \\ &\sum_{i=1}^{N} \theta^i = 1, \\ &\boldsymbol{\theta} \geq 0. \end{aligned} \tag{14}$$

For the sake of simplicity, we will focus on uncertainty in covariance matrix only. The difference between (13) and (14) is, as we can see, that optimization model (14) chooses the worst possible covariance matrix $\boldsymbol{\Sigma}$ for every allowed fixed $\boldsymbol{\theta}$. The set of our uncertainty in variance estimation is called $\mathbb{P}$.

The notation (14) is too general. We want to create some reasonable set $\mathbb{P}$ that would enable us to transform the optimization problem into numerically solvable one. For this purpose we introduce so-called *filter matrices*. We have already mentioned that the covariance matrix in the first model (13) is estimated from the two years long window of historical daily returns. Now suppose that we won't use all of them, but for example only every second one. It means that we deliberately collect returns from every second day only. By doing that, we should obtain slightly different covariance matrix. If we use this method to divide the data into two groups (the first group consisting of returns from even days and the second group from odd days), we obtain two covariance matrices. Now imagine that we collect data from every *k*-th day. We get *k* data samples what means we can estimate *k* different covariance matrices. These matrices generate our set of uncertainty $\mathbb{P}$.

Bobulský (2018) proved that optimization problem (14) can be rewritten as follows:

$$\min_{\boldsymbol{\theta}} \left\{ -\boldsymbol{\mu}^{\boldsymbol{T}}\boldsymbol{\theta} + \max_{\mathrm{A}\in\mathbb{P}} \frac{\varphi}{2} \boldsymbol{\theta}^{\boldsymbol{T}} \mathbf{X}^{\mathbf{T}} \mathbf{A}^{\mathbf{T}} \mathbf{Q} \mathbf{A} \mathbf{X} \boldsymbol{\theta} \right\},$$
$$\sum_{i=1}^{N} \theta^{i} = 1,$$
$$\boldsymbol{\theta} \geq 0. \tag{14}$$

Matrix $\mathbf{X}$ contains original two years long historical returns and matrices $\mathbf{A}$ are so-called *filter matrices*. Filter matrices consist of zeroes and ones, every row contains only one value of 1 and the number of rows is smaller than number of columns (because we want to shorten data by filtering it). For instance, the $\mathbb{P}$ for collecting returns from every third day would look like:

$$A_1 = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \end{bmatrix}.$$

$$A_2 = \begin{bmatrix} 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \end{bmatrix}.$$

$$A_3 = \begin{bmatrix} 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \end{bmatrix}.$$

The sizes of matrices **A** are adjusted to size of the matrix **X**.

Matrix **Q** is equal to:

$$\boldsymbol{Q} = \frac{1}{m}\mathbb{I} - \frac{1}{m^2}\mathbf{1}\mathbf{1}^{T} \tag{15}$$

where *m* is number of rows in matrices **A**. $\mathbb{I}$ is *m* times *m* identity matrix and **1** is vector of ones.

Via this transformation, we managed to change the problem from the one with calculation of variances to the one with few simple algebraic matrix operations.

Kilianová and Trnovská (2014) showed that due to discrete type of uncertainty we can change our robust worst-case portfolio optimization problem like:

$$\min_{\boldsymbol{\theta}} \left\{ -\boldsymbol{\mu}^{\boldsymbol{T}}\boldsymbol{\theta} + \frac{\varphi}{2}\delta \right\}.$$
$$-\delta + \boldsymbol{\theta}^{\boldsymbol{T}} \mathbf{X}^{\mathbf{T}} \mathbf{A}^{\mathbf{T}} \mathbf{Q} \mathbf{A} \mathbf{X} \boldsymbol{\theta} \leq 0. \; for\ all\ \boldsymbol{A} \in \mathbb{P}$$
$$\sum_{i=1}^{N} \theta^{i} = 1.$$
$$\boldsymbol{\theta} \geq 0. \tag{16}$$

Optimization problem (16) is convex in its variables and thus numerically easily solvable. For this case we used CVX solver and we have repeated similar calculations like for the first Markowitz based model (13).

## 3 Methodology and Data

Now we want to run and compare two models. Robust way of optimization focuses more on minimizing the variance part and less on the part with negative expected return. The thing is that even without further calculations we can expect our model to be little bit less successful in gaining a great return. On the other hand, it is reasonable to require at least lower risk in variance.

Sometimes, we can be just fine with lower expected return, if the new portfolio promises greater decrease of variance. To measure efficiency and to compare our portfolios we decided to use an indicator known as *Sharpe ratio*. This ratio is calculated as proportion of portfolio's observed return and its standard deviation (square root of the variance):

$$SR = \frac{\mu_{portfolio}}{\sigma_{portfolio}} = \boldsymbol{\mu}^{\boldsymbol{T}}\boldsymbol{\theta}/\sqrt{\boldsymbol{\theta}^{\boldsymbol{T}}\boldsymbol{\Sigma}\boldsymbol{\theta}} \tag{17}$$

where $\boldsymbol{\mu}$ and $\boldsymbol{\Sigma}$ are calculated from data. The bigger the Sharpe ratio, the better the model. It makes sense because this indicator is increasing function in expected returns and decreasing function in variance.

Now we are going to use data set of two years of daily returns. Then we run the portfolio for another two years long period, calculate its average return, standard deviation and finally compute the Sharpe ratio. Optimal weights $\boldsymbol{\theta}$ are recalculated every day. After this procedure is done for both of portfolios, we can compare which Sharpe ratio is bigger.

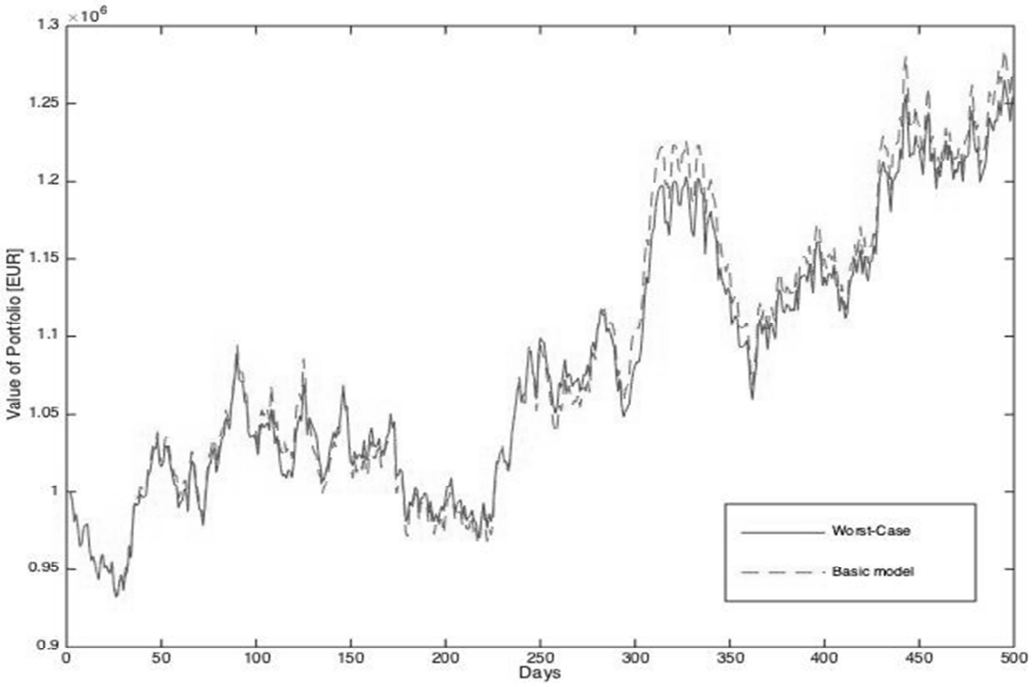
We should realize that for just one set of data we can obtain almost random outputs. The models are only estimating the best way of investing. The real returns can be slightly different. So even the Sharpe ratio of our model can be randomly greater or lower than ratio of the second model. But what if we had almost unbounded number of data sets and run the same procedures, for instance, thousand times? Then we would be able to compare in how many cases the Sharpe ratio was better in our model and how many times it was better in the second *basic* model. We will prove that our model seems to be better and more efficient in significantly more than 50% of cases. To prove this, we use Student's *t*-test for means of two paired samples. We can use this test, even without the normality in data, because of central limit theorem. One thousand calculations of independent pairs of Sharpe ratios is far too enough for assumption that the mean of many observations is approximately normally distributed.

The problem is that we need those one thousand different data sets. All of them four years long (two years for primary estimation of parameters and the two more for controlling the portfolio in time). We decided to simulate this data. Covariance matrix and expected return is estimated from daily returns of 10 companies included in DAX30 index from years 2012-2015. The simulation follows the random returns from multivariate normal distribution. Furthermore, we calculate and evaluate Sharpe ratios for various values of $\varphi$, so we can show that the robust worst-case optimization causes greater values of efficiency regardless of risk aversion of investor. Hence, even if dealing with Hamilton-Jacobi-Bellman equation, we don't have to be worried about $\varphi$ given.

One of the possible portfolio evolutions is displayed in Figure 1. We assume that one year has 250 business days. To create the uncertainty set $\mathbb{P}$, we consider the *filter matrices* that collect data from every 15th day (three weeks). This parameter was chosen during a lot of simulations when we tried to make uncertainty set as robust as possible, but on the other hand, we wanted to avoid too long computational time.

Furthermore, too robust uncertainty causes that variance matrices are computed from too little data. And this is also not very good.

**Figure 1** Evolution of Portfolio




Source: Own calculation. Simulated data based on DAX30 from 2012-2015

## 4 Results and Discussion

We have simulated a thousand of four years long daily data for every $\varphi/2$ from 0.5 to 6 (step length set equal to 0.5). A moving window for input parameters estimation was always set to two years long interval. We proceeded in time for another two years long simulation of portfolios, where every day we adjusted optimal weights and moved window one day ahead. All of the calculations have been repeated for both of approaches (basic and robust). At the end of each simulation we calculated two Sharpe ratios from observed evolutions for both portfolios. The final figures are in Table 1.

**Table 1** Sharpe ratio statistics

| $\varphi/2$ | **1** | **1.5** | **2** | **2.5** | **3** |
|---|---|---|---|---|---|
| **Robust Sharpe Wins** | 55.7% | 61.96% | 62.11% | 63.24% | 62.49% |
| **p-value. H1: <>50%** | ~0 | ~0 | ~0 | ~0 | ~0 |
| **Average Robust SR** | 1.057 | 1.109 | 1.087 | 1.167 | 1.182 |
| **Average Basic SR** | 1.026 | 1.071 | 1.048 | 1.126 | 1.136 |
| **p-value. H1: SR1>SR2** | ~0 | ~0 | ~0 | ~0 | ~0 |
| **Avg Stand. Deviation 1** | 16.65% | 15.73% | 14.84% | 14.22% | 13.59% |
| **Avg Stand. Deviation 2** | 17.47% | 16.76% | 15.92% | 15.28% | 14.63% |
| **Avg Annual Return 1** | 14.44% | 14.59% | 14.22% | 14.43% | 14.22% |
| **Avg Annual Return 2** | 14.53% | 14.75% | 14.48% | 14.77% | 14.56% |
| **Positive return** | 89,70% | 89,90% | 92,10% | 91,40% | 91,70% |

Source: Own calculations

Calculations for few values of $\varphi$ are displayed in Table 1. In the first row, we have counted in how many cases is final Sharpe ratio of robust worst-case optimization bigger than the ratio of the second basic model. Values about 50% would suggest the two

methods have no real influence on model efficiency. On the contrary, we can see that robust optimization wins the game of greater Sharpe ratio more often than its opponent. The statistical significance can be tested by Student's *t*-test. Output *p*-values we can see in row two of Table 1.

The similar approach can be seen in the rows with average Sharpe ratio for fixed $\varphi$. In this case we used Student's paired test. To the contrary, we compared real values of Sharpe ratios, not only the pieces of information about which one is greater than other. *P*-values are again almost equal to zero which means that the difference is significant. Row named *Positive return* contains information in how many cases we managed to reach profit in two years horizon.

Because of these calculations and tests we consider our robust worst-case optimization model more efficient than the standard Markowitz based model.

## References


Alexander, G. J., Baptista, A. M. (2011). Portfolio selection with mental accounts and delegation. *Journal of Banking & Finance*, vol. *35*(10)*,* pp. 2637–2656.

Alexander, G. J., Baptista, A. M., Yan, S. (2017). Portfolio selection with mental accounts and estimation risk. *Journal of Empirical Finance*, vol. 41, pp. 161-186. DOI: https://doi.org/10.1016/j.jempfin.2016.07.012.

Bobulský, M. (2018). Properties of the value function of a parametric quadratic programming problem. *Comenius University in Bratislava,* Master thesis, pp. 1-55.

Kilianová, S., Ševčovič, D. (2013). A Transformation Method for Solving the Hamilton–Jacobi–Bellman Equation for a Constrained Dynamic Stochastic Optimal Allocation Problem. *The ANZIAM Journal,* vol. 55(1), pp.14-38. DOI: 10.1017/S144618111300031X.

Kilianová, S., Trnovská, M. (2014). Robust portfolio optimization via solution to the Hamilton–Jacobi–Bellman equation. *International Journal of Computer Mathematics,* vol. 93(5), pp. 725-734. DOI: https://doi.org/10.1080/00207160.2013.871542.

Lan, W., Wang, H., Tsai, Ch. L. (2012). A Bayesian Information Criterion for Portfolio Selection. *Computational Statistics & Data Analysis*, vol. 56(1), pp. 88-99. DOI: https://doi.org/10.1016/j.csda.2011.06.012.

Nawrockia, D., Viole, F. (2014). Behavioral Finance in Financial Market Theory, utility theory, portfolio theory and the necessary statistics: A review. *Journal of Behavioral and Experimental Finance*, vol. *2,* pp. 10–17.

Pfiffelmann, M., Roger, T., Bourachnikova, O. (2016). When Behavioral Portfolio Theory meets Markowitz theory. *Economic Modelling*, vol. 53, pp. 419-435. DOI: https://doi.org/10.1016/j.econmod.2015.10.041.

# The Impact of the Ways of Agricultural Activity Reporting on Financial Statements under IFRS and Czech Accounting Legislation

**Hana Bohušová, Patrik Svoboda**

Mendel University in Brno
Faculty of Business and Management, Department of Accounting and Taxes
Zemědělská 1, 613 00, Brno
E-mail: hana.bohusova@mendelu.cz, ucpatrik@gmail.com

***Abstract:*** *The specific nature of agricultural activity compared to other business activities undertaken for profit requires different methodological approaches for their recognition, measurement, recording and reporting. The contribution deals with the impact of International Financial Reporting Standards (IFRS) reporting in agricultural activities on financial analysis ratios. The aim of the research is the evaluation of the impact of the treatments for individual kinds of biological assets (such as consumable plants and bearer plants) and their changes in value during their life reporting. The comparison of traditional accounting approaches, cost models and fair value models is the starting point of evaluation. The data of the Institute of Agricultural Economics and Information are used as a source of the information on the market values of agricultural produce and cost of individual agricultural activities. According to the authors´ research the way of biological assets reporting could affect the financial position and performance of business entities involved agricultural sector significantly.*

*Keywords: agricultural reporting, Fair value, cost measurement, Bearer plants, consumable assets.*

*JEL codes: M21, M41*

## 1 Introduction

Agriculture is a special kind of business activity. The nature of agricultural activities significantly differs from other business activities. Agricultural activity is in comparison with other activities of business subjects depended on the natural and environmental conditions, and therefore the agriculture specialization is narrowly connected with geographical position. The long production cycle is typical for agriculture, the lengths is dependent on biological production cycle which could be in the range from several weeks to tenths of years in the case of forestry. Agriculture is a kind of activity which combines labor, land, animals, plants, solar energy to provide food and raw material. It has been associated with production of essential food. It includes farming, forestry, dairy, fruit cultivation, poultry or bee keeping. The treatments used for measurement, recording and reporting of common business activities used in majority of financial reporting systems do not describe the agricultural activity properly. The common financial reporting treatments do not reflect the biological character of agricultural business. Since 2001, there is the special International Accounting Standard (IAS) 41 – Agriculture which partially respects the special character of agricultural activity and the amendment to IAS 16 - Bearer Plant (since 2013) and there is the special Section 34 - Specialized Activities in IFRS for SMEs. The Section 34 gives only a very brief and ambiguous methodology for agricultural reporting. Contrary, there is not any special treatment for agricultural reporting in many national GAAPs. In the Czech Republic, there is a general regulation of financial reporting in a form of Accounting Act, Decree 500 Col. and Czech accounting standards (CAS), especially 013 – Long-term tangible and intangible assets, 015 – Inventories and 019 – Revenues and Expenses which do not contain any special treatment concerning agriculture. As is apparent from above mentioned, the treatments for agriculture reporting are different. It would be reasonable to unify the approach to agriculture reporting in different reporting systems. The paper should contribute to the solution of this issue.

## 2 Aim and Methodology

The paper is focusing on treatments concerning reporting of agricultural plants in IFRS, and the Czech accounting legislation. The aim of this paper is to solve research questions:

- Is the fair value measurement of biological assets in accordance with the true and fair view principle?
- Is the fair value measurement understandable and does it respect differences between biological assets in the form of plants and living animals considering the production cycle of biological assets?

The paper is divided into two parts. Firstly, within the theoretical framework the possible ways of biological assets reporting are considered. The second part is a comparative analysis of possible ways of biological assets reporting which is the basis for the third part – original research in which the authors concentrated - on the possible ways of biological assets measurement and reporting proposal.

## 3 Results

The IAS 41 – Agriculture considering the specific character of agricultural activity was issued in December 2000. The model of fair value for agricultural assets and produce measurement for all biological assets was introduced in this standard. Only the fair value measurement could reflect the biological transformation process and the increase in value during the production cycle. On the other hand, there are significant differences in the nature of individual biological assets and produce, and the only way to measure and present all kinds of biological assets seems not to be appropriate and difficult to use.

Biological assets could be categorized as bearer assets and consumable assets. Consumable assets are those which are to be harvested as agricultural produce or sold and they will be consumed. Bearer assets bear produce over their productive lives, which exceeds one period. IAS 41 generalized fair value assessment for all biological assets although not all of these assets were designated for capital appreciation or sale (bearer assets). It could lead to misleading information (Aryanto, 2011). In some cases, the extra costs could be incurred and some practical difficulties could arise in fair value measurements of biological assets. According Argilés et al. (2012) and the conclusion their empirical study, there are no significant differences in relation to assessing future cash flows and the costs. Also the results of the study of Bohušová and Svoboda (2017) proved the low information value of the fair value of bearer biological assets (especially plants) for external users of financial statements and the impact of an increase or decrease in the fair value of a bearer asset in the income statement could distort the performance of a business entity. The determination of the fair value of bearer plants is greatly influenced by the fact that there is no active market for bearer plants due to their connection with the place where they are grown and it is not possible to move them and trade them separately from the relevant land.

Moreover, some kinds of mature bearer biological plants (fruit trees, oil palms or rubber trees) are very similar to other long-term tangible assets such as property, plant and equipment. These assets are mature, and they are a means of growing agricultural produce over several reporting periods until they are scrapped at the end of their useful lives. There were a lot of proponents of reporting long-term bearer biological assets similarly to property, plant and equipment (Damian et al., 2014).

Based on the over mentioned significant features of mature bearer biological plants, the Amendments to IAS 16 and IAS 41: Bearer Plants were approved. They were issued on 30 June 2014, and they are effective since January 1st, 2016. They extend the scope of IAS 16 to bearer plants, but not to the produce of these plants. The amendments bring the bearer plants, which are used solely to bring the produce, into the scope of IAS 16-Property, Plant and Equipment, so they are treated in the same way. The measurement of bearer plants at recognition is based on the same principle as the measurement of other self-constructed assets reported according to IAS 16. The measurement after

recognition allows the use of a cost or revaluation model. The scope of IAS 16 is extended only to bearer plants, not to livestock.

The measurement of biological assets in the Czech Republic is regulated by the Czech Accounting Act and there is not any exception for special biological assets. The measurement is dependent on a way of their acquisition. The biological assets purchased are measured at their acquisition costs. In the cases where the assets are purchased as a group of individual assets (land and trees) the costs are split between individual items using expert estimation of their values. In case of self-produced biological assets the value is based on production cost incurred. These costs consist of all direct costs and the share of manufacturing overheads. According to CAS 13 and CAS 15 the costing of biological assets could be based on estimated costs or cost incurred.

**Biological assets – bearer biological assets (plants)**

According to results of many studies (Bohušová and Svoboda, 2016, Bohušová and Svoboda, 2017, He at al., 2018, Argiles-Bosch et al., 2018, Hýblová and Skalický, 2018) there are similar cycles in biological transformation in the case of bearer assets and construction of long term assets. In the early stages, costs are incurred without making associated benefits in the form of biological production (fruits, wine grapes, milk, wool etc.). This phase could be considered similar to the self-construction of fixed assets, where the life cycle and accounting methodology could be divided into the acquisition phase, the use phase and the phase of decommissioning. In the case of bearer assets the life cycle could be divided into similar stages (a period of growth, a period of fertility and gradual reduction in production capabilities, and death).

According to Svoboda and Bohušová (2017) bearer biological assets in the form of living animals (dairy cows, sheep bred for wool, laying hens) differ from bearer plants. There is usually an active market for livestock - that means the determination of fair value is not as problematic as in the case of bearer plants. Livestock can be moved and thus easier to trade. A higher residual value at the end of the life cycle and lower disposal costs are typical. There is a significantly shorter lifespan for bearer animals (dairy cattle, sheep for wool and milk, laying hens). The fair value information is appropriate during the whole life cycle of livestock.

A comparison of cost and fair value measurements for bearer plants has been carried out. An apple orchard is selected as a representative. Empirical data are used for processing. The data in the form of Situational and Forward-Looking Reports (Fruits - Situační a výhledová zpráva – ovoce) and reports concerning cost efficiency presented by the Institute of Agricultural Economics and Information are used.

The estimation of the fair value is processed in an accord with IFRS 13 – Fair value measurement. IFRS 13 describes three valuation techniques that an entity might use to determine fair value, as follows: (i) the market approach. An entity uses "prices and other relevant information generated by market transactions involving identical or comparable (i.e. similar) assets, liabilities or a group of assets and liabilities"; (ii) the income approach. An entity converts future amounts (e.g., cash flows or income and expenses) to a single current (i.e., discounted) amount; and (iii) the cost approach.

In the case of the apple orchard, there is not an active market for apple orchards without land. Thus, the use of market approach is usually not possible. The income approach seems to be more suitable but there are many items that should be estimated for the fair value measurement. These are inflation rate, yields of produce, market price of produce, cost of production, useful life, subsidies and management´s approach to risk.

Considering the most common variety of apples (Golden Delicious - dwarf trees in intensive planting with an average yield during the useful life of 13 years, and three years to reach full fertility) and using the input data in the table 1, the estimation of DCF could differ significantly. The life cycle of an apple orchard is described in Figure 1.

**Table 1** Apple orchard – input data for estimation of DCF during useful life

| Year | Yield t/ha | Price CZK/t | Direct costs/ha | Revenues /ha | Profit/ha |
|---|---|---|---|---|---|
| **1** | 11.86 | 6,399 | 43,362 | 75,892 | 32,530 |
| **2** | 10.3 | 8,828 | 47,737 | 90,928 | 43,191 |
| **3** | 12.83 | 11,784 | 49,213 | 151,189 | 101,976 |
| **4** | 16.01 | 8,409 | 51,479 | 134,628 | 83,149 |
| **5** | 13.7 | 7,784 | 49,320 | 106,641 | 57,321 |
| **6** | 15.97 | 8,219 | 48,127 | 131,257 | 83,130 |
| **7** | 21.57 | 8,432 | 52,911 | 181,878 | 128,967 |
| **8** | 15.57 | 8,246 | 48,024 | 128,390 | 80,366 |
| **9** | 18.33 | 8,548 | 53,013 | 156,685 | 103,672 |
| **10** | 17.15 | 8,289 | 50,166 | 142,156 | 91,990 |
| **11** | 17.97 | 9,967 | 64,918 | 179,107 | 114,189 |
| **12** | 15.26 | 8,048 | 67,096 | 122,812 | 55,716 |
| **13** | 17.62 | 8,920 | 71,005 | 157,170 | 86,165 |
| **14** | 13.13 | 10,256 | 74,908 | 134,661 | 59,753 |
| **15** | 17.9 | 10,371 | 97,741 | 185,641 | 87,900 |
| **16** | 16.68 | 7,808 | 97,658 | 130,237 | 32,579 |
| **17** | 11.85 | 8,607 | 104,070 | 101,993 | -2,077 |
| **18** | 9.18 | 9,856 | 92,417 | 90,478 | -1,939 |
| **19** | 13.68 | 9,624 | 110,394 | 131,656 | 21,262 |
| **20** | 13.78 | 9,761 | 111,609 | 134,507 | 22,898 |
| **21** | 14.1 | 10,262 | 114,806 | 144,694 | 29,888 |

Source: Own processing based on Situační a výhledová zpráva (1994-2014)

The following formula is used for calculation:

Fair value based on discounted cash flow for each year is expressed by the following formula:

$$\mathrm{DCF_j} = \begin{pmatrix} \sum_{j=1}^{12} \frac{CF_j}{(1+i)^{j-1}} \\ \sum_{j=2}^{12} \frac{CF_j}{(1+i)^{j-2}} \\ \vdots \\ \sum_{j=11}^{12} \frac{CF_j}{(1+i)^{j-11}} \\ \frac{CF_{12}}{(1+i)^{j-12}} \end{pmatrix} \qquad (1)$$

*Where:*

*j…… useful life of bearer plant,*
*i…… interest rate,*
*CFj…… moving minimum, average, maximum of period from j to j+9,*
*DCFmin ……Discounted cash flow – pessimistic option – in year j,*
*DCFavg ……Discounted cash flow – realistic option – in year j,*
*DCFmax…… Discounted cash flow – optimistic option – in year j.*

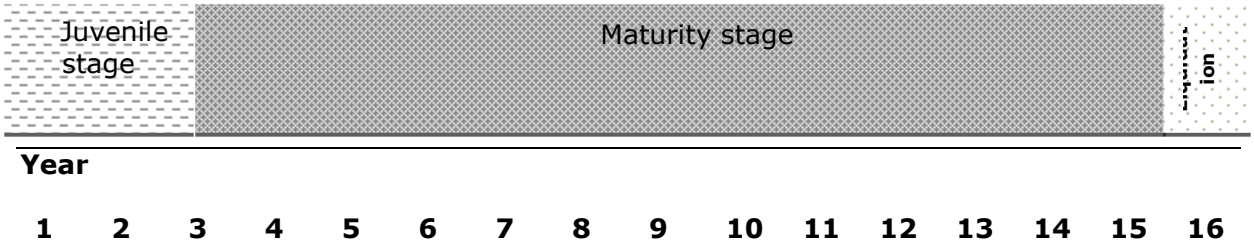
The probability (management´s approach to risk) could be taken into account in the fair value calculation. It is estimated the probability of 20% of pessimistic scenario *(p1)*, 60% of realistic scenario *(p2)* and 20% of optimistic scenario *(p3)*.

$$FV\ (j) = p_1\ .DCF_{jmin} + p_2.\ DCF_{javg} + p_3.\ DCF_{jmax} \qquad (2)$$

The fair value calculation as published by Svoboda, Bohušová (2017) for the first year of production cycle (the third year after the establishment of the orchard) using the data from the Table 1 and formulas (1) and (2) was 878,988 CZK per ha. The pessimistic, realistic and optimistic scenarios were considered. Using pessimistic scenario the fair value would be 309,897 CZK and using optimistic scenario the FV would be 1,452,926 CZK. In addition, the subsidies were excluded from calculation. These numbers were calculated based on general publicly available data, but individual agricultural companies could use their own historical data or other way of estimation of yields, selling prices and discount rate. It is therefore very subjective way of measurement and could differ for individual business entities and valuators significantly. There is not any standardized treatment for DCF calculation (neither in IFRS nor in national GAAPs). It is obvious that the residual value of the orchard is zero at the end of production cycle and after the end of production cycle is the orchard liquidated. It could be supposed that the cost of liquidation is not higher than the benefit from liquidation (mainly firewood, wood chips, and bark mulch).

The methodology for fair value estimation calculation is significantly affected by many subjective factors, these are: the input data used for estimation (in the over mentioned study the data published by UZEI were utilized, the firm´s historical production and cost data describing the special climatic conditions could be used), the estimation of useful life of bearer plants, the interest rates, etc.

**Figure 1** Life Cycle of an Apple Orchard




Source: own processing

Using the cost measurement for bearer plants, the cost of apple orchard establishment and cost of plantation until the fertility are capitalized. These costs are described in the following table 2.

**Table 2** Historical cost measurement at recognition – cost connected to the orchard setting up incurred during the first three years (until the full fertility) – standard cultivation technology (tie 4 × 2.5 m, dwarf tree planting)

| Activity | Work-related activities |
|---|---|
| **Land preparation before planting** | Compost or farmyard manure (FYM) fertilization (50 t per ha), store fertilizing (500 kg $P_2O_5$/ha, 650 kg $K_2O$/ha, 800 kg MgO/ha, 5,000 kg CaO/ha), deep ploughing, smoothing, basic laying out of the land |
| **Planting seedlings** | Pegging the area, digging pits, modification of roots and planting trees, tree guard installation, hammering stakes in and fixing trees to stakes |
| **1. year treatment** | Trees cut after planting, soil treatment- |

| | |
|---|---|
| | inter-row cultivation, herbicide application, nitrogen fertilization, protection against diseases and pests, seed blend green manure, incorporation of a mixed bag, sowing grass, summer trees cut |
| **2. year treatment** | Cut tree branches and cleaning after cutting, inter-row cultivation, herbicide application in the ranks, nitrogen fertilization, protection against diseases and pests, planting grass, grass mowing |
| **3. year treatment** | Cut tree branches and cleaning after cutting, inter-row cultivation, herbicide application in the ranks, nitrogen fertilization, protection against diseases and pests, planting grass, grass mowing |
| **Orchard setting up – total** | 450,000 CZK |

Source: Agro-technical standards of activities

As it is evident from the over-mentioned, due to the fair value measurement, the bearer plants could be reported at a higher value or lower value, compared to the cost measurement. It could mean that the bearer plants could be overestimated or underestimated, especially in the early years of useful life despite the fact that the bearer plants could not be traded separately from land. There could be a volatility of the fair value of bearer assets due to volatility in the market price, volatility in yield per hectare and influence of climatic conditions (rainfall, spring frosts) and the incidence of diseases and pests. In contrast, the cost model takes into account the level of costs incurred by the entity on acquiring the relevant bearer plant and allows recognition of these costs over the useful life of the bearer plants. These costs are depreciated during the useful life of bearer plants and could be allocated to agricultural produce. Fang (2015) evaluated the impact of cost measurement of biological assets on financial position and company performance and the conclusions were as follows:

- significant decrease in value due to changes in measurement (write downs) and appropriate decrease in shareholders' equity,
- change in cost structure – increase in depreciation cost (depreciation of mature plants).

According to IAS 41, a gain or loss arising on initial recognition of a biological asset at fair value less costs to sell and other annual gains or losses from a change in fair value less costs to sell of a biological asset were included in profit or loss for the periods in which they arise until the effectiveness of the Amendments to IAS 16 and 41.

In the Czech accounting legislation, there is not any special reporting category for long-term bearer plants as an orchard, the common cost approach is used for the measurement. The decrease in production ability during the useful life is recorded as a depreciation of this asset. After the effectiveness of the amendments to IAS 16 and IAS41- Bearer plants, the ways of reporting became compatible. This way of reporting reflects the basic financial reporting principles in a better way (especially matching principle). It makes possible to evaluate performance of agricultural business entity. Depreciation, similarly to other planting activities are recognized as direct cost of planting.

**Table 3** Impact on selected items of Balance Sheet and Income Statement

| **IFRS – IAS 41** | | **IFRS – Amendments to IAS 16** | | **Czech Accounting Legislation** | |
|---|---|---|---|---|---|
| Balance Sheet: | | Balance Sheet: | | Balance Sheet: | |
| Biological Asset | FVLCS (DCF) | Biological Asset | Acquisition Cost | Biological Asset | Acquisition Cost |

| Income Statement: | | Income Statement: | | Income Statement: | |
|---|---|---|---|---|---|
| Other Expenses | Changes in Fair Value – Loss | Depreciation Cost | Straight Line Depreciation | Depreciation Cost | Straight Line Depreciation |

Source: own processing

As seen from the Table 3, despite there is not any special treatment for bearer plants in the Czech Accounting Legislation, the characteristic features of bearer plants are in common to both, Property, plant and equipment and bearer plants. The IASB reached the same conclusion after fruitful discussions.

**Agricultural produce**

The agricultural produce is the harvested product of the entity's biological assets. Agricultural produce harvested from an entity's biological assets shall be measured at its fair value less costs to sell at the point of harvest. Such measurement is the cost at that date when applying IAS 2 - Inventories or another applicable Standard.

According to this treatment, the costs incurred in connection to planting and harvesting are recognized as an expense in the period in which they arise. They are not connected to the produce. The production of biological assets is recognized as a gain and an increase in consumable assets (inventories). Despite that this approach does not match the cost to the increase in agricultural produce and the increase is reported as a gain, which is not included in the gross profit calculation, there is not any problem in the case of short term consumable assets, but the external users could hardly evaluate the cost of revenue of agricultural activity. In the case of the long term consumable assets (forest) the costs are incurred in connection with forest plantation are expensed and the change in value of growing forest is reported as gain or loss every year. In case of sale of timber there is not any connection between cost and revenue because the fair value less cost to sell is considered as a cost of inventories.

In comparison, in the Czech Accounting Legislation, there are the common treatments for all kinds of business activities for the agricultural produce cost tracing. The external users could evaluate the cost of revenue of agricultural activity.

**Table 4** Impact on functional classification Income Statement

| **IFRS – IAS 41** | | **Czech Accounting Legislation** | |
|---|---|---|---|
| Revenues | Sale of production | Revenues | Sale of production |
| Cost of sales | IAS 2 – FVLCS | Cost of sales | Cost of Produce sold |
| **Gross Profit** | | **Gross Profit** | |
| Other Income | Agricultural Produce – Increase FVLCS | Other Income | |
| Distribution Costs | | Distribution Costs | |
| Administrative Expenses | | Administrative Expenses | |
| Other Expenses | Cost of produce | Other Expenses | Decrease (increase in agricultural produce measured in direct cost) |
| **Profit from operations** | | **Profit from operations** | |

Source: own processing

## 4 Conclusions

According to the above-mentioned possible characteristic features of individual groups of bearer biological assets, it is not reasonable to use only one accounting treatment for all kinds of biological assets. In the case of bearer plants, the information of fair value is not important for external users. The effort and cost of obtaining this information would exceed the benefit, thus the cost model is appropriate. In the case of consumable assets, the situation differs. The agricultural produce is traded on active market, information on fair value is available without additional costs. The fair value measurement is possible, there are some bottlenecks, using functional cost classification there is not any relevant information on the gross profit.

The issue of agricultural assets measurement was the main reason for research by the authors in the area. The main aim was to eliminate ambiguity in practical application of some requirements set by the standard when respecting specifics of agricultural assets and produce, and basic principles of preparation of financial statements.

## Acknowledgments

The paper is the result of GA ČR No. 18-14082S "Fair corporate taxation: Measurement of the corporate profit shifting on the budget of the Czech Republic".

## References

Argiles-Bosch, J.M., Miarons, M., Garcia-Blandon, J. (2018). Usefulness of fair valuation of biological assets for cash flow prediction In. *Spanish Journal of Finance and Accounting-Revista Espanola de Financiacion y Contabilida*, vol. 47(2), pp. 157-180.

Argilés, J. M., García Blandón, J. , Monllau, T. (2012). Fair value versus historical cost based valuation for biological assets: predictability of financial information. *Revista de Contabilidad*, vol. 14(2), pp. 87–113.

Aryanto, Y. H. (2011). Theoretical Failure of IAS 41: Agriculture. Retrieved from: http://papers.ssrn.com/sol3/papers. cfm?abstract_id=1808413.

Bohušová, H., Svoboda, P. (2016). Biological assets: In what way should be measured by SMEs? *Conference: 19th International Conference Enterprise and Competitive Environment (ECE).* Mendel University, Brno, Czech Republic, vol. 220, pp. 62-69.

Bohušová, H., Svoboda, P. (2017). Will the amendments to the IAS 16 and IAS 41 influence the value of biological assets? *Agricultural Economics (Zemědělská ekonomika)*, vol. 63, pp. 53-64.

Damian, M. I., Manoiu, S. M., Bonaci, C. B., Strouhal, J. (2014). Bearer Plants: Stakeholders' View on the Appropriate Measurement Model. *Journal of Accounting and Management Information Systems*, vol 13(4), pp. 719–738.

EAGRI (2015). *Situační a výhledové zprávy ovoce.* MZ ČR. Retrieved from: http://eagri.cz/public/web/mze/zemedelstvi/rostlinne-komodity/ovoce-a-zelenina/situacni-a-vyhledove-zpravy-ovoce/. 2002–2014.

Fang, I. L. (2015). Impact of revised FRS 41 & FRS 16 on planters. *Commodities*, 8/2015.
Retrieved from: https://brokingrfs.cimb.com/ynnNwHNxn_yOkFkQVcsR8PMfCJFrdL2MvxSwOAbss8MKdIbULpfiQcD9E4RT8G Jc4m2v_3p5oz41.pdf.

He, L. Y., Wright, S., Evans, E. (2018). Is fair value information relevant to investment decision-making: Evidence from the Australian agricultural sector? *Australian Journal of Management*, vol. 43(4), pp. 555-574.

Hýblová, E., Skalický, R. (2018). Return on sales and wheat yields per hectare of European agricultural entities. *Agricultural Economics – Zemědělská Ekonomika*, vol. 64(10), pp. 436-444.

International Financial Reporting Standard (IFRS) 13. *Fair value measurement.* IASB. 2011. Retrieved from: http://www.ifrs.org.

Amendments to IAS 16 and IAS 41 – Bearer Plants. IASB. 2013. Retrieved from: http://www.ifrs.org.

International Accounting Standard (IAS) 41. *Agriculture*. IASC. 2000. Retrieved from: http://www.ifrs.org. 2000.

Svoboda, P., Bohušová, H. (2017). Amendments to IAS 16 and IAS 41: *Are There Any Differences between Plant and Animal from a Financial Reporting Point of View? Agricultural Economics – Zemědělská Ekonomika*, vol. 65(1), pp. 327-337.

ÚZEI (2013). *Náklady a výnosy vybraných rostlinných a živočišných výrobků*. Retrieved from: http://www.uzei.cz/data/usr_001_cz_soubory/2013.pdf.

ÚZEI (2015). *Mléko a mléčné výrobky.* Situační a výhledové zprávy. 2012–2014. Retrieved from: http://eagri.cz/public/web/mze/potraviny/potravinarske-komodity/mleko-a-mlekarenske-vyrobky/situacni-avyhledove-zpravy/.

# Capital Asset Prices in the V4 Countries

**Gábor Bóta[1], László Nagy[2], Mihály Ormos[3]**

[1] Eötvös Loránd University
Institute of Business, Department of Finance and Accounting
Szép u. 2., 1053, Budapest, Hungary
E-mail: bota@gti.elte.hu

[2] Budapest University of Technology and Economics
Faculty of Economic and Social Sciences, Department of Finance
Magyar tudósok krt. 2., 1117, Budapest, Hungary
E-mail: nagyl@finance.bme.hu

[3] J. Selye University
Department of Economics
Bratislavská cesta 3322, Komárno, SK-94501, Slovakia
E-mail: ormos@ujs.sk

***Abstract:*** *In our paper we investigate the factors behind the price development of the capital markets of the Visegrad four countries: the Czech Republic, Hungary, Poland and Slovakia. We compare our results with developed European capital markets, namely Austria, France, Germany and the United Kingdom as well. We run regressions for different market equilibrium models: the standard CAPM by Sharpe (1963), Fama and French (1993 and 1996) three-factor model, Carhart (1997) four-factor model, Pastor-Stambaugh (2003) five-factor model and also Fama and French (2015) five-factor model. We use different sets of factors in order to detect the differences and similarities of these capital markets and to find the market equilibrium models with the highest explaining power. The regressions cover the period of 2005-2018 on a daily basis.*

*Keywords: asset pricing, multi-factor models, V4 countries*

*JEL codes: G11, G12, G15*

## 1 Introduction

We investigate capital markets of the Visegrad four countries: the Czech Republic, Hungary, Poland and Slovakia. Modern capital market trading re-started after the collapse of the communist regime in these countries after 1990; however, these countries and their economies fed from common roots of historical background, in the past decades substantial differences have developed. To have a better understanding of the development as a process we compare our results with developed European economies as well: Austria, France, Germany and the United Kingdom. In these developed countries stock exchanges have a much longer history and have significant differences in the number of companies listed, market capitalization and even in the role of stock exchanges. We are about to find whether these characteristics have an impact on the price development and also what implications can be found for local and international investors. Our hypothesis suggest that we can identify significant differences in asset pricing concerning the V4 countries for the last decade.

Price development in capital markets have been extensively examined in developed economies but fewer lights shed on the developing countries. Bekaert et al. (2009) examine 23 developed economies, Gray and Johnson (2011) Australian, Wang et al. (2015) Chinese equities. Morelli (2010) investigates 15, Bauer et al. (2010) 16, Papanastasopoulos (2017) also 16 developed European countries. Hou et al. (2011) use monthly data of stocks from 49 countries including emerging ones.

Our dataset provides insights in the factors behind of the capital market returns on the period 2005-2018.

Our results underpin the rationale behind international diversification even in a single first class geographical area. Daily data shows that V4 countries pay significant a size

premium; however the liquidity of these markets are comparable to that of developed markets.

## 2 Methodology and Data

Capital Asset Pricing Model (Sharpe, 1964, Lintner, 1965) gives the market as the sole factor behind price changes. Market in our case is the European market as defined by Kenneth French.

Fama and French (1993) three-factor model extends the model by size (market capitalization, price times shares outstanding, small minus big factor) and the relation between average return and price ratios like book to market value (high minus low factor). Later they add profitability (robust minus weak) and investment style (conservative minus aggressive) factors and get the Fama and French (2015) five-factor model.

Carhart (1997) constructed a four-factor model, with the three-factors used by Fama and French (market, size and value) extended with a momentum factor as the returns of winner minus loser portfolios. Pastor and Stambaugh (2003) used liquidity measure as a new factor and extended the model used by Carhart (1997) using market, size, value and momentum factors.

The source of the indices, individual equities and foreign exchange rates are Bloomberg Markets. The factors we use to explain the price development of indices and individual stocks are available in the CRSP (Center for Research in Security Prices) and from the site of Lubos Pastor. The former available both as daily and monthly readings while the latter only in monthly database.

For V4 countries we have a representative index being PX for the Czech Republic, BUX for Hungary, WIG20 for Poland and SKSM for Slovakia while for the developed countries ATX for Austria, CAC for France, DAX for Germany and UKX for the United Kingdom. We have not only the representative index but all its constituents at the end of our investigated period.

We run regressions for the market, size (small minus big), book to market value (high minus low), profitability (robust minus weak), investment style (conservative minus aggressive), momentum (winners minus losers) and liquidity (traded liquidity).

All the data are in US dollars we calculate the Euro prices and where applicable the prices denominated in local currency as well.

## 3 Results and Discussion

For the whole investigated period we receive mixed results. Slovakia being the only country with a very low determination coefficient (R2), the explaining power of the models in EUR and USD respectively: from 5,2% and 4,5% if we try to capture the return of the index only by the market proxy to 9,0% and 7,5% if we doing this by size, book to market value, profitability, investment style and momentum. For the other three countries of the V4 we receive results of R2 ranging from 44% to 54% while the developed countries show explaining power between 62% and 79% depending on the model and set of variables, as we can see in Table 1.

**Table 1** Adjusted $R^2$ of different models in daily settings

| | 1-factor | 3-factor | 4-factor | 5-factor | 6-factor |
|---|---|---|---|---|---|
| **PX in EUR** | 50% | 53% | 54% | 54% | 55% |
| **PX in USD** | 47% | 50% | 51% | 51% | 52% |
| **PX in CZK** | 50% | 53% | 54% | 54% | 55% |
| **BUX in EUR** | 47% | 48% | 48% | 48% | 48% |
| **BUX in USD** | 44% | 45% | 45% | 45% | 45% |
| **BUX in HUF** | 46% | 47% | 47% | 47% | 47% |

| | 1-factor | 3-factor | 4-factor | 5-factor | 6-factor |
|---|---|---|---|---|---|
| **WIG20 in EUR** | 51% | 52% | 52% | 52% | 52% |
| **WIG20 in USD** | 48% | 49% | 49% | 49% | 49% |
| **WIG20 in PLN** | 50% | 51% | 51% | 51% | 52% |
| **SKSM in EUR** | 5.2% | 8.3% | 8.3% | 9.0% | 9.0% |
| **SKSM in USD** | 4.5% | 7.1% | 7.1% | 7.5% | 7.5% |
| **ATX in EUR** | 66% | 68% | 68% | 68% | 68% |
| **ATX in USD** | 62% | 64% | 65% | 65% | 65% |
| **CAC in EUR** | 79% | 79% | 79% | 80% | 80% |
| **CAC in USD** | 76% | 77% | 77% | 77% | 77% |
| **DAX in EUR** | 75% | 75% | 75% | 76% | 76% |
| **DAX in USD** | 72% | 73% | 73% | 73% | 73% |
| **UKX in EUR** | 69% | 70% | 70% | 70% | 70% |
| **UKX in USD** | 70% | 71% | 71% | 71% | 71% |
| **UKX in GBP** | 66% | 68% | 68% | 68% | 68% |

Source: own calculation

If we turn to the set of variables used by different models we can see an interception between -0.0047 and -0.0050 with significant p-values very close to zero for all model settings.

Standard CAPM shows significantly positive market factors in all countries and exchange rates used, however market is close to 1 only for the Czech Republic and the United Kingdom as presented in Table 2. This result underpins the rationale behind international diversification even in a single first class geographical area. Although all of these indices represent well diversified portfolios their risk are significantly different from each other while their returns are in equilibrium.

**Table 2** Estimates and their significance in the CAPM in daily settings

| | | est. | signif. | | | est. | signif. |
|---|---|---|---|---|---|---|---|
| **PX in EUR** | int. | -0.0049 | *** | **ATX in EUR** | int. | -0,0049 | *** |
| | Mkt | 1.02 | *** | | Mkt | 1.21 | *** |
| **PX in USD** | int. | -0.0049 | *** | **ATX in USD** | int. | -0,0049 | *** |
| | Mkt | 0.99 | *** | | Mkt | 1.19 | *** |
| **PX in CZK** | int. | -0.0049 | *** | **CAC in EUR** | int. | -0.0049 | *** |
| | Mkt | 1.02 | *** | | Mkt | 1.20 | *** |
| **BUX in EUR** | int. | -0.0047 | *** | **CAC in USD** | int. | -0.0049 | *** |
| | Mkt | 1.17 | *** | | Mkt | 1.18 | *** |
| **BUX in USD** | int. | -0.0047 | *** | **DAX in EUR** | int. | -0.0047 | *** |
| | Mkt | 1.15 | *** | | Mkt | 1.15 | *** |
| **BUX in HUF** | int. | -0.0047 | *** | **DAX in USD** | int. | -0.0047 | *** |
| | Mkt | 1.16 | *** | | Mkt | 1.22 | *** |
| **WIG20 in EUR** | int. | -0.0049 | *** | **UKX in EUR** | int. | -0.0048 | *** |
| | Mkt | 1.16 | *** | | Mkt | 1.01 | *** |
| **WIG20 in USD** | int. | -0.0049 | *** | **UKX in USD** | int. | -0.0048 | *** |
| | Mkt | 1.37 | *** | | Mkt | 0.99 | *** |
| **WIG20 in PLN** | int. | -0.0049 | *** | **UKX in GBP** | int. | -0.0048 | *** |
| | Mkt | 1.15 | *** | | Mkt | 1.00 | *** |
| **SKSM in EUR** | int. | -0.0046 | *** | **SKSM in USD** | int. | -0.0046 | *** |
| | Mkt | 0.27 | *** | | Mkt | 0.25 | *** |

Source: own calculation; *, **, *** denote significance levels of 10%, 5% and 1%, respectively

The Fama-French three-factor model shows that market betas are close to one in case of developed European markets, except for Austria where this result is 1.32 in EUR and 1.27 in USD as it can be seen in Table 3. For the V4 countries the market for the Czech Republic is 1.23; 1.18 and 1.22; for Hungary is 1.28; 1.23 and 1.27; for Poland is 1.3; 1.28 and 1,29 in EUR, USD and local currency (Czech koruna, Hungarian forint and Polish

zloty) respectively. For Slovakia the market is 0.48 in EUR and 0.44 in USD. The size factor is significantly positive for all the V4 countries and Austria and significantly negative for France, Germany and the UK. These results show that by adding SMB and HML factors highlight the higher market-risk of the V4 countries. SMB factors for the V4 countries are positive which means these countries pay significant a size premium; however the liquidity of these markets are comparable to that of developed markets. In the case of developed European markets the size factor is negative but for Austria. Concerning the HML factor which is significantly positive for all V4 countries as in Austria and France contrary to the remaining developed European markets.

**Table 3** Estimates and their significance in Fama-French three-factor model

| | | est. | signif. | | | est. | signif. |
|---|---|---|---|---|---|---|---|
| **PX in EUR** | int. | -0.0050 | *** | **ATX in EUR** | int. | -0,0049 | *** |
| | Mkt | 1.23 | *** | | Mkt | 1.32 | *** |
| | SMB | 0.84 | *** | | SMB | 0.59 | *** |
| | HML | 0.27 | *** | | HML | 0.42 | *** |
| **PX in USD** | int. | -0.0049 | *** | **ATX in USD** | int. | -0,0049 | *** |
| | Mkt | 1.18 | *** | | Mkt | 1.27 | *** |
| | SMB | 0.76 | *** | | SMB | 0.51 | *** |
| | HML | 0.29 | *** | | HML | 0.43 | *** |
| **PX in CZK** | int. | -0.0049 | *** | **CAC in EUR** | int. | -0.0048 | *** |
| | Mkt | 1.22 | *** | | Mkt | 1.08 | *** |
| | SMB | 0.83 | *** | | SMB | -0.37 | *** |
| | HML | 0.29 | *** | | HML | 0.10 | *** |
| **BUX in EUR** | int. | -0.0048 | *** | **CAC in USD** | int. | -0.0048 | *** |
| | Mkt | 1.28 | *** | | Mkt | 1.04 | *** |
| | SMB | 0.52 | *** | | SMB | -0.44 | *** |
| | HML | 0.30 | *** | | HML | 0.10 | *** |
| **BUX in USD** | int. | -0.0048 | *** | **DAX in EUR** | int. | -0.0046 | *** |
| | Mkt | 1.24 | *** | | Mkt | 1.03 | *** |
| | SMB | 0.45 | *** | | SMB | -0.31 | *** |
| | HML | 0.30 | *** | | HML | 0.15 | *** |
| **BUX in HUF** | int. | -0.0048 | *** | **DAX in USD** | int. | -0.0046 | *** |
| | Mkt | 1.28 | *** | | Mkt | 0.99 | *** |
| | SMB | 0.52 | *** | | SMB | -0.38 | *** |
| | HML | 0.29 | *** | | HML | 0.15 | *** |
| **WIG20 in EUR** | int. | -0.0050 | *** | **UKX in EUR** | int. | -0.0048 | *** |
| | Mkt | 1.31 | *** | | Mkt | 0.98 | *** |
| | SMB | 0.61 | *** | | SMB | -0.25 | *** |
| | HML | 0.26 | *** | | HML | -0.28 | *** |
| **WIG20 in USD** | int. | -0.0050 | *** | **UKX in USD** | int. | -0.0048 | *** |
| | Mkt | 1.26 | *** | | Mkt | 0.94 | *** |
| | SMB | 0.54 | *** | | SMB | -0.32 | *** |
| | HML | 0.26 | *** | | HML | -0.28 | *** |
| **WIG20 in PLN** | int. | -0.0049 | *** | **UKX in GBP** | int. | -0.0048 | *** |
| | Mkt | 1.29 | *** | | Mkt | 0.96 | *** |
| | SMB | 0.56 | *** | | SMB | -0.26 | *** |
| | HML | 0.24 | *** | | HML | -0.27 | *** |
| **SKSM in EUR** | int. | -0.0047 | *** | **SKSM in USD** | int. | -0.0047 | *** |
| | Mkt | 0.48 | *** | | Mkt | 0.44 | *** |
| | SMB | 0.69 | *** | | SMB | 0.62 | *** |
| | HML | -0.08 | | | HML | -0.07 | |

Source: own calculation; *, **, *** denote significance levels of 10%, 5% and 1%, respectively

In the four-factor model we expand the market, size and value factors with momentum factor (winners minus losers: WML). In this model setting from among V4 countries we receive negative results for WML factor, however it is significant (at the 1% level) for the Czech Republic, only 5% and 10% level in case of Poland depending on the currency, in 10% level or insignificant for Hungary and insignificant for Slovakia. For Austria and the United Kingdom WML factor is significantly negative, for France it is negative but

significant only in USD. For Germany WML factor is positive but at a significant level only in measured in EUR. Thus the momentum effect is not that strong as we expected. As Poterba and Summers (1988) show the mean-reverting nature of stock market prices is usually stronger in less sophisticated markets, it seems to be worthwhile to run a robustness test or even examine, how the momentum factor sensitivity is changing over the period under investigation.

**Table 4** Estimates and their significance in Carhart four-factor model

| | | est. | signif. | | | est. | signif. |
|---|---|---|---|---|---|---|---|
| **PX in EUR** | int. | -0.0049 | *** | **ATX in EUR** | int. | -0,0049 | *** |
| | Mkt | 1.20 | *** | | Mkt | 1.31 | *** |
| | SMB | 0.90 | *** | | SMB | 0.62 | *** |
| | HML | 0.15 | *** | | HML | 0.36 | *** |
| | WML | -0.26 | *** | | WML | -0.14 | *** |
| **PX in USD** | int. | -0.0049 | *** | **ATX in USD** | int. | -0,0049 | *** |
| | Mkt | 1.15 | *** | | Mkt | 1.26 | *** |
| | SMB | 0.83 | *** | | SMB | 0.55 | *** |
| | HML | 0.16 | *** | | HML | 0.36 | *** |
| | WML | -0.28 | *** | | WML | -0.17 | *** |
| **PX in CZK** | int. | -0.0049 | *** | **CAC in EUR** | int. | -0.0048 | *** |
| | Mkt | 1.20 | *** | | Mkt | 1.08 | *** |
| | SMB | 0.89 | *** | | SMB | -0.37 | *** |
| | HML | 0.17 | *** | | HML | 0.09 | *** |
| | WML | -0.25 | *** | | WML | -0.03 | |
| **BUX in EUR** | int. | -0.0048 | *** | **CAC in USD** | int. | -0.0048 | *** |
| | Mkt | 1.28 | *** | | Mkt | 1.03 | *** |
| | SMB | 0.54 | *** | | SMB | -0.43 | *** |
| | HML | 0.27 | *** | | HML | 0.08 | *** |
| | WML | -0.06 | | | WML | -0.06 | *** |
| **BUX in USD** | int. | -0.0048 | *** | **DAX in EUR** | int. | -0.0047 | *** |
| | Mkt | 1.23 | *** | | Mkt | 1.04 | *** |
| | SMB | 0.48 | *** | | SMB | -0.33 | *** |
| | HML | 0.26 | *** | | HML | 0.18 | *** |
| | WML | -0.09 | ** | | WML | 0.06 | *** |
| **BUX in HUF** | int. | -0.0047 | *** | **DAX in USD** | int. | -0.0046 | *** |
| | Mkt | 1.27 | *** | | Mkt | 0.99 | *** |
| | SMB | 0.54 | *** | | SMB | -0.39 | *** |
| | HML | 0.25 | *** | | HML | 0.17 | *** |
| | WML | -0.07 | * | | WML | 0.03 | *** |
| **WIG20 in EUR** | int. | -0.0049 | *** | **UKX in EUR** | int. | -0.0048 | *** |
| | Mkt | 1.30 | *** | | Mkt | 0.97 | *** |
| | SMB | 0.63 | *** | | SMB | -0.22 | *** |
| | HML | 0.23 | *** | | HML | -0.33 | *** |
| | WML | -0.07 | * | | WML | -0.10 | *** |
| **WIG20 in USD** | int. | -0.0049 | *** | **UKX in USD** | int. | -0.0048 | *** |
| | Mkt | 1.25 | *** | | Mkt | 0.93 | *** |
| | SMB | 0.56 | *** | | SMB | -0.29 | *** |
| | HML | 0.22 | *** | | HML | -0.34 | *** |
| | WML | -0.09 | ** | | WML | -0.13 | *** |
| **WIG20 in PLN** | int. | -0.0049 | *** | **UKX in GBP** | int. | -0.0048 | *** |
| | Mkt | 1.28 | *** | | Mkt | 0.95 | *** |
| | SMB | 0.58 | *** | | SMB | -0.24 | *** |
| | HML | 0.21 | *** | | HML | -0.32 | *** |
| | WML | -0.07 | * | | WML | -0.11 | *** |
| **SKSM in EUR** | int. | -0.0047 | *** | **SKSM in USD** | int. | -0.0047 | *** |
| | Mkt | 0.48 | *** | | Mkt | 0.44 | *** |
| | SMB | 0.68 | *** | | SMB | 0.63 | *** |
| | HML | -0.07 | *** | | HML | -0.07 | *** |
| | WML | 0.02 | | | WML | -0.01 | |

Source: own calculation; *, **, *** denote significance levels of 10%, 5% and 1%, respectively

Results of Fama-French five-factor model show that from among V4 countries only the Czech Republic has significantly negative RMW factor, while Hungary has positive but not significant in either EUR, USD or local currency (HUF). Poland has also positive but only significant at the 10% level RMW factor in local currency (PLN), and positive but not significant RMW factor in EUR, USD. Slovakia has positive and insignificant RMW factor in EUR and positive and significant in the 10% level in USD. From among the developed countries Austria and France have a significant and negative RMW factor, while Germany has positive and significant RMW factor both in EUR and USD. The United Kingdom has negative RMW factors in EUR, USD and local currency (GBP) but only significant in USD. These results explain that the nature of operating profitability is different in the V4 countries compared to developed European countries and strongly differ from the US markets. In these countries the difference between profitability characteristics of the firms do not convey a premium for the investors which is a striking result, which also suggest that standard accounting based analyses of listed companies does not really gives added value for risk decisions.

**Table 5** Estimates and their significance in Fama-French five-factor model

| | | **est.** | **signif.** | | | **est.** | **signif.** |
|---|---|---|---|---|---|---|---|
| **PX in EUR** | int. | -0.0048 | *** | **ATX in EUR** | int. | -0,0049 | *** |
| | Mkt | 1.18 | *** | | Mkt | 1.29 | *** |
| | SMB | 0.80 | *** | | SMB | 0.56 | *** |
| | HML | 0.12 | *** | | HML | 0.38 | *** |
| | RMW | -0.57 | *** | | RMW | -0.26 | *** |
| | CMA | -0.49 | *** | | CMA | -0.31 | *** |
| **PX in USD** | int. | -0.0048 | *** | **ATX in USD** | int. | -0,0048 | *** |
| | Mkt | 1.11 | *** | | Mkt | 1.22 | *** |
| | SMB | 0.72 | *** | | SMB | 0.48 | *** |
| | HML | 0.17 | *** | | HML | 0.39 | *** |
| | RMW | -0.59 | *** | | RMW | -0.37 | *** |
| | CMA | -0.66 | *** | | CMA | -0.49 | *** |
| **PX in CZK** | int. | -0.0048 | *** | **CAC in EUR** | int. | -0.0048 | *** |
| | Mkt | 1.17 | *** | | Mkt | 1.10 | *** |
| | SMB | 0.79 | *** | | SMB | -0.37 | *** |
| | HML | 0.14 | *** | | HML | -0.09 | *** |
| | RMW | -0.57 | *** | | RMW | -0.16 | *** |
| | CMA | -0.51 | *** | | CMA | 0.18 | *** |
| **BUX in EUR** | int. | -0.0048 | *** | **CAC in USD** | int. | -0.0048 | *** |
| | Mkt | 1.28 | *** | | Mkt | 1.04 | *** |
| | SMB | 0.53 | *** | | SMB | -0.45 | *** |
| | HML | 0.37 | *** | | HML | -0.01 | *** |
| | RMW | 0.15 | | | RMW | -0.26 | *** |
| | CMA | -0.03 | | | CMA | -0.00 | |
| **BUX in USD** | int. | -0.0048 | *** | **DAX in EUR** | int. | -0.0047 | *** |
| | Mkt | 1.22 | *** | | Mkt | 1.06 | *** |
| | SMB | 0.45 | *** | | SMB | -0.28 | *** |
| | HML | 0.37 | *** | | HML | 0.36 | *** |
| | RMW | 0.04 | | | RMW | 0.60 | *** |
| | CMA | -0.21 | * | | CMA | 0.22 | *** |
| **BUX in HUF** | int. | -0.0048 | *** | **DAX in USD** | int. | -0.0047 | *** |
| | Mkt | 1.27 | *** | | Mkt | 0.99 | *** |
| | SMB | 0.52 | *** | | SMB | -0.36 | *** |
| | HML | 0.33 | *** | | HML | 0.36 | *** |
| | RMW | 0.05 | | | RMW | 0.49 | *** |
| | CMA | -0.09 | | | CMA | 0.04 | |

| | | est. | signif. | | | est. | signif. |
|---|---|---|---|---|---|---|---|
| **WIG20 in EUR** | int. | -0.0050 | *** | **UKX in EUR** | int. | -0.0048 | *** |
| | Mkt | 1.28 | *** | | Mkt | 0.96 | *** |
| | SMB | 0.61 | *** | | SMB | -0.26 | *** |
| | HML | 0.42 | *** | | HML | -0.26 | *** |
| | RMW | 0.24 | ** | | RMW | -0.05 | |
| | CMA | -0.25 | ** | | CMA | -0.22 | *** |
| **WIG20 in USD** | int. | -0.0050 | *** | **UKX in USD** | int. | -0.0048 | *** |
| | Mkt | 1.21 | *** | | Mkt | 0.89 | *** |
| | SMB | 0.53 | *** | | SMB | -0.34 | *** |
| | HML | 0.42 | *** | | HML | -0.26 | *** |
| | RMW | 0.15 | | | RMW | -0.17 | *** |
| | CMA | -0.44 | *** | | CMA | -0.41 | *** |
| **WIG20 in PLN** | int. | -0.0049 | *** | **UKX in GBP** | int. | -0.0048 | *** |
| | Mkt | 1.25 | *** | | Mkt | 0.93 | *** |
| | SMB | 0.56 | *** | | SMB | -0.28 | *** |
| | HML | 0.39 | *** | | HML | -0.24 | *** |
| | RMW | 0.19 | * | | RMW | -0.09 | |
| | CMA | -0.27 | *** | | CMA | -0.30 | *** |
| **SKSM in EUR** | int. | -0.0047 | *** | **SKSM in USD** | int. | -0.0047 | *** |
| | Mkt | 0.54 | *** | | Mkt | 0.48 | *** |
| | SMB | 0.72 | *** | | SMB | 0.65 | *** |
| | HML | -0.10 | | | HML | -0.07 | |
| | RMW | 0.23 | ** | | RMW | 0.19 | * |
| | CMA | 0.53 | *** | | CMA | 0.36 | *** |

Source: own calculation; *, **, *** denote significance levels of 10%, 5% and 1% respectively

The investment factor (conservative minus aggressive) is negative for three of four V4 countries: the Czech Republic, Hungary and Poland and significant in all cases except for Hungary where only in USD and only in 10% level is significant. From among the developed countries with developed capital markets CMA factor is significantly negative for Austria and the United Kingdom, while for France and Germany CMA factor is significantly positive in EUR, and insignificantly negative in USD for France and insignificantly positive for Germany. These results presented in Table 5 suggest that V4 listed firms apply aggressive investment strategies which means they are high investment firms. This outcome well accommodate the hypothesis that these post-communist economies required to have much higher and more aggressive investment policies compared to developed ones to converge their economic performance to those.

If we add aforementioned momentum factor to Fama-French five-factor model we receive a six-factor model. From among the V4 countries only the WML factor is negative for all cases but only for the Czech Republic is significant at the 1% level, for Hungary and Poland this sixth factor is significant at 5% or 10% depending on the currency and insignificant for Slovakia. WML factor is significantly (even at the 1% level) negative for Austria and the United Kingdom, negative for France but only significantly at the 10% level when measured in USD and insignificant when measured in EUR, while insignificantly positive when measured in EUR and insignificantly negative when measured in USD for Germany.

## 4 Conclusions

All of the V4 countries joined the European Union on the 1st of May in 2004, they exhibit common historical roots and similar social regime switch from a communist economy to market economy in the beginning of the 1990's.

We investigate how the stock markets accommodated to the developed European countries. We find that V4 countries capital asset pricing behave well concerning the standard asset pricing models with only slight surprising results.

Behaving well means in this context that the explanatory powers of the applied models are high and most of the explaining factors are significant. It is surprising that WML, i.e.

the momentum factor is not as strong as Poterba and Summers (1988) suggested. We also find that the investment style of V4 firms are aggressive which result is in line with our economic intuition.

It seems to be clear that our research should be extended with a rolling window regression analysis to visualize the process of asset pricing development.

## Acknowledgments

This research was supported by the Pallas Athéné Domus Educationis Foundation.

## References

Bauer, R., Cosemans, M., Schotman, P. C. (2010). Conditional asset pricing and stock market anomalies in Europe. *European Financial Management*, vol. 16(2), pp. 165-190.

Bekaert, G., Hodrick, R. J., Zhang, X. (2009). International stock return comovements. *Journal of Finance*, vol. 64(6), pp. 2591-2626.

Carhart, M. M. (1997). On persistence in mutual fund performance. *Journal of Finance*, vol. 52(1), pp. 57-82.

Fama, E. F., French, K. R. (1993). Common risk factors in the returns on stocks and bonds. *Journal of Financial Economics*, vol. 33(1), pp.3-56.

Fama, E. F., French, K. R. (1996). Multifactor explanations of asset pricing anomalies. *Journal of Finance*, vol. 51(1), pp. 55-84.

Fama, E. F., French, K. R. (2015). A five-factor asset pricing model. *Journal of Financial Economics*, vol. 116(1), pp. 1-22.

Gray, P., Johnson, J. (2011). The relationship between asset growth and the cross-section of stock returns. *Journal of Banking & Finance*, vol. 35(3), pp. 670-680.

Hou, K., Karolyi, G. A., Kho, B. C. (2011). What factors drive global stock returns? *Review of Financial Studies*, vol. 24(8), pp. 2527-2574.

Lintner, J. (1965). Security prices, risk, and maximal gains from diversification. *Journal of Finance*, vol. 20(4), pp. 587-615.

Morelli, D. (2010). European capital market integration: An empirical study based on a European asset pricing model. *Journal of International Financial Markets, Institutions and Money*, vol. 20(4), pp. 363-375.

Papanastasopoulos, G. A. (2017). Asset growth anomaly in Europe: Do profits and losses matter? *Economics Letters*, vol. 156, pp. 106-109.

Pastor, L., Stambaugh, R. F. (2003). Liquidity risk and expected stock returns. *Journal of Political Economy*, vol. 111(3), pp. 642–685.

Poterba, J. M., Summers, L. H. (1988). Mean reversion in stock prices: Evidence and implications. *Journal of Financial Economics*, vol. 22(1), pp. 27-59.

Sharpe, W. F. (1964). Capital asset prices: A theory of market equilibrium under conditions of risk. *Journal of Finance*, vol. 19(3), pp. 425-442.

Wang, Y., Liu, C., Lee, J. S., Wang, Y. (2015). The relation between asset growth and the cross-section of stock returns: Evidence from the Chinese stock market. *Economic Modelling*, vol. 44, pp. 59-67.

# Statistical Arbitrage Portfolio Selection in the Old and New EU Member States

**[1]Bálint Botos, [2]László Nagy, [3]Mihály Ormos**

[1]Department of Finance, Budapest University of Technology and Economics
Magyar tudósok krt. 2. Budapest, H-1117, Hungary.
botos.balint@forestay.hu

[2]Department of Finance, Budapest University of Technology and Economics
Magyar tudósok krt. 2. Budapest, H-1117, Hungary.
nagyl@finance.bme.hu

[3]Department of Economics, J. Selye University
Bratislavská cesta 3322, Komárno, SK-94501, Slovakia
ormosm@ujs.sk

***Abstract**: In this study we analyze the return gained by cointegration-based pairs trading arbitrage strategy in Western and Eastern European capital markets. To achieve that, we showcase the contrarian evidence to the weak form of market efficiency found. The aim of the paper is to explore the mean reversion nature of the highly cointegrated stock pairs and to create a trading strategy with predefined entry and exit points. The portfolios used are created over 250-day long testing periods based on the cointegration selection of the pairs and then traded for 125 days. The realized return between 2012 and 2017 were 16.98% and 20.74% annually in the Western end Eastern European markets respectively. We also evaluate the standard deviations of returns achieved by the strategy and the portfolios' correlations to the MSCI Europe, S&P 500 and the risk-free rate. As the strategy result in low correlation to the market, we confirm its market neutrality. The Sharpe-ratios of the portfolios for the full sample period are 0.57 (western) and 0.92 (eastern) but come up to 1.89 and 1.39 in the last 10 years.*

*Keywords: pairs trading, asset pricing, cointegration, statistical arbitrage, market neutral strategy*

*JEL codes: C53, G17*

## 1 Introduction

In this paper we investigate the cointegration-based pairs trading strategy on the European stock market. Pairs trading is a market-neutral statistical arbitrage strategy based on the convergence of stock prices. First, stock pairs, presenting significant cointegration, are selected, and then by adding equivalent long and short positions we create zero-investment portfolios; or/alternatively when the stock pairs abnormally deviate for a short period excess return can be gained. Based on previous studies (e.g. Gatev et al., 2006.), the strategy tend to result in abnormal return. In this paper we compare the above-mentioned active portfolio strategy to passive portfolio holding, that results in the return of pairs trading strategy of stocks traded on the European market to the return of the MSCI Europe, S&P500 and the risk-free rate. The market data used are collected over 16 years and then the European sample selection is divided into data from Western and from Eastern European countries. We analyze the mean reversion nature of cointegrating stock pairs and create a trading strategy with predefined entry and exit points. As a result of our empirical study, we argue that this strategy has delivered an average annual return of 16.98% in Western Europe and 20.74% in Eastern Europe in the recent 16 years. In Western Europe, the standard deviation was 24.17%, and the Sharpe-ratio was 0.57. In Eastern Europe, the standard deviation was 19.12%, and the Sharpe-ratio was 0.92.

The applied pairs trading method is an investment strategy developed by Gerry Bamberger and Nunzio Tartaglia, both quantitative analyzers of Morgan Stanley, against the perfect market of the Black-Scholes-Merton model appearing in the 1970s. The

model relies on the correction of market mispricing based on the convergence of prices and return to the historical trend. In fact, the method is a relative pricing mechanism based on the Law-of-One-Price. In accordance with the definition by Ingersoll (1987), if different investments generate the same risk adjusted cash flow then they should be marketed at the same price. This observation was further developed by Chen and Knez (1995), by stating that two similar stocks that might not guarantee identical payments must be marketed also at similar prices. This concept was taken further by Elliott et al. (2005) and Mohanty et al. (2010) by replacing two different businesses with a single one and modeling the correlation between the internal value process of the business and its market price with stochastic methods.

In the 1980s, pairs trading was one of the most successful investment strategies, and in accordance with Gatev et al. (2006), Morgan Stanley achieved a profit of $50 million by using the strategy even in 1987, later on its efficiency has reduced as a result of the intensifying spread of the method, and therefore the group of Tartalgia ceased to exist by 1989.

## 2 Theoretical Background

Gatev et al. (2006) analyzed the cointegration-based pairs trading strategy on daily data from July 1963 to December 2002 in their comprehensive study on the profitability of the strategy. Their portfolios contained the twenty best pairs and generated an average monthly gross return of approximately 1.44 percent (t-statistics=11.56). Their research also explored significant differences between profits before and after the 1980s. While on the basis of data before the 80s of the cost and risk adjusted average monthly net profit was 67 basis points, this reduced to 42 basis points in the period between 1988 and 2002.

In our opinion, the difference is explained not only by the extensive use of the strategy but also by the growth of stock market profits. They prove that pairs trading tends to achieve a better performance with low market prices than with high ones, and therefore the growth of stock market prices also significantly reduced the profitability of the strategy by the end of the 1980s. In their scholarly paper Gatev et al. (2006) also proved that the portfolio was sensitive to parallel yield curve movements, and it resulted in higher profits in the case of a rising yield curve.

The above study on the composition of the portfolios demonstrates that a portfolio with a higher number of components is more diversified, i.e. it generates less standard deviation. While in the case of the best five pairs 124 out of the 474 months covered by the study resulted in losses, in the case of the best twenty pairs this number was only 71. In the course of re-testing, the yield generated by the strategy has doubled the yield of S&P 500 with less standard deviation. We note that this was a completely market-neutral investment strategy since the portfolio was hardly sensitive to the systematic risk factors.

Following the above-mentioned scholarly paper of Gatev et al. (2006), an analysis was made also on the daily stock exchange index data of Taiwan in view of the pairs trading strategy in 2005. Sandro et al. (2005) examines the time series of 647 various companies of Taiwan between 4 January 1994 and 29 August 2002. The portfolio used in the course of the back test contained the best twenty pairs with even weights. The results obtained during the research were significantly similar to the results obtained by Gatev et al. (2006). The average excess return of the portfolio built throughout the analysis of the prices of the TSEC was 10.18% per year against the portfolio of the Taiwanese market, while the excess return was 11.28% in the case of Gatev et al. (2006). On an average, 19.69 out of the best twenty pairs of the Taiwanese portfolio has on open position, contrary to the analysis of Gatev et al. (2006) where 19.30 out of the twenty pairs were open during the length of the study.

The strategy is further developed by Vidyamurthy (2004), who determined his portfolio by introducing another significant, already existing concept. He considered short term

deviations from the long term balance as a stationary noise, and this approach lead to the cointegration and the study of the co-integrity of the stock pairs. The study of Caladeira and Moura (2013) ran on the basis of this approach in which data of BM&FBOVESPA between Jan 2005 and Oct 2012 was examined. The portfolio determined by means of the VAR(p) model applied during the research resulted in an excess return of 16.38% against the given market portfolio. In our research, the study of the model described in the article of Caladeira and Moura (2013) using the kernel density estimation method specified by Silverman (1982) or Betov et al. (2010), based on the results of Vidyamurthy (2004) was performed in relation to the European markets.

## 3 Pairs Trading Strategy Model

The following concepts are defined for the description of our study. Operator S is called a back step if process $Y_t = X_{t-1}$ is assigned to process $X_t$. Process $X_t$ is called ARMA(p,q) composite autoregressive moving average process if back step operator S has such

$$A(\mathrm{S})X_t = X_t - a_1 X_{t-1} - \ \ldots - a_p \ X_{t-p} \tag{1}$$

$$B(\mathrm{S})X_t = b_0 + \ b_1 \mathrm{S} + \ \ldots + b_q S^q \tag{2}$$

polynomial elements where $n_0 \neq 0$ and

$$A(\mathrm{S})X_t = \ B(\mathrm{S})\varepsilon_t \tag{3}$$

where $\varepsilon_t$ is a white noise process.

Always A(S), B(S) polynomial elements with the lowest degrees are taken into consideration in the definition, which also means that A(S), B(S) polynomial elements have no common radical.

If the radicals of A(S) polynomial member are beyond the unit circle then there is a stationary $X_t$ ARMA(p, q) process where is met, and it has MA(∞) form.

$$X_t = \sum_{i=1}^{p} a_i X_{t-i} + \sum_{j=1}^{q} b_j \, \varepsilon_{t-j} \tag{4}$$

If the radicals of B(S) polynomial element are beyond the unit circle then $X_t$ has AR(∞) form, i.e. the process can be inverted.

Should be d ∈ N, and $X_t$ a stochastic process without a deterministic process and if it is differentiated d times then it has a stationary and invertible ARMA representation. Then $X_t$ is d-th integrated process and is marked as $X_t \sim$ I (d).

The $X_t$ , $Y_t \sim$ I (d) time series are cointegrated if β, so that $X_t$ + β$Y_t$ $\sim$ I (d − k) where 0 ≤ k ≤ d.

**Selection of Pairs**

Our study covers 649 stocks that represents $\binom{649}{2}$ potential pairs. We want to choose n pieces from these pairs so that the stock prices per pair viewed on the logarithmic scale can perfectly cointegrate. i.e. by pair ∃ $\beta_i$ so that

$$\ln S_t^{i,1} = \mu_i + \beta_i \ln S_t^{i,2} + \varepsilon_t^i \tag{5}$$

$$\ln S_t^{i,1} \sim I(d) \quad and \quad \ln S_t^{i,2} \sim I(d) \tag{6}$$

where d ∈ N, $\varepsilon_t^i$ ∀ i ∈ [0, n] are stationery mean reverting processes.

The study is performed for each possible pair, the relevant linear regressions and the $u_t^i$ difference processes are calculated (values $\beta_i$ specified on the logarithmic scale are considered),

$$u_t^i = \ln S_t^{i,1} - \mu_i - \beta_i \ln S_t^{i,2} \tag{7}$$

then the stationarity of process $u_t^i$ is characterized with the Augmented Dickey-Fuller (1981) test, ADF test statistics and the study of the periodogram. n pieces of stock pairs belonging to the strongest test statistics are considered in the next steps. The pairs are created after a 250-day study period which is followed by a 125-day trading period.

**Trading**

We are about to create a market neutral portfolio with the cointegrating pairs determined based on the above methodology. The next step of the strategy is to calculate the value of $Z^{(i)}$, applying the Gauss core function $Z^{(i)}$, i ∈ {1, 2, . . . , n} density function estimations, and finally the periodograms are studied.

$$Z_t^{(i)} = \frac{S_t^{i,1} - \beta_i S_t^{i,2} - \mathbf{E}(S_t^{i,1} - \beta_i S_t^{i,2})}{\sigma(S_t^{i,1} - \beta_i S_t^{i,2})} \tag{8}$$

The opening and closing points of the position are determined by means of $Z_t^{(i)}$ values and the stock price movement:

- If in the case of i. pairs at time $Z_t^{(i)} > 2$, then a position is opened, and a short position is added to $S_t^{i,1}$ stock and a long position to $S_t^{i,2}$ stock. If in the case of i. pairs at t time $Z_t^{(i)} < -2$, then a position is opened, and a long position is added to $S_t^{i,1}$ stock and a short position to $S_t^{i,2}$ stock.
- If in the case of i. pairs and at t time $0.5 > Z_t^{(i)} > -0.5$, then the position is closed.
- If $|Z_t| > 4$, the position is closed,
- If the price of $S_t^{i,1}$ or $S_t^{i,2}$ moves more than 5%, position is closed.

The first point shows the opening trigger, the second point shows the normal closing trigger, In addition, stop-loss terms must also be integrated since an extremely high $Z_t^{(i)}$ value cannot be considered accidental, and therefore the prices of i. stock pairs might not be perfectly cointegrated in the new larger data set. Besides, we can be stuck in a position for a very long time which is undesirable. As a stop-loss trigger we use the third and fourth point above.

During the creation of the portfolio, the methodology of Caladeira and Moura (2013) is followed, and therefore certain stock pairs are taken into consideration identically in the case of several open positions. When the portfolio is changed, we try to achieve a preliminarily set (m) total value. If a position is opened on a new pair, then a sufficient part of the already existing positions is closed to obtain the same amount on each pair in the position. However, if a position is closed then the weight of the other open positions is increased proportionally to the weight of the closed position and to the number of the open positions. Our portfolio contains a maximum of 20 cointegrating stock pairs and the null hypothesis of the ADF statistics used for their stationarity study can be accepted with 95% safety. In our study, data of 250 days are followed, and these data are used to determine the pairs to be traded in the next 125 days. During the management of the portfolio, 125 day moving averaging is used to determine Z values in addition to 4 stop loss levels, i.e. if $|Z_t| > 4$ then the position is closed.

In addition to the stop loss level, time limits are also integrated in accordance with the indexes that are of 85 days for the Eastern European stocks, and of 70 days for the Western European stocks.

## 4 Data

The data used in this study are daily closing prices collected between 31/12/2001 and 31/12/2017. The stock prices are corrected with dividends and denominated in USD, collected from the Thomson Reuters Data Stream database. The stocks covered by the study contain the components of the main European indices as of 31st December 2017 (see Table 1). These are 128 stock in western portfolio and 125 stocks in eastern portfolio at the end of the period. As the stock indices reflect the actual content, the data series is exposed to survivorship bias. The stocks have various lengths of time series, thus significantly less stocks were involved in the analysis at the beginning of the research than towards the end of the research. The inefficiency resulting from the decreasing number of stocks going back to the starting periods can be observed on the yield curves.

**Table 1** Variety of Stocks

| Country | Nr. of Stocks | Country | Nr. of Stocks |
|---|---|---|---|
| **England** | 100 | Baltic countries (E, L, | 9 |
| **Austria** | 20 | Cyprus | 100 |
| **Belgium** | 20 | Czech | 50 |
| **Denmark** | 20 | Poland | 20 |
| **Finland** | 25 | Hungary | 13 |
| **France** | 40 | Malta | 20 |
| **Greece** | 20 | Slovakia | 5 |
| **Netherlands** | 25 | Slovenia | 7 |
| **Ireland** | 20 | | |
| **Germany** | 30 | | |
| **Italy** | 40 | | |
| **Spain** | 35 | | |
| **Sweden** | 30 | | |

Source: Author's dataset. Notes: there are no restrictions made on the stocks having to belong to similar industries or having similar beta, etc; the pairs are generated merely based on the results of co-integration process.

## 5 Results

During the analyses, the above strategy is applied to study the Eastern and Western European stock market prices. In the Western European stock markets in the recent 16 years, 338% cumulative return is achieved by the strategy, thus an average gross return of 16.98% per year. The standard deviation of the annual returns is 24%. The average length of the positions is 35 days with a standard deviation of 33 days. During the study of the Eastern European stocks in the recent 16 years, 414% cumulative return is achieved, and this results an average annual gross return of 21%. The standard deviation of the annual returns is 19% and the average length of the positions is 39 days with a standard deviation of 45.8 days. The annual results and the standard deviations of the annual returns are presented in Table 2.

We calculate the excess returns as each year's pairs trading portfolio return minus the actual year's market return. The returns show excess above MSCI Europe by 9.89% and 13.77% for the Western and Eastern European portfolio respectively. The average annual excess returns above the risk-free rate are 13.77% and 17.54%. We prefer to use the

risk-free rate as a benchmark, the very low correlation to market returns is shown, which implies the market neutrality of the portfolio.

It would also be worth studying the results in sub-periods. Our results show a 23.53% return for Western Europe for the first 10 years and 10.43% returns for the following 10 years. The standard deviations are 33.43% and 4.54% for the Eastern and for the Western European markets respectively. Examining the Eastern European portfolio, it shows returns of 25.34% in the first 10 years and 16.15% in the second 10 years. The standard deviations are 24.89% and 10.27%.

This difference in the standard deviation is due to the smaller number of same-time-traded stocks in the first period. The amount of money in the portfolio is always equal to the total amount of investment, even if there is only one open position. When there are only a few numbers of open positions, then the standard deviation of the portfolio is higher. The second period of the study reflects more of a real-life portfolio as the numbers of open positions are higher, the equity is better distributed and the diversification effect produces less standard deviation.

**Table 2** Annual Returns of the Strategy

| Year | W. Europe P. T. | E. Europe P. T. | W. Europe Excess MSCI | E. Europe Excess MSCI | W. Europe Exc. Risk Free | E. Europe Exc. Risk Free |
|---|---|---|---|---|---|---|
| **1993** | -0.01 | 0.30 | -0.16 | -0.03 | -0.03 | 0.27 |
| **1994** | -0.07 | 0.86 | -0.12 | -0.11 | -0.11 | 0.82 |
| **1995** | 0.25 | 0.14 | -0.06 | 0.19 | 0.19 | 0.08 |
| **1996** | 0.33 | 0.40 | 0.02 | 0.28 | 0.28 | 0.34 |
| **1997** | -0.23 | 0.17 | -0.24 | -0.29 | -0.29 | 0.12 |
| **1998** | 0.79 | 0.22 | 0.67 | 0.74 | 0.74 | 0.16 |
| **1999** | 0.30 | -0.08 | 0.44 | 0.25 | 0.25 | -0.13 |
| **2000** | -0.06 | 0.19 | 0.09 | -0.12 | -0.12 | 0.13 |
| **2001** | 0.34 | 0.27 | 0.59 | 0.30 | 0.30 | 0.23 |
| **2002** | 0.70 | 0.07 | 0.21 | 0.69 | 0.69 | 0.05 |
| **2003** | 0.11 | 0.08 | -0.12 | 0.10 | 0.10 | 0.07 |
| **2004** | 0.07 | 0.20 | -0.02 | 0.05 | 0.05 | 0.19 |
| **2005** | 0.06 | 0.14 | -0.17 | 0.03 | 0.03 | 0.11 |
| **2006** | 0.15 | 0.09 | 0.09 | 0.10 | 0.10 | 0.04 |
| **2007** | 0.11 | 0.13 | 0.59 | 0.06 | 0.06 | 0.08 |
| **2008** | 0.03 | 0.27 | -0.27 | 0.01 | 0.01 | 0.25 |
| **2009** | 0.14 | 0.03 | 0.17 | 0.14 | 0.14 | 0.03 |
| **2010** | 0.10 | 0.18 | 0.14 | 0.10 | 0.10 | 0.18 |
| **2011** | 0.18 | 0.11 | 0.11 | 0.18 | 0.18 | 0.11 |
| **2012** | 0.09 | 0.38 | 0.02 | 0.09 | 0.09 | 0.38 |
| **Avg.:** | 16.98 | 20.74 | 9.89 | 13.77 | 13.77 | 17.54 |
| **Std.:** | 24.17 | 19.12 | 27.79 | 24.17 | 24.17 | 19.05 |

Source: Author's calculation

**Risk and Risk-adjusted Returns**

We are not only interested in the absolute and relative returns but also in the risk-adjusted return of the portfolio. We measure the risk as the standard deviation of the portfolio and use the Sharpe-ratio to compare the risk-adjusted return to different portfolios.

**Table 3:** Sharpe-ratios of the Portfolio

| | 1993-2003 | 2004-2013 | 1993-2013 |
|---|---|---|---|
| **Western Europe Sharpe-ratio** | 0.56 | 1.89 | 0.57 |
| **Eastern Europe Sharpe-ratio** | 0.83 | 1.39 | 0.92 |
| **MSCI Europe Sharpe-ratio** | 0.21 | 0.15 | 0.18 |

Source: Author's calculation

As it is shown in Table 3, the Sharpe ratio of the investigated portfolios in the two sub-periods are significantly different. This is due to the above expressed difference in the standard deviations. In the second sub-period we find 1.89 and 1.39 ratios that represent a very high value compared to the market proxy. In the first period these ratios are just slightly above those observable on the market; however, in the second period the found ratios are significantly higher than the average ones on the stock market.

Beside the Sharpe-ratio it would be reasonable to have a closer look at the results of the well-known equilibrium models such as of Fama and French (1996) and Carhart (1997). We have run these regressions; however, as the trading strategy is market neutral it means that the returns gained are not correlating with the market and other proxies, thus their betas are not significant. As a result of that, all the yielded return can be interpreted as Jensen (1968) alpha, as only the constants of the regressions becomes significant, while the determination coefficient (R2) of the models tends towards zero.

**Correlation of the Portfolio**

On the one hand, Table 3 above clearly indicates that the pairs trading portfolios result in higher returns and exhibit less standard deviation in the case of both stock indices. However, on the other hand, one of our aims is to prove the strategies market neutrality as defined by Alexander and Dimitriu (2002). Returns are set against the MSCI Europe, S&P 500 and the risk-free rate and show low correlations against these listed as presented in Table 4. This result means that the portfolio is not dependent on market movements and therefore it is market neutral.

**Table 4** Covariance Matrix

| | Western Europe P.T. | Eastern Europe P.T. | MSCI Europe | S&P500 | Risk-Free |
|---|---|---|---|---|---|
| **Western Europe P.** | 1.000 | 0.003 | -0.010 | -0.019 | 0.003 |
| **Eastern Europe P. T.** | 0.003 | 1.000 | -0.020 | -0.012 | -0.020 |
| **MSCI** | -0.010 | -0.020 | 1.000 | 0.276 | 0.032 |
| **S&P500** | -0.019 | -0.012 | 0.276 | 1.000 | 0.018 |
| **Risk-Free** | 0.003 | -0.020 | 0.032 | 0.018 | 1.000 |

Source: Author's calculation

## 6 Concluding Remarks

In this paper we examined the Eastern and Western European stock market based on the pairs trading statistical arbitrage strategy. Our aim was to explore the mean reversion nature of the highly cointegrated pairs and establish a trading strategy, with predefined entry and exit points. The database included 20 years of European stock prices. The results showed excess returns above the MSCI Europe index by 9.89 and 13.77 for Western and Eastern European countries respectively. Sharpe-ratios were 0.56 and 0.83 for the entire twenty years, but 1.89 and 1.39 in the recent ten years for western and eastern countries of Europe respectively. We also examined the correlation between our results and the market return. We found low correlation to the MSCI Europe, S&P 500 and to the risk-free rate, confirming the market neutrality of the strategies.

## Acknowledgements

This research was supported by the Pallas Athéné Domus Educationis Foundation.

## References

Alexander, C., Dimitriu, A. (2002). The Cointegration Alpha: Enhanced Index Tracking and Long-Short Equity Market Neutral Strategies*. ISMA Discussion Papers in Finance 08*. ISMA Finance.

Betov, Z. I., Grotowski, J. F., Kroese, D.P. (2010). Kernel Density Estimation via Diffusion. *Annals of Statistics*, vol. 38(5), pp. 2916-2957.

Caldeira, J. F., Moura, G. V. (2013). Selection of a Portfolio of Pairs Based on Cointegration: A Statistical Arbitrage Strategy. *Federal University of Rio do Sul, Federal University of Santa Catarina*, Brazil.

Carhart, M. M. (1997). On Persistence in Mutual Performance. *The Journal of Finance*, vol. 52(1), pp. 57-82.

Chen, Z., Knez, P. J. (1995). Measurement of Market Integration and Arbitrage. *Review of Financial Studies*, vol. 8(2), pp. 287-325.

Dickey, D. A., Fuller, W. A. (1981). Likelihood Ratio Statistics for Autoregressive Time Series with a Unit Root. *Econometrica*, vol. 49(4), pp. 1057-1072.

Elliott, R. J., Van Der Hoek, J., Malcolm, W.P. (2005). Pairs Trading. *Quantitative Finance*, vol. 5(3), pp. 271-276.

Fama, E. F., French, K. R. (1996). Multifactor Explanations of Asset Pricing Anomalies. *Journal of Finance*, vol. 51(1), pp. 55-84.

Gatev, E., Goetzmann, W. N., Rouwenhorst, K. G. (2006). Pairs Trading: Performance of a Relative-Value Arbitrage Rule. *Working paper*, Yale University.

Ingersoll, J. E. (1987). *Theory of Financial Decision Making: Rowman and Littlefield Studies in Financial Economics*. United States of America.

Jensen, M. C. (1968). The Performance of Mutual Funds in the Period 1945–1964. *Journal of Finance*, vol. 23(2), pp. 389-416.

Mohanty, S., Nandha, M., Bota, G. (2010). Oil Shocks and Stock Returns: The Case of the Central and Eastern European (CEE) Oil and Gas Sectors. *Emerging Markets Review*, vol. 11(4), pp. 358-372.

Sandro, A. C., Pietro, V., Seasholes, M. S. (2005). Understanding the Profitability of Pairs Trading*. Economics Bulletin preprint*.

Sharpe, W. F. (1975). Adjusting for Risk in Portfolio Performance Measurement. *Journal of Portfolio Management*, vol. 1(2), pp. 29-34.

Silverman, B. W. (1982). Kernel Density Estimation Using the Fast Fourier Transform. *Journal of the Royal Statistical Society, Series C (Applied Statistics)*, vol. 31(1), pp. 93-99.

Vidyamurthy, G. (2004). *Pairs Trading: Quantitative Methods and Analysis*. John Wiley & Sons, Inc., Hoboken, New Jersey.

# Determinant Factors of Fiscal Revenues, under Current Economic Conditions

**Loredana Andreea CRISTEA[1], Alina Daniela VODĂ[2] and Dragoș Mihai UNGUREANU[3]**

[1] Lucian Blaga University of Sibiu
Faculty of Economic Sciences, Department of Doctoral Studies
Victoriei Boulevard, 8-10 number, 550024, Sibiu, Romania
E-mail: crs.loredana@yahoo.com

[2] Lucian Blaga University of Sibiu
Faculty of Economic Sciences, Department of Doctoral Studies
Victoriei Boulevard, 8-10 number, 550024, Sibiu, Romania
E-mail: alina.voda3@yahoo.ro

[3]Spiru Haret University Of Bucharest
Faculty of Economic Sciences
Ion Ghica street, no. 13, sector 1, Bucharest, Romania
E-mail: dragos.ungureanu@yahoo.com

***Abstract:*** *Most of the state's financial resources are covered by compulsory deductions, namely taxes, fees and social security contributions, translated into fiscal revenues. In recent years, financial and economic research has focused heavily on the interdependence between taxes and economic growth. The main purpose of this research is to analyze the factors that lead to the increase or decrease of fiscal revenues collected by the state. Taking into account the current economic situation, the research will focus on a comparative study of Romania with an emerging state and a developed country, from the European Union, for a period of 10 years. The following variables are taken into account: fiscal revenues, inflation, unemployment rate, number of emigrants, imports and exports, factors with a significant impact on economic growth. In order to achieve the proposed objective, we will use the statistical analysis, through the SPSS software, to see the relationship between the independent variables and the dependent variable. The Pearson correlation coefficient will be used to measure the relationship between model variables. The study's data is taken from the Eurostat and World Bank databases. After analyzing the results, there are outlined proposals for the optimization of the fiscal policy of the state, depending on the determinants of fiscal revenues, in order to ensure a balanced economy.*

*Keywords: fiscal revenues, taxation, determinant factors, European Union*

*JEL codes: E62, H20, E22, E24, F43*

## 1 Introduction

Current economic conditions in the European Union still bear the traces left by the 2008-2009 economic and financial crisis, and the instability of emerging countries makes it necessary to implement clear, long-term regulation with reference to fiscal policy, which may entail positive and sustainable macroeconomic consequences. This is emphasized by the fact that the economic, financial and social stability and development of a state can be achieved through direct and indirect taxation, i.e. through fiscal revenues. In addition to the austerity measures and rescue plans undertaken in times of crisis, it is important to implement measures with regard to the optimal national tax reform, so that the fiscal system and the fees and taxes system become the stabilizer of the national economy. Due to the fact that taxes are the major source of government revenue, or the backbone of government (Ahmed et al., 2016), the main purpose they have is to generate sufficient revenues to the state budget, to finance the public sector activities in a non-inflationary way, and for the cover of government spending it is necessary a sustainable fiscal system. If fiscal revenues do not grow fast enough to finance public services, in the

long run, governments should seek to cut spending, raise tax rates or modify other structural features of the system (Bird and Zolt, 2008).

Starting from the fact that fiscal policy is one of the main macroeconomic policy instruments, this research is concretized by the empirical study of the factors that can influence the fiscal revenues, as well as on the study of the responses of the revenues to the evolution of the determinant factors, over the years 2008-2017. The main objective of this research is to outline and to know the underlying causes of changes in fiscal revenues from the three European Union Member States (EU) chosen in the study, namely the Czech Republic, Romania and Poland. The study is essential, because by providing an answer to the research question, namely whether the analyzed indicators have significant effects on fiscal revenues, a clear horizon can be given with regard to financial planning, depending on the economic factors studied.

**Literature review**

In the literature, there is a considerable number of studies on the determinants of fiscal revenues, respectively on taxation. These studies, taking into account the fiscal competitiveness, have assumed that taxation is an important fiscal policy instrument which is in close correlation with the macroeconomic outcomes (Andrejovska and Pulikova, 2018), given the current economic conditions. Over time, has been carried out a lot of research, to identify decisive factors for the degree of variation in fiscal revenues. The link between the national government systems, resulted in the governance, the level of inflation, and the level of corruption has been studied, in correlation with fiscal revenues, by authors such as Epaphra and Massawe (2017). Through a study of 30 African countries, they concluded that corruption-related variables have a negative effect on fiscal revenues, while those related to government effectiveness, quality of regulation in the state, but also in connection with the rule of law has a positive effect on them. We believe that in this situation, the state's duty is to reduce corruption by improving quality within the tax administration, so that income levels to be at a high threshold in relation to government debt.

The same results, regarding the influence of corruption, inflation and the quality of government on fiscal revenues, have also reached by Hunady and Orviska (2015), who studied this correlation in the member states of the Organization for Economic Co-operation and Development (OECD), Ajaz and Ahmad (2010), Ehrhart (2011), Amin et al. (2014) and Ahmed et al. (2016) who also studied this link in countries from the Asian continent. All of these studies can be considered starting points in finding legislative proposals in fiscal policy, so as to not affect the sustainability of public finances in relation to governance.

The tax collection is negatively influenced, according to Monteiro (2012), by factors such as unemployment and corruption, and positive, by factors such as industry turnover, the number of businesses and foreign direct investment of an economy. Macroeconomic variables, such as import level, exchange rate and turnover in the industrial sector, have been found to have a positive influence on fiscal revenues formation, as opposed to agricultural sector turnover, that has a negative influence on them, according to Basirat et al. (2014). Gobachew et al. (2018) have also highlighted the fact that fiscal revenues are affected by the inflation rate and the share of the agricultural sector in gross domestic product (GDP), but are positively influenced by the share of the industrial sector in GDP, per capita income and the degree of trade opening, measured by the share of export and import in GDP.

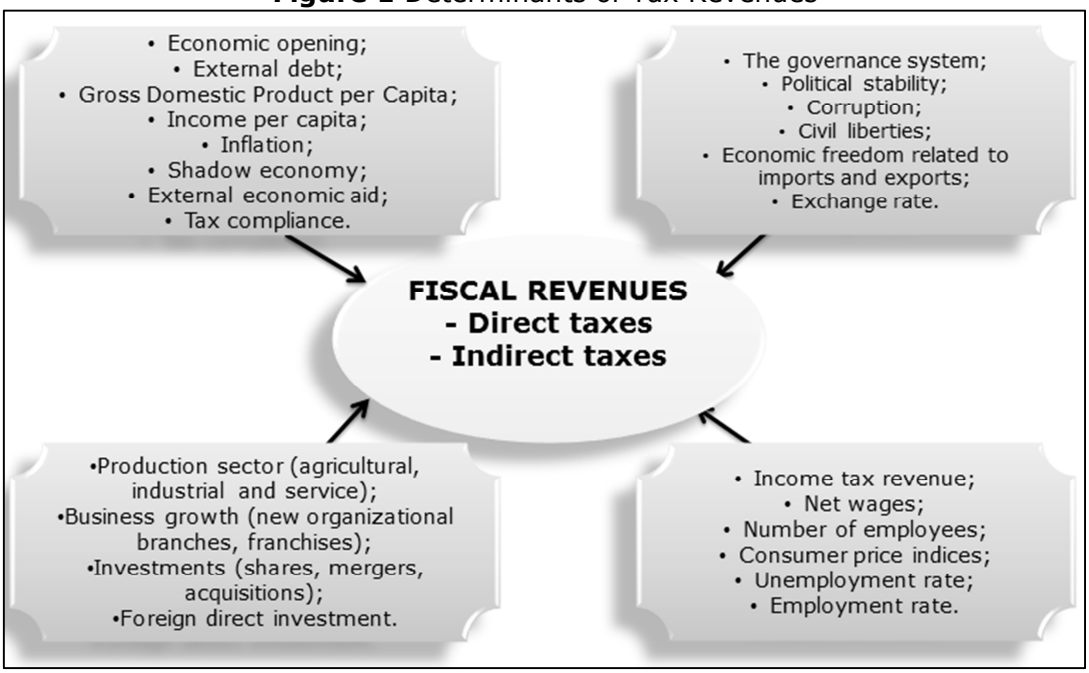
An interesting approach on the determinants of fiscal revenues is given by Dioda (2012), who in her research concluded that among the factors with significant influence are the economic ones (GDP growth rate, GDP per capita, the degree of openness of the economy, the share of the agricultural sector in GDP), political factors (degree of freedom, internal and external conflicts, political stability, sustainability of the political regime) and socio-demographic factors (education level, population density, urbanization level, shadow economy). The autochthonous authors, Constantin and Bacanu (2015),

studied the effects of monetary factors, price levels, tax rates, tax efficiency and tax collection, on tax revenue formation. They concluded that the level of fiscal revenues should have a higher growth rate than gross domestic product, so that fiscal burden to be at levels that the taxpayer can afford.

**Relevance of research**

Through the study and analysis of the specialized literature, from 2010-2019 period, respectively the studies of the following researchers: Chaudhry and Munir (2010), QadirPatoli et al. (2012), Castro and Camarillo (2014), Kumari and Nene (2017), Maulia and Sofyan (2018), Streimikiene et al. (2018), Belov (2018), Cristea (2019) and Palic et al. (2019), Figure 1 shows the determinants of fiscal revenues, which, following the researches carried out, had positive or negative effects on the revenues obtained from the collection of taxes and fees.

**Figure 1** Determinants of Tax Revenues




Source: authors processing based on literature

As can be seen in the above figure, research over time has concluded that fiscal revenues are more or less influenced by many factors that are related to the economic, financial, political and social environment. Most studies regarding on government revenues determinants have been conducted in Asian countries, in United States and OECD countries. Considering that research on the situation of the EU Member States is limited and that the situation of Romania, compared to other EU Member States, is very little deepened, this scientific paper seeks to study the main macroeconomic factors that can influence the state's fiscal revenues.

## 2 Methodology and Data

Given that the main purpose of this research is to identify the influence factors of fiscal revenues, the situation existing in Romania, with reference to fiscal policy, will be analyzed in comparison with Poland (emerging state - according to the International Monetary Fund, IMF, 2019) and Czech Republic (developed state - according to the IMF, 2019). The choice of these countries derives from the fact that they are states from Central and Eastern Europe, member states of the European Union, from May 1, 2004 - Poland and the Czech Republic, respectively January 1, 2007 - Romania. The statistical data used in the study were taken from the databases of the European Commission-Eurostat and the World Bank.

The independent variables we have considered are part of four categories of influence, namely: financial category - inflation, social and demographic factors - unemployment and the number of emigrants, economic factors - foreign direct investment and trade freedom. Trade freedom, in our study, is materialized through the import and export of goods and services, and inflation is reflected in the consumer price index (CPI). In order to study the influence of the exogenous variables on the endogenous variable, respectively the fiscal revenues, we used the statistical analysis program for social sciences- SPSS.

The period studied in this research is 10 years, namely 2008-2017. This time limit stems from the fact that there are no statistical data available for 2018, in the case of fiscal revenues. In the statistical analysis, quarterly data was used. For fiscal revenues, the consumer price index, the number of emigrants and the import and export values there was available only annual data in the Eurostat database. For a more in-depth analysis, the annual data was converted into quarterly data, with the help of the "frequency conversion method" function of the Eviews econometric program.

The first step in the analysis is to determine the Pearson correlation for each country, and then using the "Enter" function of the SPSS software, for each analyzed state. In this way, based on the coefficient table, a multiple linear regression equation (1) will be obtained, in the form of:

$$REV = f(CPI, UNEMPL, EMIG, FDI, IMP, EXP), \text{ where:} \quad (1)$$

- REV- fiscal revenues, dependent variable (expressed in million euro);
- CPI- annual average consumer price index, independent variable (expressed as a percentage);
- UNEMPL- unemployment rate, independent variable (expressed as number of persons in the total active population);
- EMIG- the number of emigrants, independent variable (expressed in number of persons);
- FDI- foreign direct investment, independent variable (expressed as a share of GDP and representing net inflows in the reporting economy from foreign investors);
- IMP and EXP- import and export of goods and services, independent variables (expressed in million euros).

In order to find out which of the study variables have the greatest influence on revenues, the situation in each country has been analyzed separately, so that it can be possible to outline some proposals regarding the optimization of Romania's fiscal policy compared to Poland and the Czech Republic, with the aim of ensuring an economy in balance, taking into account the current economic conditions.

## 3 Results and Discussion

Starting from the fact that taxes and fees are the main source of generating government revenues; inflation is an important phenomenon in ensuring the prosperity of the economy, emigration is a growing phenomenon in emerging countries, and the number of immigrants in developed countries rose to the order of millions; high unemployment rate leads to undesirable economic effects; foreign direct investments are the result of lifting barriers to the international economy and the mobility of foreign capital, and freedom of trade is a "cause" of market liberalization, the empirical analysis of this paper seeks to establish the correlation between taxation and its determinants. In order to establish this link, it is necessary to identify the degree of influence exercised by the elected indicators on fiscal revenues.

In order to achieve the proposed objective, the Pearson correlation between independent variables and fiscal revenues, was studied at the level of each surveyed country, and according to the obtained results, there are strong correlations between the model variables. The convention in most research is to use a significance level of 0.05. This means that if the Sig value is less than 0.05, we will reject the null hypothesis and the variable will be included in the model. All tests were performed at the significance level of

5%. Taking as a starting point the high correlations encountered between the variables, we have analyzed the relationship between them and fiscal revenues, using multiple linear regression obtained in SPSS. The analysis uses the Enter method from the statistical program IBM SPSS.

**Table 1** Summary of the Regression Model - Czech Republic

| Model Summary values | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| | ,977 | ,955 | ,946 | 1266,58 |

Source: Authors processing based on Eurostat and World Bank data, with SPSS software

Table 1 summarizes the regression model of Czech Republic, in which the determination coefficient R is presented, which shows the degree of influence of the independent variables on the REV dependent variable. In the case of the developed country, Czech Republic, the values of R and $R^2$ show the strong correlation between the indicators, chosen for the analysis, and the fiscal revenues, respectively the percentage with which the endogenous variable is influenced by the exogenous variables. Thus, the fluctuations in taxes and fees revenues are influenced by 95.5% of the independent variables fluctuations, respectively the determinants of fiscal revenues.

**Table 2** Summary of the Regression Model - Poland

| Model Summary values | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| | ,999 | ,997 | ,997 | 987,91 |

Source: Authors processing based on Eurostat and World Bank data, with SPSS software

Table 2 shows the situation in Poland, an emerging state, where the values of R and $R^2$ show a very strong correlation between the variables, the fiscal revenues being influenced by 99.7% of the determinant factors accepted in the model.

**Table 3** Summary of the Regression Model- Romania

| Model Summary values | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| | ,996 | ,993 | ,992 | 465,36 |

Source: Authors processing based on Eurostat and World Bank data, with SPSS software

In table 3, the determination coefficient $R^2$ of 99.3% in Romania, shows the close link between the variables chosen in the study. According to the summary of the regression models in these three countries, synthesized in the above tables, the variables chosen in this research tend to have a strong influence on tax revenues, so we can consider these variables as determining factors of taxes and fees revenues.

However, to deepen the analysis, three multiple linear regression relations were formed, in which is study the influence of each independent variable on the variation of the resultative variable REV. The equations (2), (3) and (4), presented below, related to the three studied countries (REVczech, REVpoland, REVromania), were obtained from the coefficient table generated by SPSS software. We note that in the Czech Republic the FDI variable was not accepted in the model with Sig> 0.05 and in the case of Poland, the social variables, respectively the unemployment rate and the number of emigrants, are not significant factors of the tax revenues, so they are not accepted and not included in the model.

$$REVczech = -3057{,}186CPI - 955{,}914UNEMP - 0{,}162EMIG + 3{,}221EXP - 2{,}904IMP + 302806{,}69 \quad (2)$$

According to the relation (2) related to the Czech Republic, the FDI variable was not accepted in the model, with Sig = 0.823. The other exogenous variables have a value of Sig = 0.00, and due to the coefficient of determination $R^2$, with values> 95%, it is highlighted a correct choice of variables, which has a strong influence on the fiscal policy of the state, respectively on the formation of financial resources. As can be seen, there is

a negative influence between the CPI and the REV, respectively when the inflation increases with one unit, there is a decrease of 3057,18 units among the fiscal revenues. Considering this, the level of inflation has to be taken into account when fiscal policies and tax bases are established, because, in addition to inflation, negative influences are also encountered in the case of unemployment rates, the number of emigrants and imports. The negative link between unemployment, emigration and fiscal revenues is understandable, because these two phenomena have negative effects on the whole economy, but especially on the business environment, creating consequent decreases in revenues, but also among the consumption and production. The only positive influence is related to exports, which attract higher collections in the state budget.

$$REVpoland = 1290{,}277CPI - 1564{,}251FDI - 0{,}435EXP + 1{,}007IMP - 82479{,}314 \quad (3)$$

According to relationship (3), related to Poland, the UNEMP and EMIG variables did not have a significant influence on REV formation, which made them not included in the model. Taking into account the determination coefficient $R^2$ of 99.7%, the independent CPI, FDI and international trade related variables exert a significant influence on Polish taxation. As can be seen, there is a positive influence relationship between CPI, IMP and REV and there is a negative influence between FDI, EXP and REV. Thus, the fluctuation of inflation and imports exerts an influence in the same sense on fiscal revenues, but of different magnitudes, and the inversely proportional influence between FDI and EXP makes it necessary to take into account some accountable monitoring of the granting of tax incentives with regard to these two variables with negative influence.

$$REVromania = 783{,}706CPI + 1520{,}308UNEMP + 0{,}077EMIG + 1095{,}475FDI + 0{,}367IMP - 0{,}259EXP - 70593{,}395 \quad (4)$$

According to the relationship (4), unlike the other two countries, Romania accepts all the variables within the model, and the coefficient of determination $R^2$= 99.3% indicates the high influence of the factors chosen in the formation of the state's fiscal revenues. The only variable that exerts a negative influence on REV is EXP. Thus, an increase with a unit of measure of exports leads to a decrease of the fiscal revenues by 0.259 units. This may be due to the fact that in Romania the level of imports is higher than that of exports, and the trade deficit leads to economic downturns, by increasing public expenditures, even if the IMP has a positive influence on the dependent variable. The positive relationship between UNEMP, EMIG and REV can be a consequence of changes in income and profit taxes, the rise/fall of the two variables leading to the increase/ decrease of tax rates, or vice versa.

According to the IMF, the Czech Republic is a developed state, and precisely this makes the fiscal policy and the economic policy undertaken in the country to have the aim of balancing and facilitating economic growth, so we consider it is necessary to be taken into account the influences exercised by the aforementioned factors. The results show that there is a need to develop proposals on fiscal policy planning, so that inflation and elements with a negative impact on fiscal revenues, such as UNEMP, EMIG and IMP to be used as key elements in solving the budget deficits.

As for Romania and Poland, emerging countries, the relationship between the CPI and REV is a positive one, which can be translated by the fact that a rising inflation leads to high fiscal revenues, but these may not be in line with government spending. Under current economic conditions, the positive relationship between FDI and REV, in Romania, may be an indirect consequence of foreign direct investment in leading to job creation, reducing unemployment and thus increasing fiscal revenues, but especially in economic growth, by creating opportunities within the state. The negative relationship between FDI and REV, in Poland, makes it necessary to take into account strong governmental monitoring of the fiscal incentive regulations for this category of investment.

The negative/ positive relationship between imports and REV and the positive / negative link between exports and REV in these three countries, can be determined by the fact that the share of customs duties in most states occupies low proportions in the fiscal revenues and the result obtained in the revenue structure, also depends heavily on the

import and export price elasticity, on which can be added the exchange rate as well as the tax legislation on exemptions, reductions and deductions from payments.

## 4 Conclusions

Fiscal revenues have a particular importance in the sustainability of the economy in emerging and developed countries, being the main source of government revenue, which helps to provide public goods and services, but also helps to meet the social needs of taxpayers.

In order for the positive effects of the studied factors to be felt in these three states, the government must resort to increased trade, to improving customs and tax administration, but also to diminishing the emigration phenomenon and increasing the desire of citizens from emerging countries, especially Romanians, to return home. Increasing the immigration of citizens into the country of residence would bring economic, financial and social benefits, as long as policies on the labor market, fiscal and political regulations will be attractive enough for them, such that they will join the labor force of the state of residence, in the long run.

Romania is still characterized by a faulty collection of taxes and fees, a collection that is largely influenced by excessive bureaucracy, inefficient tax administration, repeated and inconsistent changes in fiscal legislation, as well as negative economic phenomena such as the underground economy and corruption. For a long-term economic recovery, both in Romania and in the rest of the emerging countries, it is necessary to align with European fiscal policies, in compliance with the directives of the European Commission and with taking as an example the developed countries with a good fiscal system, which entails, directly and indirectly, to economic growth.

The results of the study are in line with the literature and are essential, because they can be used to outline proposals for fiscal reforms to be undertaken, in the event of a fall in financial resources or in the event of a deep budget deficit. In order to have an economic and financial balance, and to overcome budget deficits that occur at a rapid pace, governments need to study and plan the revenue-expenditure relationship in the long run, so that their trajectory to be balanced without drastic increases, in terms of government spending, or large declines in government revenue.

The study has some limitations, from the point of view of the analyzed period and from the point of view of the analyzed variables. For example, we did not include political factors such as political instability, corruption, government policies, or factors such as economic stability, government spending, public debt, tax bases, exchange rate, number of employees, number of businesses, etc. A future direction of research could be represented by the study of the direct and indirect tax`s determinants.

## References

Ahmed, K. H., Ahmed, S., Mushtaq, M., Nadeem, M. (2016). Socio economic determinants of tax revenue in Pakistan: An empirical analysis. *Journal of Applied environmental and biological science*, vol. 6, pp. 32-42.

Ajaz, T., Ahmad, E. (2010). The effect of corruption and governance on tax revenues. *The Pakistan Development Review*, vol. 44(4), pp. 405-417.

Amin, A., Nadeem, A. M., Parveen, S., Kamran, M. A., Anwar, S. (2014). Factors affecting tax collection in Pakistan: An empirical investigation. *Journal of Finance and Economics*, vol. 2(5), pp. 149-155.

Andrejovska, A., Pulikova, V. (2018). Tax Revenues in the Context of Economic Determinants. *Montenegrin Journal of Economics*, vol. 14(1), pp. 133-141.

Basirat, M., Aboodi, F., Ahangari, A. (2014). Analyzing the effect of economic variables on total tax revenues in Iran. *Asian Economic and Financial Revie*w, vol. 4(6), pp. 755.

Belov, A. V. (2018). Tax revenues, public investments and economic growth rates: evidence from Russia. *Journal of Tax Reform*, vol. 4(1), pp. 45-56.

Bird, R. M., Zolt, E. M. (2008). Tax policy in emerging countries. *Environment and Planning C: Government and Policy*, vol. 26(1), pp. 73-86.

Castro, G. Á., Camarillo, D. B. R. (2014). Determinants of tax revenue in OECD countries over the period 2001–2011. *Contaduría y administración*, vol. 59(3), pp. 35-59.

Chaudhry, I. S., Munir, F. (2010). Determinants of Low Tax Revenue in Pakistan. *Pakistan Journal of Social Sciences (PJSS)*, vol. 30(2).

Constantin, S. B., Bacanu, M. N. (2015). Study On Tax Revenues In Romania As Contributor To The European Union Budget. *Regional Development And Integration*, vol. 2, pp. 112.

Cristea, L. A. (2019). Increasing the Quality of the Taxes and Fees Impact Assessment on the Romanian Economy. *Quality - Access to Succes Journal*, vol. 20(S1), pp. 497. WOS:000459686300087.

Dioda, L. (2012). Structural determinants of tax revenue in Latin America and the Caribbean, 1990-2009 (No. 26103). *Naciones Unidas Comisión Económica para América Latina y el Caribe* (CEPAL).

Ehrhart, H. (2011). Assessing the relationship between Democracy and Domestic taxes in developing countries. *CERDI, Etudes et Documents*, E.30.

Epaphra, M., Massawe, J. (2017). Corruption, governance and tax revenues in Africa. *Business and Economic Horizons (BEH)*, vol. 13(1232-2019-715), pp. 439.

Gobachew, N., Debela, K. L., Shibiru, W. (2018). Determinants of Tax Revenue in Ethiopia. *Economics*, vol. 6(6), pp. 58.

Hunady, J., Orviska, M. (2015). The effect of corruption on tax revenue in OECD and Latin America countries. *Theoretical and Practical Aspects of Public Finance*, vol. 20, pp. 80.

IBM Corp. Released 2011*, IBM SPSS Statistics for Windows*, Version 20.0.

International Monetary Fund (2019). *World economic outlook, April 2019.* Retrieved from: https://www.imf.org/external/pubs/ft/weo/2019/01/weodata/index.aspx.

Kumari, T. H., Nene, G. (2017). The Determinants Of Tax Revenue In Ethiopia. *Journal of Marketing Strategy (JMS)*, vol. 5.3, pp. 198-209.

Maulia, E., Sofyan, H. (2018). Tax revenue and inflation rate predictions in Banda Aceh using Vector Error Correction Model (VECM). In IOP Conference Series: *Materials Science and Engineering,* vol. 352(1), pp. 012056. IOP Publishing.

Monteiro, M. E. R. (2012). A Panel Data Econometric Study of Corporate Tax Revenue in European Union: Structural, Cyclical Business and Institutional Determinants. Retrieved from: https://ssrn.com/abstract=2162442.

Palic, I., Hodzic, S., Dumicic, K. (2019). Personal Income Taxation Determinants in Federation of Bosnia and Herzegovina. *Business Systems Research Journal*, vol. 10(1), pp. 153-163.

QadirPatoli, A., Zarif, T., Syed, N. A. (2012). Impact of Inflation on Taxes in Pakistan: An empirical study of 2000-2010 period. *Journal of Management and Social Sciences*, vol. 8(2), pp. 31-41.

Streimikiene, D., Raheem Ahmed, R., Vveinhardt, J., Ghauri, S. P., Zahid, S. (2018). Forecasting tax revenues using time series techniques–a case of Pakistan. *Economic research-Ekonomska istraživanja*, vol. 31(1), pp. 722-754.

# Hurst Exponent and the Efficiency of the Czech Electricity Market

**Juraj Čurpek[1], Jitka Veselá[2]**

[1] University of Economics Prague
Faculty of Finance and Accounting, Department of Banking and Insurance
W. Churchill sq. 4, 130 67 Prague 3, Czech Republic
E-mail: xcurj07@vse.cz

[2] University of Economics Prague
Faculty of Finance and Accounting, Department of Banking and Insurance
W. Churchill sq. 4, 130 67 Prague 3, Czech Republic
E-mail: veselaj@vse.cz

***Abstract:*** *Efficient Market Hypothesis (EMH) assumes a random, independent movement of the investment instrument prices. EMH validity testing, especially on stock and currency markets, did not bring clear results. Part of the research conducted so far confirms the validity of EMH, part of the research refutes the validity of EMH. This paper focuses on commodity market efficiency testing, specifically on the electricity market in Czechia (Czech electricity and gas market operator OTE) using a time-varying Hurst exponent estimated by the Detrended Fluctuation Analysis in period 2016-2018 applied on the returns of transformed hourly intra-day electricity prices. Since the value of 0.5 for the Hurst exponent is associated with the random process, and thus with the weak form of EMH, its value can indicate whether the studied market is efficient or not. To conduct our research, we computed the Hurst exponents in the subsamples that slid along the full sample, which is called the sliding-window technique, and thereby we were able to get a view of temporal behavior of the Hurst exponent. First, our results showed the so-called multi-scale nature of the returns of transformed electricity prices, i.e. we detected two Hurst exponents on different time scales separated by the crossover. Secondly, the Hurst exponent temporal behavior, calculated on the smaller time scale, revealed the short periods when the studied market approached the weak-form efficiency. On the other hand, for the larger time scale, the Hurst exponents attained values associated with the mean-reverting process and not the random one, and thus in that case the short-term electricity market in Czechia was inefficient with respect to the weak form of EMH.*

*Keywords: Efficient Market Hypothesis, electricity market, Hurst exponent*

*JEL codes: G1, G14*

## 1 Introduction

The Efficient Market Hypothesis (EMH) was introduced by Fama (1965), and is an important theoretical concept that explains the behavior of the financial markets and has played a dominant role in financial theory for a long time. EMH assumes that the prices of investment instruments absorb almost all available information immediately and adequately. Individual price-triggering information is not related. Movements in the prices of investment instruments responding to this information are also independent. In an efficient market, investment instruments are traded at prices close to their fair value due to an adequate response to new, unexpected information. In this situation, it is not possible in the efficient market to use tools in the form of technical and fundamental analysis to achieve excessive returns.

There are three forms of market efficiency depending on the type of information that is quickly, almost immediately processed. A weak form of efficiency assumes that historical information is almost immediately absorbed into the prices of investment instruments. Since the past price data cannot be used successfully to forecast their future development, the technical analysis, becomes ineffective. The semi-strong form of efficiency requires a rapid response of investment instrument prices to all public information available (past and present). In this situation there are not any significantly

overvalued and undervalued investment instruments. Thus, both technical analysis and fundamental analysis, which relies on forecasting price developments for public information, become ineffective. A strong form of efficiency requires investment instrument prices to absorb not only historical and public information, but also insider information. In later revision of EMH (Fama, 1991) refutes the existence of a strong form of efficiency. However, a weak and semi-strong form of efficiency can work in different market segments under certain conditions.

However, there is no uniform opinion amongst academics about the validity of this theory. Supporters of the EMH believe that it is futile to look for trends and dependencies in price development on the market and that market developments are repeatedly heading for a steady state. EMH critics, on the other hand, point to the occurrence of unexpected shock events in the market (such as the October 1987 crash, when the DJIA index fell by more than 20 percent, or the Dotcom bubble generation and burst in 2000, or the DJIA's 8% fall in 1997), which showed that the prices of investment instruments have repeatedly deviated significantly from their real fundamental values on the market. The incidence of inconsistencies in EMH has led to alternative theoretical concepts explaining the behavior of financial markets such as behavioral finance, adaptive market hypothesis (AMH) or fractal market hypothesis (FMH).

The electricity is a special commodity with the unique characteristics. Its aggregate demand should always equal the aggregate supply at every instant, so the power grid must be always prepared to deliver the certain amount of electricity when needed. Moreover, it is difficult to efficiently (from the economic perspective) store it, so there is no actual stockpile of electricity used when needed. This is a result of the process of liberation and deregulation of power industry in developed countries which occurred in recent years.

Since the price of electricity is the result of the underlying processes that shape the demand and supply, its price dynamics possesses some special features well-known as the stylized facts (Simonsen et al., 2004), namely the multi-seasonality caused by periodical weather changes and social factors, clustered and extreme volatility caused by the non-storability, positive and negative spikes as a result of sudden alteration of consumption, i.e. shocks, mean-reverting property and occurrence of negative prices.

We conducted our research on the wholesale intra-day market that facilitates electricity trading between the power producers and retailers or alternatively large consumers. The contract, in our case, is a trade of predefined amount of electricity (in megawatt hour - MWh) at a specific price (in CZK) for almost immediate (no less than 60 minutes) use which helps to equilibrate the market for every hour, and thereby complements the spot market.

The current market efficiency research is focused mainly on stock, currency and precious metal markets. However, the electricity market efficiency tests, based especially on the testing of the randomness via Hurst exponent of time series are of lesser number. In fact, the Hurst exponent can be used as a measure of market persistence or presence of long-term memory when assessing market efficiency (Cajueiro et al., 2005).

For instance, (Serletis, 2009) investigated the informational efficiency of the Alberta electricity market using the Detrending Moving Average method to obtain Hurst exponent which was below 0.5 indicating the market inefficiency. Another study of electricity prices predictability (Uritskaya et al., 2015) in the Canadian provinces of Alberta and Ontario and in the US Mid-C market, using the DFA concluded that the day-ahead prices exhibited strong anti-persistent behaviour, which stipulates the market inefficiency.

Some authors (Papaioannou et al., 2018) used a composite index comprising more than just Hurst exponent to measure the efficiency deviation from the random walk benchmark on four European electricity markets. Furthermore, there are many publications concerning the application of Hurst exponent methodology on electricity prices/returns data, but rather for testing of mean-reversion than for weak form of efficiency itself. Regarding the Czech market, (Kristoufek et al., 2013) showed that

hourly spot prices of electricity on the Czech market in period of 2009-2012 were anti-persistent with the scaling Hurst exponent being $H_F \approx 1.1$.

Since there are no recent studies of efficiency of electricity market in Czechia exploiting the Hurst exponent, the purpose of this paper is to assess whether the Czech short-term electricity market was efficient in years 2016 - 2018 with respect to the concept of weak form of EMH and Random Walk Hypothesis (RWH) or not.

## 2 Methodology and Data

The Hurst exponent introduced by the hydrologist H.E.Hurst was meant to study the long-term water levels in Asuan water reservoir (Hurst, 1951). Nowadays it is widely used as the measure of predictability in the meaning that it quantifies a persistence of trends in time series, which can lead to three cases. If $H < 0.5$ then time series is anti-persistent, which should be the case of electricity prices according to the stylized facts. If $H \approx 0.5$ then the time series is uncorrelated and follows a random walk, else $H > 0.5$ indicates that time series is persistent. Note that the values of the (classical) Hurst exponent are bounded to an interval between zero and one (included) and it is assumed that time series is stationary, which might not be the case of the most of the real financial time series. To handle even non-stationary time series the Detrended Fluctuation Analysis (DFA) algorithm was introduced by C.K. Peng (Peng et al., 1994) who was studying the long-range correlations in DNA sequences. Since the scaling Hurst exponent is, in fact, larger than one for non-stationary time series, its link to the classical Hurst exponent is given as:

$$H = H_F - 1. \tag{1}$$

The DFA computation begins with dividing time series with $N$ observations into $k$ equally sized non-overlapping subsamples of length $t$. Then in every subsample we find a local trend $y_t(k)$ which is, in general, a polynomial fit of some order. Hence for the linear fit we denote this method as DFA(1), quadratic fit as DFA(2) etc. Consequently, the integrated time series $y(k)$ is detrended by subtracting the local trend in each subsample to get the so-called fluctuation or scaling function for given subsample of size $t$, which can be also interpreted as time-scale in case of time series.

$$F(t) = \sqrt{\frac{1}{N}\sum_{k=1}^{N}(y(k) - y_t(k))^2}\,. \tag{2}$$

Then the scaling Hurst exponent is defined as a slope of the line between $logF(t)$ and $log(t)$ for over all time scales. Since the relationship between $F(t)$ and the time-scale $t$ ($C$ is some constant) can be also written as:

$$F(t) = Ct^{H_F}, \tag{3}$$

it is obvious, that it is, in fact, the exponent that relates the fluctuation function and time scale.

The DFA is usually applied on the logarithmic returns of given time series. However, since electricity prices can sometimes attain negative values, their use is limited. We rather used the inverse hyperbolic sine transformation (Schneider, 2012) to compute returns, because it allows for zero and negative values and has the asymptotic logarithmic behavior:

$$x = \sinh^{-1}\left(\frac{p-\xi}{\lambda}\right), \tag{4}$$

where $p$ is price, $\xi$ is and offset and $\lambda$ stands for scale. Due to simplicity the offset equals zero and scale equals one.

Since we wanted to examine a behavior of the Hurst exponent in time, it was necessary to compute the Hurst exponent on the subsamples with a constant size $N_s$ of the full

sample $N_{max}$ that move along the time series by defined step $\delta_s$, which is called the sliding-window technique. Obviously, due to the use of sliding window the sequence of the Hurst exponents is shorter than the original time series. The larger sliding window (keeping the step size constant), the shorter sequence of the Hurst exponents.

Since the length of the sliding window should be in range that that the scaling law equation (3) holds, (Carbone et al., 2004) suggest the minimum size to be $N_{min} \approx 2000 - 3000$.

As a data source we used the publicly available data by the Czech energy market operator OTE on its webpage (http://www.ote-cr.cz/statistika/) contained in annual reports. Specifically, we used data of the average electricity prices on intra-day trading with hourly frequency available (or converted when needed) in CZK/MWh. Total length of dataset used covers the period from 1.1.2016 to 31.12.2018 which is 26304 observations in total. The Hurst exponent in this research was computed by the robust method called Detrended Fluctuation Analysis (DFA) applied on inverse hyperbolic sine returns described before and the computation took place on the sliding window with size of 3000 and 4380 observations.

The common phenomenon while applying the DFA is that the process often exhibits so-called multi scaling, i.e. there are more Hurst exponents than one, which means there is some time scale at which the scaling behavior (slope of the line between *logF(t)* and *log(t)*) changes which is called the crossover. It was empirically shown (Bashan et al., 2008) that for DFA(1) the real crossover differs from the observed one and can be determined as:

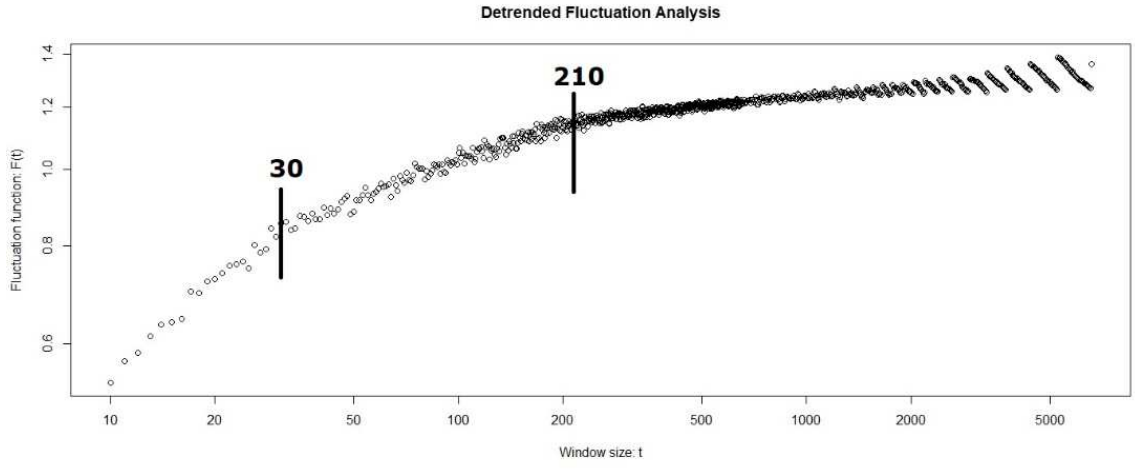
$$ln(s_x^{real}) \approx \ln(s_x^{obs}) - 0.25\,. \tag{5}$$

## 3 Results and Discussion

We estimated the Hurst exponents on inverse hyperbolic sine returns of hourly intra-day electricity prices in Czechia in period that covers three years from 2016 using a DFA(1) method and sliding window technique. The DFA method was implemented in free statistical software R (RStudio ver. 1.1463, package nonlinearTseries ver. 0.2.5).

To take care of the crossovers, we first used the full sample, which calculations resulted in two crossovers dividing the Fluctuation function into three regions and thus giving three scaling exponents – 0.38, 0.16, 0.04, similarly to (Marossy, 2013) who was using the log-returns and found out that DFA methods results in two crossovers.

**Figure 1** Positions of the Observed Crossovers when Using the Whole Sample

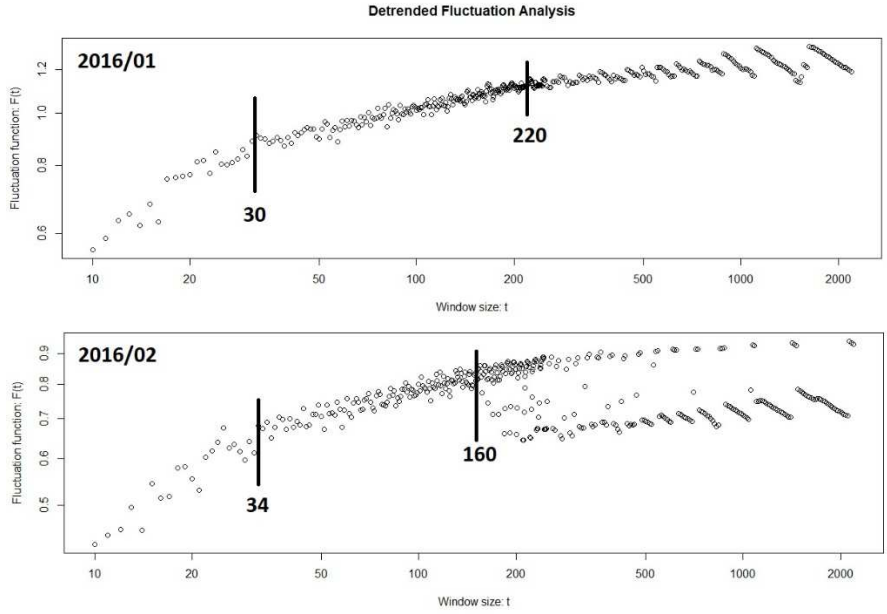



Source: own computation

However, when using the shorter subsample, the Hurst exponent above the second crossover was difficult to estimate because the Fluctuation function values seem to not give the robust results and the values are biased at the higher time scales. Using a larger sliding window would provide us with the better results but also shorten the sequence of Hurst exponents. For that reason, we estimated only two scaling exponents up to the second crossover.

In addition, it is implicitly assumed, that the crossover position stays constant in time which might not be the case as visualized on Figure 2 on next page.

**Figure 2** Positions of Observed Crossovers between the First and the Second Half of 2016




Source: own computation

Since identifying the crossover positions for every subsample would be non-optimal and time-consuming for pragmatic reasons (there are 971/914 subsamples), we split the whole sample into six subsamples according to the half-years at which we identified observed crossover positions graphically and calculated the positions of real crossovers. Thus, we partially abandoned the implicit assumption of time stability of crossover positions and assumed, for the sake of simplicity, that they are stable within the half-year.

Then in each subsample we computed the scaling Hurst exponents respecting the real crossover positions which resulted in more precise results. The exact point on time series where we start using a different crossover for our calculations starts where the center of the sliding window happens to be at the beginning of the new subsample. The positions of crossovers for individual half-years are presented in Table 1 below.

**Table 1** Positions of the crossovers – observed/real (rounded).

| | **2016/01** | **2016/02** | **2017/01** | **2017/02** | **2018/01** | **2018/02** |
|---|---|---|---|---|---|---|
| **1st crossover** | 30/23 | 34/28 | 24/19 | 32/25 | 28/22 | 24/19 |
| **2nd crossover** | 220/171 | 160/123 | 180/140 | 160/123 | 170/134 | 160/123 |

Source: Own computation

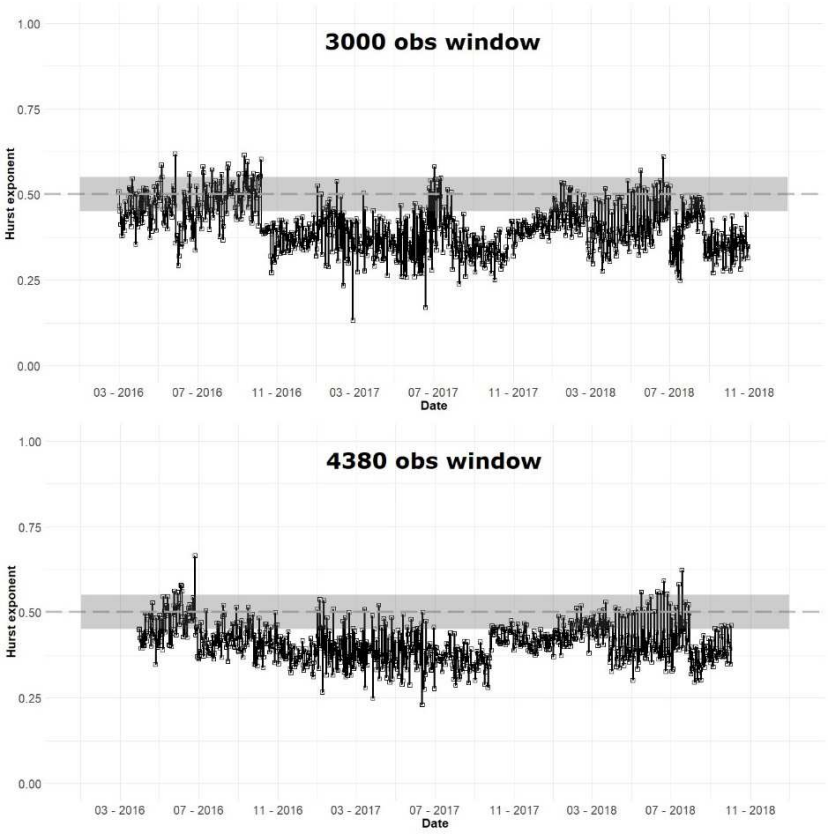
First, we estimated the Hurst exponent for the scales less than the first real crossover which occurred between 19 and 28 hours. The Figure 3 on next page indicates the periods when the Hurst exponent was in the interval between 0.45 and 0.55 (grey area),

which we consider as being close to randomness. In summary, the Hurst exponent was between 0.45 and 0.55 in 224 out of 971 observations, and its mean value was 0.4064.

However, since the sequence of Hurts exponents using 3000 observations-window is evidently too volatile, we tried to use a larger sliding window with size of 4380 observations (half year) which should smooth the results, with 193 out of 914 observations being close to randomness (in grey area), and the mean value was 0.4111.

The Figure 3 shows that for some periods the electricity returns after a transformation by the inverse hyperbolic sine, behaved nearly randomly. The period corresponding to the sliding window center that ranges approximately from April 2016 to October 2016 shows periods of almost random movement. Moreover, the similar periods occurred in period from April 2018 to June 2018. In 2017 there were shorter periods when the Hurst exponent was close to value of 0.5, but most of the time the process was mean-reverting, just like in the second half of 2018.

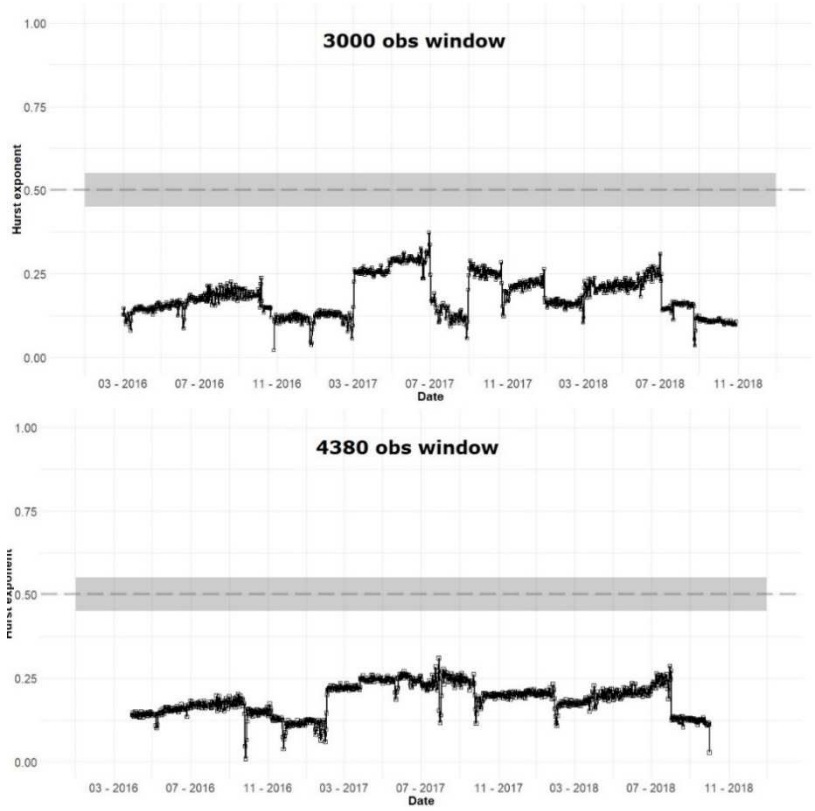
**Figure 3** Hurst Exponents for Short Time Scales – Below the First Crossover




Source: own computation

Secondly, using DFA(1) we computed the Hurst exponent at the time scales between the first real and the second real crossover that occurred between 123 and 171 hours. As seen on the Figure 4 on next page, the inverse hyperbolic sine returns of hourly intra-day prices of electricity exhibit mean-reverting behavior which is in the agreement with the stylized facts. Using the larger sliding window only smoothed the sequence but it is obvious that the values of the Hurst exponent are far from being random. The mean value of the Hurst exponents was 0.1775 and 0.1855 respectively. Hence on the larger time scales, the short-term electricity market was clearly inefficient with respect to the concepts of weak form of EMH and RWH.

**Figure 4** Hurst Exponents for Large Time Scales – Between the First and Second Crossover




Source: own computation

## 4 Conclusions

The prices (and returns too) of the electricity are assumed to be a mean-reverting process according to the stylized facts, which implies that the electricity market is not efficient with respect to the weak form of EMH. The goal of this paper was to assess the efficiency of the short-term electricity market in Czechia in terms of random behavior of the returns of transformed intra-day electricity prices by applying the Detrended Fluctuation Analysis method to calculate the Hurst exponent, which value indicates whether the process is mean-reverting or random or persistent. To achieve that we applied the sliding-window technique that resulted in estimations of the Hurst exponents on sliding subsamples with the lengths of 3000 and 4380 observations over the period from 2016 to 2018.

There are two key findings of our research. First one is a detection of a multi-scale behavior of the returns of transformed intra-day prices of electricity represented by the presence of the crossovers, which varied with time, so there were distinct Hurst exponents on distinct time scales. Secondly, on the time scales approximately larger than one day, the Hurst exponent values point to the mean-reverting behavior, which is in the accordance with the stylized facts, and thereby the studied electricity market was inefficient. To the contrary, on the shorter time scales the returns of transformed prices of electricity were weakly mean-reverting or sometimes approaching a random behavior, which could indicate that on the short time scales the studied electricity market sometimes behaved almost efficiently with respect to the weak form of EMH.

Nevertheless, our results show that the Czech short-term electricity market was, in general, inefficient with the respect to the concepts of weak form of EMH and RWH in period from 2016 to 2018 with a few exceptions, when the returns of transformed prices behaved almost randomly, but only on the short time scales. Further study comprising

more metrics related to the assessment of EMH and RWH than just the Hurst exponent, and including day-ahead and forward prices would contribute to an understanding of the complex behavior of the electricity market in Czechia as a whole.

## Acknowledgments

The article is processed as an output of a research project under the registration number IG102029.

## References

Bashan, A., Bartscha, R., Kantelhardt, J. W., Havlina, S. (2008). Comparison of detrending methods for fluctuation analysis. *Physica A: Statistical Mechanics and its Applications*, vol. 387(21), pp. 5080–5090. DOI: https://doi.org/10.1016/j.physa.2008.04.023.

Cajueiro D. O., Tabak B. M. (2005). Ranking efficiency for emerging equity markets II. *Chaos, Solitons and Fractals*, Vol. 23(2), pp. 671-675.

Carbone, A., Castelli, G., Stanley, H. E. (2004). Time-dependent Hurst exponent in financial time series. *Physica A: Statistical Mechanics and its Application*, vol. 344(1-2), pp. 267-271. DOI: https://doi.org/10.1016/j.physa.2004.06.130.

Fama, E. F. (1965). The Behaviour of Stock Market Prices. *Journal of Business*, vol 64, pp. 34-105.

Fama, E. F. (1991). Efficient Capital Markets II. *Journal of Finance*, vol. 46(5), pp. 1575-1617.

Hurst, H. E. (1951). Long-Term Storage of Reservoirs: An Experimental Study. *Transactions of the American Society of Civil Engineers*, vol. 116, pp. 770-799.

Kristoufek, L., Lunackova, P. (2013). Long-term Memory in Electricity Prices: Czech Market Evidence. *Finance a úvěr - Czech Journal of Economics and Finance*, vol. 63(5), pp. 407-424.

Marossy, Z. (2012). Analysis of spot electricity prices using statistical and econophysical methods. *Thesis outline*. Retrieved from: http://phd.lib.uni-corvinus.hu/520/2/marossy_zita_ten.pdf.

Papaioannou, P. G., Dikaiakos, Ch., Stratigakos, A. C., Papageorgiou, P., Krommydas, K. (2019). Testing the Efficiency of Electricity Markets Using a New Composite Measure Based on Nonlinear TS Tools. *Energies*, vol. 12(4), pp. 618. DOI: https://doi.org/10.3390/en12040618.

Peng, C.-K., Buldyrev, S. V., Havlin, S., Simons, M., Stanley, H. E., Goldberger, A. L. (1994). Mosaic Organization of DNA nucleotides. *Physical Review*, E 49(2), pp. 1685. DOI: https://doi.org/10.1103/PhysRevE.49.1685.

Schneider, S. (2011). Power spot price models with negative prices. *The Journal of Energy Markets*, vol. 4, pp. 77–102. Retrieved from: https://www.risk.net/journal-of-energy-markets/volume-4-number-4-december-2011.

Serletis, A., Bianchi, M. (2007). *Informational Efficiency and Interchange Transactions in Alberta's Electricity Market.* University of Calgary, Department of Finance. Retrieved from: https://econ.ucalgary.ca/sites/econ.ucalgary.ca/files/publications/Serletiswp05.pdf.

Simonsen, I., Weron, R., Mo, B. (2004). Structure and stylized facts of a deregulated power market. *Working Paper presented at the 1st Bonzenfreies Colloquium on Market Dynamics and Quantitative Economics.* Alessandria. Retrieved from: http://mpra.ub.uni-muenchen.de/1443/.

Uritskaya, O. Y., Uritsky, V. M. (2015). Predictability of price movements in deregulated electricity markets. *Energy Economics*, vol. 49, pp. 72-81. DOI: https://doi.org/10.1016/j.eneco.2015.01.012.

# The Effectiveness of Lower Secondary Education in OECD Countries

**Darya Dancakova[1], Jozef Glova[2]**

[1] Technical University of Kosice
Faculty of Economics, Department of Banking and Investment
Němcovej 32, 04001 Košice, Slovak Republic
E-mail: darya.dancakova@tuke.sk

[2] Technical University of Kosice
Faculty of Economics, Department of Banking and Investment
Němcovej 32, 04001 Košice, Slovak Republic
E-mail: jozef.glova@tuke.sk

***Abstract:*** *In contemporary society the meaning of education has changed dramatically. The phenomenon of knowledge economy represents the highest stage of the post-industrial society and economy development, where the competitiveness of a country is no longer defined through the ever-larger number of factory workers, but is directly related to the stock of knowledge and capability for learning new skills embodied in even more educated population. Therefore, in today´s fast-changing global environment, education is recognized as one of the most important factors, besides financial and material resources, determining a success of a modern society. Mainly, the secondary education attainment could be perceived as an important stage in educational progressing across developed countries, since leaving school with a good qualification is crucial for getting into tertiary education as well as for entering a job market. The following study measures the efficiency of secondary education using Data Envelopment Analysis (DEA) and compares the results across the selected EU countries. The aim of the paper is to provide an empirical analysis of the relationship between educational expenditures and its efficiency reflected in the PISA testing results.*

*Keywords: secondary education, student achievement, PISA 2015, spending on education, DEA*

*JEL codes: J2, H2, H52, I21, I22*

## 1 Introduction

The recent years have witnessed an information revolution that has resulted in a new era of economics and society where the knowledge and education have acquired an unprecedented role. The essential link between education and economic development of the country has been revealed already during the industrial age by such economists like W. Petty, A. Smith, or J. S. Mill (Youngson, 1959). From an economic perspective, education can be viewed as an investment in knowledge and skills of population. Speaking about investing in education, it is necessary to mention Schulz (1960), who proposed to treat education as an investment in individual that becomes an integral part of a person receiving it, and therefore it consequences shall be handled as a form of capital referring to the human capital. The human capital theory was popularized by Becker (1992) and it became one of the most important theories of modern economics. It puts emphasis on education of individuals, since the well-skilled labor promotes economic growth, individual wellbeing and poverty reduction. Vawda (2003) suggested that investing in people in form of government spending is critical for economic and social development of the country, since it may help to achieve greater equity and efficiency in education among young people. According to the Dissou et al. (2016), expenditures on education, schooling and training will raise labor productivity, earnings, improve general welfare and foster economic growth. Never-ending learning equips people with new skills, enabling them to express themselves and critically evaluate the world around. Moreover, the schooling promotes individuals to think creative and makes them able to come up with new ideas and to think out of the box. Additionally, better educated people can benefit from a higher income from their work and they are less at risk of unemployment. Among other things, Hanushek (2009) asserted that education is an essential element in

a global economic competition and investments in human capital will directly affect the improvements in productivity and national income, because national income rises directly with earnings from workers with more qualification and better skills. Promoting and supporting education should be, therefore, one of the top priority areas of government´s development policy around the world.

Education systems around the world are different and vary a lot between countries. However, in the middle of 70s, UNESCO developed a statistical framework "The International Standard Classification of Education" (ISCED) with aim to provide a generalized classification of individual education systems, as well as to enable their international comparison. According to the ISCED2, the lower secondary education refers to the junior secondary education and considered to be a second stage of the compulsory education after finishing primary education. In general, students enter the lower secondary education around the age of 11-12 and complete the lower secondary phase around the age of 15-16, depending on the individual education programme of the country concerned (Iwamoto et al., 2005).

The main goal of our study is to investigate the efficiency of lower secondary education and examine the impact of educational spending on educational outcome represented by the students` achievement in PISA tests. The "Programme for International Student Assessment" (PISA) was launched by OECD in 2000 with aim to measure skills of 15-year-olds near the end of their compulsory education, particularly in reading, math and science. Starting from 2003 students have been additionally assessed in collaborative problem solving, and in financial literacy starting from 2012. PISA questionnaires are not constructed with objective to evaluate specific teaching plans and fixed syllabus in schools, but they are setting out a real-life situation in order to measure skills important for effective learning and production of knowledge. Participating students are tested regardless of their social or cultural status and type of school. In general terms, PISA examines how successful different education systems among participating countries are in giving fair and equal education opportunities to young people, regardless of their social, cultural and economic background. Thus, it allows to monitor and compare quality, equity and efficiency of education systems across OECD and partner countries (OECD, 2015).

In recent years, there has been an increasing amount of literature on international comparison of education outcomes at different levels. Such researches as Bessent and Bessent (1980), Charnes et al. (1981), were among the first who focused their attention to measuring efficiency of education systems using "Data Envelopment Analysis" (DEA) technique, arguing that DEA methodology is easily applicable for estimating the efficiency of " Decision Making Units" (DMUs) in the public and not-for-profit sectors. Much of current literature tends to consider the achievement in PISA tests for the world`s metric of education outcome at lower secondary level. A literature review of the most relevant studies dealing with the issue of secondary education efficiency has been briefly summarized into the following table (Table 3).

**Table 3** Literature review

| Author | Study | Year | Aim of the study | Methodology | DEA Inputs | DEA Outputs |
|---|---|---|---|---|---|---|
| **Petar Sopek** | Efficiency of public expenditure on education in Croatia. | 2011 | Examine technical efficiency of public expenditures on education in Croatia. | Data Envelopment Analysis (output-oriented); Free Disposable Hull. | Public expenditure on education (% of GDP); Student- Teacher ratio. | Average PISA score in 2009. |
| **Tommaso Agasisti** | The efficiency of Italian secondary schools and the potential role of competition: a data envelopment analysis using OECD-PISA2006 data. | 2013 | Measure efficiency of student performance at school level in Italy using DEA. | Data Envelopment Analysis; Bootstrapping and quantile regression analysis. | Students-Teachers ratio; Computers connected to the web; Parental education. | Science score; Math score. |
| **Aleksander Aristovnik, Alka Obadić** | Measuring relative efficiency of secondary education in selected EU and OECD countries: The case of Slovenia and Croatia. | 2014 | Investigate secondary education efficiency in public education sector. | Data Envelopment Analysis. | Model 1: Expenditure per student, secondary (% of GDP per capita). Model 2: Expenditure per student, secondary (% of GDP per capita); Teacher-pupil ratio, secondary. Model 3: Teacher-pupil ratio, secondary. Model 4: School enrolment, secondary (% gross). | Model 1: School enrolment, secondary (% gross); PISA average 2006; Teacher-pupil ratio, secondary. Model 2: School enrolment, secondary (% gross); PISA average 2006. Model 3: PISA average (2006); School enrolment, tertiary (% gross). Model 4: PISA average (2006); School enrolment, tertiary (% gross). |
| **Fatma Lorcu, Bilge Acar Bolat.** | Comparison of Secondary Education Pisa Results in European Member States and Turkey via DEA and SEM. | 2015 | Comparison of the results of effectiveness of education at secondary level in Turkey and the selected EU member states. | Additive Data Envelopment Analysis; Structural Equation Modelling. | GDP allocation to education; Student-Teacher ratio. | PISA scores in math, reading and science. |
| **Daniel Santín, Gabriela Sicilia** | Measuring the efficiency of public schools in Uruguay: main drivers and policy implications. | 2015 | Identify inefficiency in public high schools in Uruguay | Data Envelopment Analysis (BCC model, output-oriented); Bootstrapping regression model. | Parental education; School educational resources; Proportion of fully certificated teachers. | Average reading score; Average math score. |
| **Yi Yuan, Mingfeng Shan.** | The educational efficiency evaluation framework: By using DEA model and CA method. | 2016 | Efficiency analysis of 17 districts in Shanghai performed using DEA and cluster methodology. | Data Envelopment Analysis; Multivariate regression; Cluster analysis. | Total budget per capita; Equipment budget per capita; Student-Teacher ratio. | Quota per class; Quota per school; Student density per km2. |

**Source: Own elaboration**

## 2 Methodology and Data

PISA testing aims to assess capability of 15- year-olds from all around the world to face and solve the real-life situations. An international assessment measures student performance in science, reading and math. In addition, students are optionally tested in collaborative problem solving and financial literacy. According to the Education at a Glance (2015), approximately 540 000 youth students from 72 countries participated in OECD' s PISA 2015.

The data sample for our research was collected from the OECD database and initially consisted of 36 OECD countries and economies that participated in PISA 2015. In view of the missing values, the initially selected dataset has been reduced to the 24 countries, namely: Australia (AUS), Austria (AUT), Czech Republic (CZE), Germany (DEU), Denmark (DNK), Spain (ESP), Estonia (EST), Finland (FIN), France (FRA), United Kingdom (GBR), Greece (GRC), Hungary (HUN), Chile (CHL), Island (ISL), Italy (ITA), Japan (JPN), Korea (KOR), Luxemburg (LUX), Mexico (MEX), Poland (POL), Portugal (PRT), Slovak Republic (SVK), Slovenia (SVN), Sweden (SWE).

The research methodology of this study has followed numerous studies investigated efficiency of educational systems at different levels. Many of academics and researchers performed Data Envelopment Analysis (DEA) to measure public sector efficiency, mainly in health and education related issues. Methodology used in our paper, as well as selection of the input and output variables, were based on several studies proposed by Sopek (2011), Agasisti (2013), Aristovnik and Obadić (2014) among others.

The main goal of the study was to assess the efficiency of compulsory secondary education considering three selected variables which may affect students` performance at the national level in a significant way. Secondly, we explored the relationships among these factors and student achievement by performing correlation analysis, as well as exploring the associations between output and input variables graphically using scatterplots. We assumed that student scores achieved in PISA testing are significantly determined by the amount of financial resources spent on education, class size representing students per teaching staff and last, but not least, the number of hours per year spent in school.

Educational attainment of 15-year-olds has been chosen to be an output variable in our analysis. Traditionally, the student educational achievement has been assessed by measuring their performance in achieving results in PISA testing. Therefore, the output in our study is measured corresponding to the performance of 15-year-olds in the PISA 2015. Afonso and Aubyn (2006) have pointed out that the student performance is likely to depend on resources employed not only in the year of testing, but also in previous years. Following their study, we have taken time average values using three input measures:

- The time of schooling, corresponding to compulsory instruction time spent in lower-secondary education in hours per year for the 12- to 14- year-olds, on average for 2012-2014.
- The average class size in public and private institutions for secondary education, corresponding to the student-teacher ratio based on full-time equivalents, on average for 2012-2014.
- Annual expenditure per student incurred by public and private educational institutions, in equivalent USD converted using PPPs for GDP, based on full-time equivalents, on average for 2012-2014.

The **Table 4** summarises key characteristics of the final data sample:

**Table 4:** Data characteristics

| | Mean | Standard deviation | Minimum | Maximum |
|---|---|---|---|---|
| **PISA (2015)** | 491.2 | 26.2 | 415.7 (MEX) | 528.7 (JPN) |
| **Class size (2012-2014)** | 22.4 | 5.1 | 10.2 (SWE) | 32.6 (KOR) |
| **Hours per year (2012-2014)** | 733.4 | 130.1 | 558.8 (SWE) | 966.2 (ESP) |
| **USD per student (2012-2014)** | 9732.0 | 3880.6 | 2489.2 (MEX) | 20588.3 (LUX) |

Source: Own elaboration

**Model Specification**

Data envelopment model used in this study is mostly based on the methodology proposed by Afonso and Aubyn (2006), referring to the preliminary work undertaken by Charnes et al. (1978). Data envelopment analysis, by its very nature, enable to measure performance through evaluation of relative efficiency of the decision-making units (DMUs). In our calculation of technical efficiency, we supposed output-oriented DEA model with variable returns to scale (VRS), described with the formula shown below:

$$Maximize\ \varphi - \varepsilon\left(\sum_{i=1}^{m} s_i^- + \sum_{r=1}^{m} s_r^+\right) \tag{1}$$

$$\sum_{j=1}^{n} \lambda_j x_{ij} + s_i^- = x_{i0}\,, \quad i = 1,\ldots.m \tag{2}$$

$$\sum_{j=1}^{n} \lambda_j y_{rj} + s_r^+ = \varphi y_{i0}\,, \quad r = 1,\ldots.s \tag{3}$$

$$\sum_{j=1}^{n} \lambda_j = 1\,, \quad j = 1,\ldots.n \tag{4}$$

$$\lambda_j \geq 0\,, \quad j = 1,\ldots.n \tag{5}$$

The output-oriented DEA model evaluate by how much the output measures can be proportionally increased, while the inputs proportions remain unchanged, with the output efficiency defined by $\varphi$. Assuming a hypothesis of variable returns to scale (VRS) in our model, the formula shown above, allows us to estimate efficiencies whether an increase or decrease in selected output or input quantities does not determine a proportional change in the output or input units correspondingly (Cooper et al., 2011). In the formula (1) the efficiency $\varphi$ for a group of peers - DMUs ($j$=1…. $n$) is computed for the selected outputs ($y_{rj,}$ $r$=1…. $s$) and inputs ($x_{ij}$, $i$=1….$m$), weighted by the peer's weight being $\lambda_j$. When a DMU is efficient, the $\lambda$ values would be equal to 1. The $s_i^-$ and $s_r^+$ represent input and output slacks, respectively, where the superscripted minus sign on input slacks indicates reduction, while superscripted positive sign on output slacks requires enlargement of outputs.

## 3 Results and Discussion

The results obtained from the standard data envelopment analysis with variable-returns-to-scale and output orientation are shown in **Chyba! Nenalezen zdroj odkazů.**.

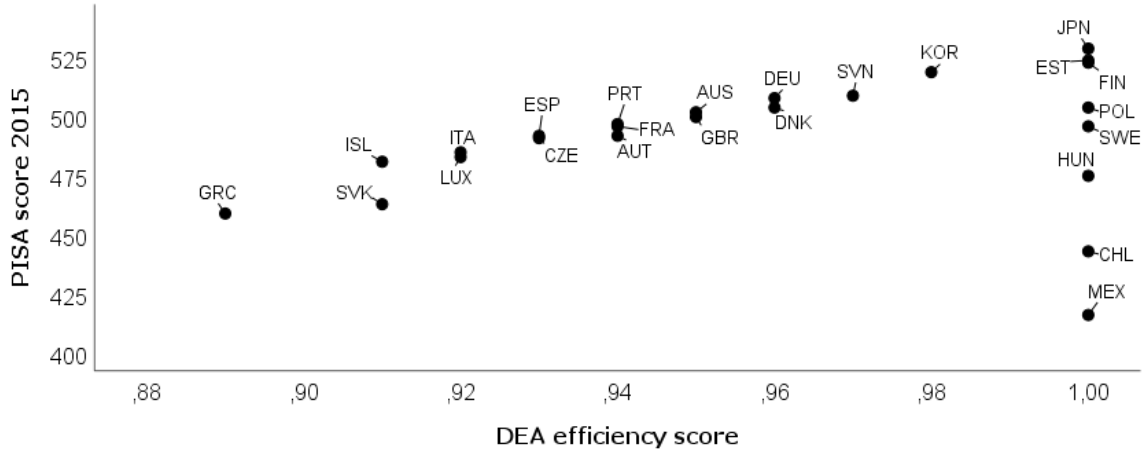
**Table 3:** Results

| Country name | Country code | Efficiency (VRS_OUT) | RANKING |
|---|---|---|---|
| **Estonia** | EST | 1 | 1 |
| **Hungary** | HUN | 1 | 1 |
| **Chile** | CHL | 1 | 1 |
| **Japan** | JPN | 1 | 1 |
| **Mexico** | MEX | 1 | 1 |
| **Poland** | POL | 1 | 1 |
| **Sweden** | SWE | 1 | 1 |
| **Finland** | FIN | 1 | 1 |
| **Korea** | KOR | 0,98 | 9 |
| **Slovenia** | SVN | 0,97 | 10 |
| **Germany** | DEU | 0,96 | 11 |
| **Denmark** | DNK | 0,96 | 12 |
| **Australia** | AUS | 0,95 | 13 |
| **United Kingdom** | GBR | 0,95 | 14 |
| **Portugal** | PRT | 0,94 | 15 |
| **France** | FRA | 0,94 | 16 |
| **Austria** | AUT | 0,94 | 17 |
| **Spain** | ESP | 0,93 | 18 |
| **Czech Republic** | CZE | 0,93 | 19 |
| **Italy** | ITA | 0,92 | 20 |
| **Luxemburg** | LUX | 0,92 | 21 |
| **Island** | ISL | 0,91 | 22 |
| **Slovak Republic** | SVK | 0,91 | 23 |
| **Greece** | GRC | 0,89 | 24 |

Source: Own elaboration

It is apparent from this table that only eight countries could be characterized as the most efficient ones, as they reached efficiency scores equal to 1. The peer group of the most efficient countries is comprised of Estonia, Hungary, Chile, Japan, Mexico, Poland, Sweden, and Finland. The only country that proved to be the least efficient in educational achievement with selected inputs is Greece. The average efficiency score is found at 0.96, meaning that countries with efficiency scores below this frontier should be able to improve the PISA score results on average by 4% with the currently available resources. One could assume that a higher technical efficiency score of standard DEA would obviously indicate a better student achievement in PISA testing. To investigate mentioned assumption, we have expressed the relationship between the DEA efficiency score and average PISA results in a scatterplot shown below.

**Figure 1:** PISA Score & DEA Efficiency Relationship




Source: own elaboration

As **Figure 1** shows, the most of countries follow a clear trend of a strong, positive, linear association between average PISA score and DEA efficiency scores correspondingly. However, the countries with the efficiency score equal to 1, do not follow the similar pattern. Even though the fact that outlying countries have reached different levels of performance in PISA testing, they were able to become efficient, meaning that they have achieved the best possible results corresponding to the different values of resources employed.

The second stage of our research was to identify the relationship between selected inputs and output from the statistical point of view. In **Table 5**, correlations among inputs and outputs are reported.

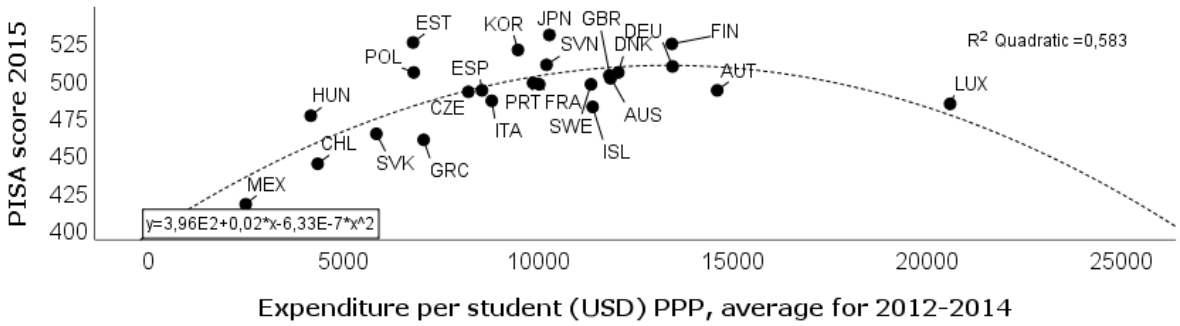
**Table 5** Correlation analysis

| | PISA | EXP | STR | TIME |
|---|---|---|---|---|
| **PISA** | 1.000 | | | |
| **EXP** | 0.493 | 1.000 | | |
| **STR** | -0.104 | -0.248 | 1.000 | |
| **TIME** | -0.217 | 0.073 | 0.231 | 1.000 |

Source: Own elaboration

A positive correlation was found between spending on education (EXP) and student educational achievement (PISA), meaning that approx. 49% of variation in mean PISAs results, among observed countries, can be predicted from the relationship between annual expenditure per student and PISA scores. But, on the other hand, PISA score showed only weak and negative correlations with other input variables: students-teacher ratio (STR) and hours per year spent in school (TIME).

**Figure 2** PISA Score 2015 & Spending on Education Relationship

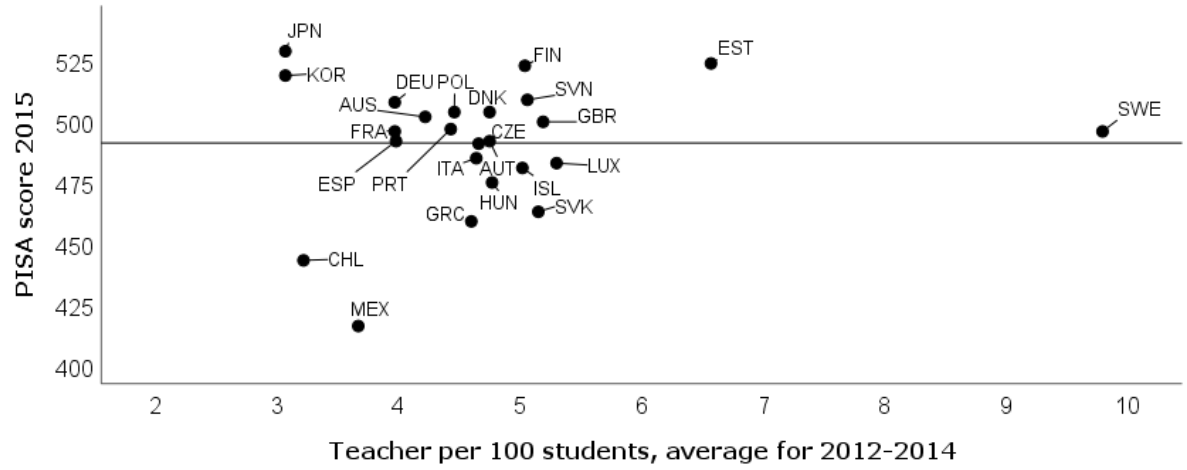



Source: own elaboration

The graph shown above, illustrates the relationship between student s achievement in PISA 2015 and educational spending per student in private and public institutions. At a first sight, it might seem that the students tended to score higher in economies with higher level of educational spending. Nevertheless, it is apparent from the Fig. 2 that the input-output relationship has the form of a curve, rather than a straight line. The possible explanation for this might be that the variable "PISA score 2015" does not increase at a constant rate and may even start decreasing after reaching a certain point. The most striking result to emerge from the data is that Luxemburg students have scored in PISA testing below an average overall score (491 points) with only 483 points, although the annual expenditure on education reached the maximum value of 20.588,32 USD per student, among observed countries. Our data visualization supposes a gradual decline in average PISA testing outcomes after reaching the level of education spending at 13.349,13 USD per student (computed from the first derivation of the polynomial function applied to the scatterplot represented in Fig.2), confirming that the higher expenditure on education does not guarantee better student performance, as witnessed in Luxemburg and other countries. Moreover, Hanushek (2006) suggested that expenditure on education does not explain well cross-country differences in learning outcomes.

The next section of our data analysis was concerned with estimating the impact of class size on learning performance. The following figure shows the relationship between the class size and the student achievement in PISA 2015.

**Figure 3** PISA Score 2015 & Class Size Relationship




Source: own elaboration

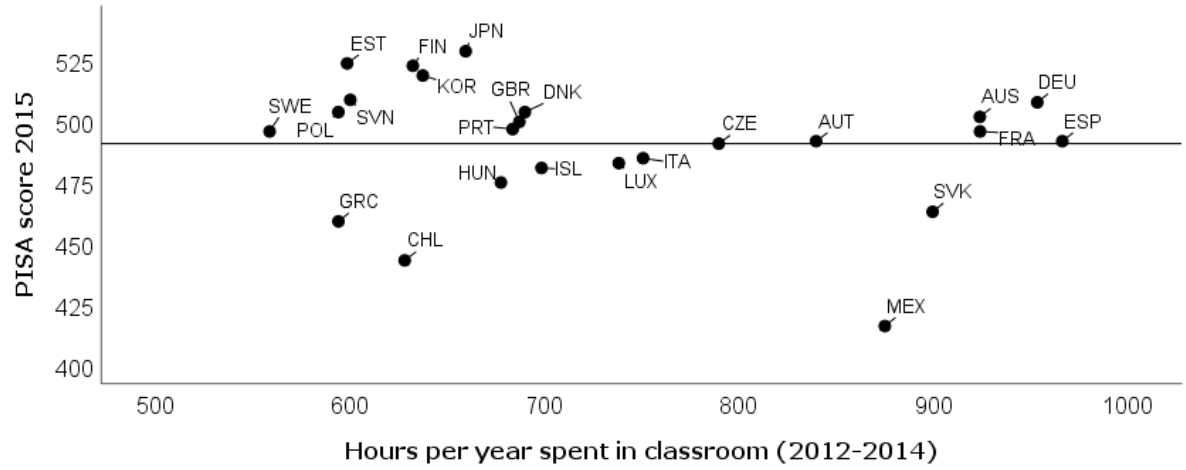
We believed that the students in smaller classes would tend to score higher in compare to those in larger classes. We also assumed that the smaller class creates better conditions for the adaptation of curriculum to student s needs, knowledge and level of understanding.

In our data sample, the average class size at the lower secondary level is approx. 22-23 students. However, there are significant differences between countries, ranging from over 32 students in Japan and Korea to 10 students per class in Sweden. On average across selected countries, there are 5 teachers per 100 students. The two most striking observations to emerge from the country comparison were in Japan with only approx. 3 teachers per 100 students and the best student achievement reaching 529 points overall; and in Sweden with almost 10 teachers per 100 students and education outcome slightly above the average of 491 points, with 496 points overall. On average, the teacher per 100 students` ratio vary between 4 and 6 in majority of countries without indicating a strong relationship between the number of teachers and the student performance in PISA.

Another research question was whether the time spent in class would have a positive effect on the student performance in PISA testing.

In some countries and economies, such as Australia, France, Germany and Spain, the students spend on average more than 923 hours per year educating themselves in public and private institutions, while in others, like Estonia, Greece, Poland and Sweden, the students spend less than 600 hours a year studying. We believe that time spent in classroom is crucial for the learning outcome. However, the correlation analysis performed in this study, did not show a strong correlation between time of educating and performance in PISA test.

**Figure 4** PISA score2015 & Time Spent in Classroom Relationship




Source: own elaboration

The graph shows that there is a peer of 8 countries positioned below the average level in education achievement, and another peer of remaining 16 countries to be found above the average line, regardless the hours a year their students spent studying at school. Since it is quite difficult to suggest any hypothesis about the patterns in analysed data, we tend to conclude that all the graphical illustration in our study can only confirm the results obtained from the performed correlation analysis.

## 4 Conclusions

The issue of efficiency in education, as well as the ways to measure it, have always been widely debated topics. In this paper, we have estimated efficiency of the education systems at the lower secondary level across OECD countries. The analysis has been performed by assessing output being an average score achieved in PISA 2015 against the most often used inputs in education efficiency related studies, being expenditure on education, class size and time students spent in school. The empirical results obtained from the output-oriented DEA analysis has shown that the technical efficiency in education sector does not vary a lot across the selected countries. The average efficiency score was found at 0.96, meaning that countries with efficiency scores below this frontier should be able to improve the students` education achievement on average by 4% with the currently available resources. Given that our findings are based on a limited number of countries concerned, the results from our analysis should therefore be treated with considerable caution. Nevertheless, it should be noted that no significant correlation was found between the inputs and output (except the relationship of the input "expenditure per student" and the PISA achievement), even though the selected data have been the most frequently used by other researchers in numerous studies. This throws up many questions in need of further investigation. What is now required is a further examination of how does the absence of correlation between inputs and output may bias the results in a cross-national effectiveness analysis? Broadly speaking, is it altogether appropriate to consider such variables on the input side which may do not have a direct effect on the

output considered in the DEA analysis? These questions remain unanswered at present. This fact is a topic for a later research, which necessitates an alteration to the standard DEA analysis to account for the qualitative input variables rather than for the quantitative ones.

## Acknowledgments

This research was supported by VEGA project No. 1/0430/19.

## References

Afonso, A., Aubyn, M. S. (2006). Cross-country efficiency of secondary education provision: A semi-parametric analysis with non-discretionary inputs. *Economic modelling*, vol. *23*(3), pp. 476-491.

Agasisti, T. (2013). The efficiency of Italian secondary schools and the potential role of competition: a data envelopment analysis using OECD-PISA2006 data. *Education Economics*, vol. 21(5), pp. 520–544. DOI: 10.1080/09645292.2010.511840.

Aristovnik, A., Obadić, A. (2014). Measuring relative efficiency of secondary education in selected EU and OECD countries: The case of Slovenia and Croatia. *Technological and Economic Development of Economy*, vol. 20(3), pp. 419-433.

Becker, G. S. (1992). Human capital and the economy. *Proceedings of the American philosophical society*, vol. 136(1), pp. 85-92.

Bessent, A. M., Bessent, E. W. (1980). Determining the comparative efficiency of schools through data envelopment analysis. *Educational Administration Quarterly*, vol. 16(2), pp. 57-75.

Cooper, W. W., Seiford, L. M., Zhu, J. (2011). *Data Envelopment Analysis: History, Models, and Interpretations*. In: Cooper, W.W., Seiford, L.M. and Zhu, J., Eds., Handbook on Data Envelopment Analysis, Springer US, New York, pp. 1-39. DOI: http://dx.doi.org/10.1007/978-1-4419-6151-8_1.

Dissou, Y., Didic, S., Yakautsava, T. (2016). Government spending on education, human capital accumulation, and growth. *Economic Modelling*, vol. 58, pp. 9-21.

Gurria, A. (2016). PISA 2015 results in focus. *PISA in Focus*, No. 67.

Hanushek, E. A. (2006). School resources. *Handbook of the Economics of Education*, vol. 2, pp. 865-908.

Charnes, A., Cooper, W. W., Rhodes, E. (1978). Measuring the efficiency of decision-making units. *European journal of operational research*, vol. 2(6), pp. 429-444.

Charnes, A., Cooper, W. W., Rhodes, E. (1981). Evaluating program and managerial efficiency: an application of data envelopment analysis to program follow through. *Management science*, vol. 27(6), pp. 668-697.

Iwamoto, W., Bahri, S., Perera, M., Siamatowe, C., Adubra, E., Kono, M., Uchida, H. et al. (2005). *Secondary education reform: Towards a convergence of knowledge acquisition and skills development*. United Nations Scientific, Cultural and Cultural Organization (France), Report No: ED-2005/WS/37 pp, 5.

Lorcu, F., Bolat, B. A. (2015). Comparison of Secondary Education Pisa Results in European Member States and Turkey via DEA and SEM. *Journal of WEI Business and Economics,* vol. 4(3), pp. 7.

OECD (2015). *Education at a Glance 2015: OECD Indicators*. OECD Publishing, Paris. DOI: https://doi.org/10.1787/eag-2015-en.

Santín, D., Sicilia, G. (2015). Measuring the efficiency of public schools in Uruguay: main drivers and policy implications. *Latin American Economic Review*, vol. 24(1), pp. 5.

Schultz, T. W. (1960). Capital formation by education. *Journal of political economy*, vol. 68(6), pp. 571-583.

Sopek, P. (2011). Efficiency of public expenditure on education in Croatia. *Institute of Public Finance*, No. 61.

Vawda, A. Y. (2003). Who benefits from public education expenditures? *Economic Affairs*, vol. 23(1), pp. 40-43.

Youngson, A. J. (1959). *Possibilities of economic progress*. CUP Archive.

Yuan, Y., Shan, M. (2016). The educational efficiency evaluation framework: By using DEA model and CA method. *International Journal of Information and Education Technology*, vol. 6(12), pp. 923.

# Information Asymmetry in Insurance Market

**Michaela Florianová**

Masaryk University
Faculty of Economics and Administration, Department of Finance
Lipová 41a, 602 00 Brno-střed, Czech Republic
E-mail: michaela.florianova@mail.muni.cz

***Abstract:*** *Does information asymmetry exist in the insurance market? Does it impact the market equilibrium? These are current topics of the research dealing with economic and insurance issues. Many publications have been published over the last century, confirming or refuting the existence of information asymmetry in the non-life insurance market same as in the life insurance market. The aim of this article is to introduce the topic of information asymmetry, including the supply and demand point of view and dividing the asymmetry on adverse selection and moral hazard. The main goal of this paper is to review and compare the results of existing publications and papers dealing with information asymmetry in the insurance market, with focus on differences between life and non-life insurance research results, and open the door for further discussions on this issue.*

*Keywords: Information asymmetry, insurance, insurance market, moral hazard, adverse selection, asymmetric information*

*JEL codes: G22, D82, G14*

## 1 Introduction

Information asymmetry is a situation where entities on one side of the market have better information than entities on the other. If some entity exploits and abuses this better information, it may harm other market participants. This paper focuses only on information asymmetry in the insurance industry.

In the insurance industry, the information asymmetry has a significant impact on the functioning of the insurance market. Ducháčková and Daňhel (2010) divide the information asymmetry in insurance markets into asymmetry with the advantage on the demand side and preferably on the supply side. The advantage on the demand side means that the information benefit is on the side of the insurance client. This advantage arises from the fact that no one except the clients know their health condition, technical condition of property, financial situation, etc. better than the client who insures himself. The authors continue to claim that the asymmetry of information with the advantage on the supply side, i.e. the insurance company, arises from the insurance company's decision on the amount of the premium. Given the large number of clients and insured events, the insurance company may use its historical statistical set of clients' claims and estimate the future development of policies currently closed. In addition, an insurance company usually has better information about its own insurance product, in terms of insurance terms, deadlines and other conditions for payment of insurance benefits. In most markets, there is at least one element of asymmetric information: a seller almost never knows the buyer's preferences perfectly, and a buyer usually knows little about production costs, and sometimes product quality (Pouyet, 2008).

The core of the analysis of insurance markets is private information. For instance, "adverse selection" is the propensity of high-risk individuals to purchase more coverage. Rothschild and Stiglitz (1976) show that if people have private information about their risk type, the competitive equilibrium (if it exists) is not efficient: adverse selection drives up premiums and low-risk individuals are underinsured. As a result, there may be a scope for a government intervention in insurance markets (e.g. mandatory insurance coverage). If risk aversion is higher among lower-risk customers, adverse selection can be reduced or even reversed, leading to "advantageous" selection. The functioning of insurance markets can also be distorted by "moral hazard," which is another type of

informational asymmetry (Arrow, 1963; Pauly, 1968). Moral hazard arises, if ex-post risk of insured individuals is higher than the ex-ante risk. This occurs if insurance, by lowering the cost of health care, increases the rate of health care utilization (conditional on health outcomes) and/or decreases the incentive to avoid bad outcomes. In either case, insurance coverage tends to increase a person's health care utilization. Thus, both adverse selection and moral hazard manifest themselves in a positive relationship between ex-post realization of risk and insurance coverage (Chiappori and Salanie, 2000).

Recent work of Einav and Finkelstein (2010) exploring asymmetric information in insurance markets has emphasized both the roles of adverse and advantageous selection. The insurance market is unique for high take-up and low reliance on government involvement or mandates relative to markets for health, auto, and long-term care insurance, as well as annuities. Several recently published studies – all using the Health and Retirement Survey (HRS) – have reached differing conclusions about the degree of existence of adverse selection in the insurance market (Cawley and Philipson, 1999; He, 2009; He, 2011), which will be also discussed in this paper.

The main goal of this paper is to review up-to-date literature on the information asymmetry in the insurance market. Based on the comparison of the findings of already published research papers, it will be shown, how the research developed through the past years and if all of the research papers confirmed the information asymmetry existence in the insurance market with a focus on differences between non-life and life insurance.

## 2 Literature review

The asymmetry of information is a very important concept in the study of marketplace exchanges with remarkable consequences in finance, accounting, organizational behavior, economics and marketing (Tilles et al., 2011). The first known theoretical research was done by Arrow (1963), which was followed by Akerlof (1970), who introduced and analyzed the impact of asymmetric information in the market failure problem. Another important paper was written by Pauly (1974) who commented on Arrow's research and he stated that *"the welfare case for insurance of all sorts is overwhelming. It follows that the government should undertake insurance where the market, for whatever reason, has failed to emerge"*. He showed that even if all individuals are risk-averters, insurance against some types of uncertain events may be nonoptimal. One of the most important and popular research in this area was done by Rothschild and Stiglitz (1976); they found out that the structure of the equilibrium as well as its existence depends on a number of assumptions that, with perfect information, are inconsequential. For the study about the information asymmetry, these researches represent the basic knowledge everybody should have.

**Market equilibrium**

*"If competitive equilibrium is defined as a situation in which prices are such that all arbitrage profits are eliminated, then competitive economy will not be always in equilibrium for those, whose arbitrage makes no (private) return from their (privately) costly activity. Hence, the assumptions that all markets, including that for information, are always in equilibrium and always perfectly arbitraged are inconsistent when arbitrage is costly*." (Grossman and Stiglitz, 1980).

The most important research in this area was done by Rothschild and Stiglitz (1976). They found out following: the single price equilibrium of conventional competitive analysis was shown to be no longer viable; market equilibrium, when it existed, consisted of contracts which specified both prices and quantities; the high-risk (low ability, etc.) individuals exerted a dissipative externality on the low-risk (high ability) individuals. They showed that not only may a competitive equilibrium not exist, but when equilibria do exist, they may have strange properties. Also if individuals were willing or able to reveal their information, everybody could be made better off. By their very being, high-risk

individuals cause an externality: the low-risk individuals are worse off than they would be in the absence of the high-risk individuals. A competitive insurance market may have no equilibrium (Rothschild and Stiglitz, 1976).

Grossman and Stiglitz (1980) have shown that if information is very inexpensive, or when informed traders get very precise information, then equilibrium exists, and the market price will reveal most of the informed traders´ information. Also Pouyet (2008), who divided information into private and common, characterizes the impact on the efficiency of competitive equilibria. His results show that under private values[1] hidden information does not matter: it does not change the set of competitive equilibria, and each contract traded is efficient for the type that chooses it.

In general, a model based on moral hazard and adverse selection suggests that basic insurance should cover treatments that suffer the most from adverse selection. This formalizes a well-known intuition that the government can improve the market outcome by solving adverse selection problems. However, both the government and the market suffer from moral hazard and hence moral hazard plays no role when deciding whether or not a treatment should be covered by basic insurance (Boone, 2015).

**Life insurance**

The general interpretation of the life insurance is it is an insurance against death, survival of a certain age or the date specified in the insurance contract as the end of the insurance or in case of another insured event. The definition is similar in different countries and we can include there: whole-life plan, limited-Payment Life, Term-life Policy, Endowment Insurance, Life Annuity Policy, Universal Life Policy.

When we discuss the empirical research done in the past year, the basic prediction of the information asymmetry depends on adverse selection theory in insurance market, which concerns the correlation between insurance coverage and risk. Having said that, policyholders who are known by themselves (but not by their insurers) to be risk lovers will tend to choose higher insurance coverage; thus, coverage and risk are expected to be positively correlated (Cohen and Siegelman, 2010).

Crocker and Snow (1984) set out an environment with adverse selection and defined allocative efficiency without reference to the institutions that might govern market exchange. They have applied the definition proposed by Harris and Townsend for economic efficiency in an environment of asymmetric information to the insurance market model presented by Rothschild and Stiglitz (1976).

One of the empirical researches was done by He D. (2009), who found evidence of asymmetric information in the life insurance market. His conclusion was that after risk classification is carefully taken into account, individuals with higher mortality risk are 19%–49% more likely to buy individual term life insurance than those with lower mortality risk are, depending on the length of the time window within which the mortality risk is defined. Author focus on potential new buyers is what drives the difference from the earlier literature's findings. Furthermore, He extended his research and in 2011 stated that individuals older than middle fifties have ''passed their peak need for life insurance''. He found out that individuals with lower mortality risk are more likely than higher-risk individuals to lapse a contract and to lapse a greater contract face value (He, 2011).

Results of the Keane and Stavrunova (2014) study imply that the moral hazard (or price) effect is substantial. They discovered that individuals with Medigap[2] insurance spend about $1,615 more on health care (on average) than similar individuals without Medigap ($6,789 vs $8,404). This is a 24% increase which results in confirmation o presence of the information asymmetry. Another confirmation about appearance of the information

[1] A piece of hidden information is classified as a private value if it does not impact directly the payoff of other agents, for given trades between these agents. For example, the preferences of a buyer are usually private values, because the seller only cares about production costs and transfers, and not directly about the willingness-to-pay of the buyer. (Poyuet, 2008)

[2] Medigap is a supplementary medical program for policyholders covered by Medicare USA.

asymmetry in the life insurance market is done by Boone (2015). His research says that universal health insurance, by being applied to everyone, can overcome adverse selection. This reasoning implies that basic insurance should cover treatments that suffer most from adverse selection. The comparison of just few publications shows us the differences between the results of each study based on the used data. The same approach we will used for a non-life insurance market.

**Non-life insurance**

Non-life insurance, also called property and casualty insurance, is a type of coverage that is very common and covers both businesses and individuals. It protects them, monetarily, from disaster by providing money in the event of a financial loss. Non-life insurance ensures the property and goods against the varieties of risk such as fire, earthquake, accident and theft. In general non-life insurance is taken as a means of providing financial protection for building, machinery, equipment, furniture, and vehicle against risks mentioned above.

The first two studies on the subject of information asymmetry in the non-life insurance market were done by Dahlby (1983, 1992), who did not have individual data on coverage. Puelz and Snow (1994) used individual data and also found adverse selection. Dionne et al. (2001) criticized Puelz and Snow for failing to take nonlinear effects into account and reported (using different data) that the insurer's risk classification was sufficient in the sense that there was no residual adverse selection in each risk class in the insurer's portfolio once nonlinear effects were accounted for.

Richaudeau (1999) concludes that a modified version of adverse selection may be at work: those who drive more are more likely to purchase comprehensive insurance even though they are not at the higher risk per mile driven. This is not the intrinsic risk that is typical of most adverse selection models, but neither is it insurance-induced risky behavior (moral hazard). Chiappori and Salanie (2000) found no correlation between risk and coverage in French auto insurance market. This study focused on a relatively homogeneous group of about 6,000 "beginning drivers" with 1 to 3 years of experience. Cohen (2005) obtained results suggesting that Chiappori and Salanie's (2000) finding of no coverage–risk correlation may have been due to their focus on beginning drivers. Cohen studied the Israeli insurance market, focusing on all new customers of a single insurer, and enjoying full access to all insurer data about the customers. Using methodologies essentially similar to those of Chiappori and Salanie, Cohen found no correlation between coverage and accident risk for beginning drivers (those with fewer than 3 years of experience) but did find a sizable and statistically significant correlation for drivers with more than 3 years of experience. This is the important milestone in the research when we can see the reasons why the results of the research differ. Saito (2006) concluded that there was only a very weak and insignificant positive correlation (for both beginning and experienced drivers) between crash risk and the purchase of own-vehicle coverage, even when controlling for all variables observed by the insurer. Based on the literature review of the information asymmetry in the non-life insurance market, it is visible that results are very similar to the life insurance market. Some of the studies confirm the information asymmetry in the insurance market in general which can lead to the market disequilibrium.

**Evidence of the information asymmetry**

This section briefly reviews the evidence of the information asymmetry in the up-to-date research papers. As the theoretical analysis began around 1970, the empirical testing started in the middle 1980s. The main aim is to generalize and extend the Cohens research about the testing of adverse selection and conclude the results of testing information asymmetry in the insurance markets in the very similar and understandable way.

**Table 1:** Evidence of the information asymmetry

| Author | Insurance market | Data | IA found? | Comments |
|---|---|---|---|---|
| Crocker, Snow (1984) | General | Theoretical | Yes | |
| Puelz, Snow (1994) | Non-life insurance | US 1986 | Yes | |
| Cutler and Reber (1998) | Life insurance | US (1990s) | Yes | Welfare losses are about 2%–4% of total spending. |
| Cutler and Zeckhauser (1998) | Life insurance | US (1990s) | Yes | |
| Cawley and Philipson (1999) | Life insurance | US | No | Mortality is lower for those with life insurance |
| Richaudeau (1999) | Non-life insurance | France 1995 | Yes | Negative binominal model |
| Chiappori, Salanié (2000) | Non-life insurance | France 1989 | No | Parametric/nonpara metric tests |
| Cutler and Zeckhauser, (2000) | Life insurance | US (1990s) | Yes | |
| Cardon and Hendel (2001) | Life insurance | US (1987) | No | |
| Dionne, Gouriéroux, Vanasse (2001) | Non-life insurance | Unclear | No | Methods as in Puelz and Snow + additional specifications |
| Finkelstein and Poterba (2002) | Life insurance | UK (1998) | Yes | |
| Hendel and Lizzeri (2003) | Life insurance | US | No | |
| Finkelstein and Poterba (2004) | Life insurance | UK (1981-1998) | Yes | Extension of the previous research |
| Cohen (2005) | Non-life insurance | Israel: 1994-1999 | Yes | |
| Davidoff and Welke (2005) | Life insurance | Not specified | Yes | |
| Saito (2006) | Non-life insurance | Japan (1999-2000) | No | |
| Finkelstein and McGarry (2006) | Life insurance | US (1995-2000) | Yes | |
| Pouyet (2008) | Life insurance | Not specified | Yes | |
| Fang, Keane, and Silverman (2008) | Life insurance | US (2000-2002) | Yes | Those with Medigap insurance spend $4,000 less than those without |
| He (2009) | Life insurance | US (1992-2004) | Yes | Comparison of death rates |
| McCarthy and Mitchell (2010) | Life insurance | US, UK, Japan | No | Policyholders have lower mortality than noninsured. |
| Einav, L., Finkelstein, A. Schrimpf, P. (2010) | Life insurance | UK | Yes | |
| Tilles et al., (2011) | Life | Not specified | Yes | |

| | | | | |
|---|---|---|---|---|
| | insurance | | | |
| Shi, P., Zhang W., Valdez E. A. (2012) | Non-life insurance | Singapore (2001) | Yes | Two-dimensional information framework |
| Spindler, M. , Winter, J., Hagmayer, S. (2013). | Non-life insurance | Germany (2009) | Yes | |
| Harris, Yelowitz, (2014) | Life insurance | US (1990-1991) | No | Higher mortality are no more likely to hold life insurance |
| Keane and Stavrunova (2014) | Life insurance | US (2000-2002) | Yes | The moral hazard (or price) effect is substantial |
| Boone (2015) | Life insurance | US | Yes | |
| Zavadil (2015) | Non-life insurance | Netherlands (1995-2000) | No | The insurance company and her senior clients |

Source: Author's own construction based on the reviewed literature

In the Table 1 are listed some of the publications about the information asymmetry same as the results of their research. In the first column are named the authors and the year of the research. The second and third columns are showing the information about the insurance market and data used for the research. Fourth column is the most important for us, it shows if the research found the information asymmetry or not. In the fifth column, additional comments to the publications are mentioned.

As you can see in the Table 1, the research differs in finding the information asymmetry in the insurance market. The most of the studies are based on the testing of the coverage-risk correlation predicted by adverse selection across a different insurance markets and with a different data and empirical approach. We discovered that 75 % of the researchers found the existence of the information asymmetry in the life insurance market. Most of the research were done on the US data (1990s) but they differ in empirical approach, i.e. different parametric and non-parametric tests.

In the non-life insurance market the results slightly differ from the life insurance market. The result of presence of the information asymmetry is almost fifty-fifty. Based on the analysis of the empirical research, the biggest difference is caused by different data from different countries. It is important to mention that research are done on the car insurance market mostly and research differ in used data, which are from the similar time period as in life insurance market (mostly from 1990s). I.e. when the "beginner drivers" data set was used, no information asymmetry was found, on the other hand, using the "senior drivers" data set we can find an information asymmetry. This is the clear results since we assume that the senior drivers know more about their riskiness.

We can see some similarities on both analyzed insurance markets, but a deeper analysis of the research would be needed to better understanding of the causes and differences in the results. Results indicate that work in this area is still at an inconclusive stage and that more consistent results should be expected to appear over time.

## 3 Conclusion

After the publication of the first research in the area of information asymmetry as a study from Arrow (1963), Akerlof (1970), Pauly (1974), Rothschild and Stiglitz (1976) the work was done mostly theoretically. The main subject of the studies was the adverse selection, which was later researched based on the empirical models trying to find a correlation between the insurance coverage and the risk-level of the policyholder. Since the first paper has been presented, there have been a lot of the empirical studies confirming or

rejecting the presence of the information asymmetry in the insurance market. The main goal of this paper was to review and compare the results of existing publications and papers dealing with information asymmetry in the insurance market with focus on differences between life and non-life insurance research results.

The answer for the question *"Does the information asymmetry exist in the insurance market?"* was quite different on both markets. Based on the reviewed literature, exactly 75 % of the researchers have found the existence of the information asymmetry in the life insurance market, most likely in the form of the adverse selection. Almost 50 % of the researchers have rejected the presence of the information asymmetry on the non-life insurance market. All the differences come from different empirical approach and used data set as mentioned in the previous chapter.

Based on the findings we can see that researching whether information asymmetry exists is not the most important. One direction for subsequent work is to further the study and understand the factors that cause the information asymmetry, especially than the insurance coverage-risk correlation. The literature review has implications also for policy discussions in this area. Such discussions should not be based on a general assumption that information asymmetry exists or not, but it should be about understanding the circumstances under which an information asymmetry should or should not be expected to arise and what is the impact.

## Acknowledgments

The support of the Masaryk University internal grant MUNI/A/1102/2018 is gratefully acknowledged.

## References

Akerlof, G. A. (1970). The market for „Lemons": Quality Uncernainty and the Market Mechanism. *Quarterly Jurnal of Economics*, vol. 84(3), pp. 488-500.

Arrow, K. J. (1963). Uncertainty and the Welfare Economics of Medical Care. *The American Economic Review*, vol. 53(5), pp. 941-973.

Boone, J. (2015). Basic versus supplementary health insurance: Moral hazard and adverse selection. *Journal of Public Economincs*, vol. 128(1), pp. 50-58.

Cardon, J. H., Hendel I. (2001). Asymmetric Information in Health Insurance: Evidence from the National Health Expenditure Survey. *RAND Journal of Economics*, vol. 32, pp. 408-427.

Cawley, J., Philipson, T. (1999). American Economic Association: An Empirical Examination of Information Barriers to Trade in Insurance. *The American Economic Review*, vol. 89(4), pp. 827-846.

Chiappori, P. A., Salanié, B. (2000). Testing for Asymmetric Information in Insurance Markets. *Journal of Political Economy*, vol. 108, pp. 56-78.

Cohen, A. (2005). Asymmetric Information and Learning in the Automobile Insurance Market. *Review of Economics and Statistics*, vol. 87, pp. 197-207.

Cohen A., Siegelman P. (2010). Testing for adverse selection in insurance markets. *Journal of Risk and Insurance*, vol. 77(1), pp. 39-84.

Crocker, K. J., Snow A. (1984). The efficiency of competitive equilibria in insurance markets with asymmetric information. *Journal of Public economics*, vol. 26(1), pp. 201-219.

Cutler, D. M., Reber, S. J. (1998). Paying For Health Insurance: The Trade-Off Between Competition and Adverse Selection. *The Quarterly Journal of Economics*, vol. 113, pp. 433–466.

Cutler, D. M., Zeckhauser, R. J. (2000). The Anatomy of Health Insurance. In: Anthony J. Culyer and Joseph P. Newhouse, eds. *Handbook of Health Economics*, vol. 1, ch. 11, pp. 563–643 (Amsterdam: Elsevier Science).

Dahlby, B. (1983). Adverse Selection and Statistical Discrimination: An Analysis of Canadian Automobile Insurance. *Journal of Public Economics*, vol. 20, pp. 121-130.

Davidoff, T., Welke G. (2005). Selection and Moral Hazard in the Reverse Mortgage Market. *Working paper, Haas School of Business, University of California, Berkeley.*

Dionne, G., Gourieroux C., Vanasse C. (2001). Testing for Evidence of Adverse Selection in the Automobile Insurance Market: A Comment. *Journal of Political Economy*, vol. 109, pp. 444-473.

Ducháčková, E., Daňhel, J. (2006). Dopady kvalitatívnych změn v charakteru rizik na problem asymetrie informace na pojistných trzích. *Český finanční a účetní časopis*, vol. 1(1), pp. 150-162.

Einav, L., Finkelstein, A., Schrimpf, P. (2010). Optimal mandates and the welfare cost of asymmetric information: Evidence from the UK anuity market. *Econometrica*, vol. 78(3), pp. 1031-1092.

Finkelstein, A., McGarry, K. (2006). Multiple Dimensions of Private Information: Evidence from the Long-Term Care Insurance Market. *American Economic Review*, vol. 96, pp. 938–958.

Finkelstein, A., Poterba, J. (2004). Adverse Selection in Insurance Markets: Policyholder Evidence from the U.K. Annuity Market. *Journal of Political Economy*, vol. 112, pp. 183-208.

Grossman, R. J., Stiglitz, E. (1980). On the Impossibility of Informationally Efficient Markets. *The American Economic Review*, vol. 70(3), pp. 393-408. American Economic Association.

Harris, T., Yelowitz, A. (2014). Is there adverse selection in the life insurance market? Evidence from a representative sample of purchasers. *Economics letter*, Elsevier, vol. 124(1), pp. 520-52.

He, D. (2009). The life insurance market: Asymmetric information revisited. *Journal of Public Economics*, Elsevier, vol. 93(9-10), pp. 1090-109.

He, D. (2011). Is there dynamic adverse selection in the life insurance market? *Economics Letters*, Elsevier, vol. 112(1), pp. 113-115.

Hendel, I., Lizzeri A. (2003). The Role of Commitment in Dynamic Contracts: Evidence from Life Insurance. *Quarterly Journal of Economics*, vol. 118, pp. 299–327.

Keane, M., Stavrunova, O. (2010). Adverse Selection, Moral Hazard and the Demand for Medigap Insurance. In: *Health, Econometrics and Data Group (HEDG) Working Papers 10/14, HEDG, c/o Department of Economics*, University of York.

McCarthy, D., Mitchell, O. S. (2010). International Adverse Selection in Life Insurance and Annuities. In: Shripad Tuljapurkar, Naohiro Ogawa, and Anne Gauthier, eds. *Riding the Age Waves: Responses to Aging in Advanced Industrial States* (Amsterdam: Elsevier).

Pauly, M. V. (1968). The Economics of Moral Hazard: Comment. *The American Economic Review*, vol. 58(3), Part 1 (Jun., 1968), pp. 531-537.

Pauly, M. V. (1974). Overinsurance and Public Provision of Insurance: The Roles of Moral Hazard and Adverse Selection. *The Quarterly Journal of Economics*, vol. 88(1), pp. 44-62.

Puelz, R., Snow, A. (1994). Evidence on Adverse Selection: Equilibrium Signaling and Cross-Subsidization in the Insurance Market. *Journal of Political Economy*, vol. 102, pp. 236-257.

Richaudeau, D. (1999). Automobile Insurance Contracts and Risk of Accident: An Empirical Test Using French Individual Data. *Geneva Papers on Risk and Insurance Theory*, vol. 24, pp. 97-114.

Rotschild, M., Stiglitz, J. (1976). Equilibrium in Competitive Insurance Markets: An Essay on the Economics of Imperfect Information. *The Quarterly Journal of Economics*, vol. 90(4) (Nov., 1976), pp. 629-649, The MIT Press.

Saito, K. (2006). Testing for Asymmetric Information in the Automobile Insurance Market Under Rate Regulation. *Journal of Risk and Insurance*, vol. 73(2), pp. 335-356.

Shi, P., Zhang W., Valdez, E. A. (2012). Testing adverse selection with two-dimensional information: Evidence from the Singapore auto insurance market. *The Journal of Risk and Insurance*, vol. 79(4), pp. 1077-1114.

Spindler, M., Winter, J., Hagmayer, S. (2013). Asymmetric Information in the Market for Automobile Insurance: Evidence From Germany. *The Journal of Risk and Insurance*, vol. 81(4), pp. 781-801.

Tilles, P. F. C., Ferreira F., Gerson, F., Pereira, C, Sarti, F. M. (2011). A Markovian model market—Akerlof's lemons and the asymmetry of information. *Physica A: Statistical Mechanics and its Applications*, Elsevier, vol. 390(13), pp. 2562-2570.

Zavadil, T. (2015). Do the Better Insured Cause More Damage? Testing for Asymmetric Information in Car Insurance. *The Journal of Risk and Insurance*, vol. 82(4), pp. 865-889.

# IFRS 16 Leases: The Result of the IASB and FASB Cooperation with a Focus on Differences Compared to ASC 842

**Milan Gedeon**

University of Economics in Bratislava
Faculty of Economic Informatics, Department of Accounting and Auditing
Dolnozemská cesta 1, 852 35 Bratislava, The Slovak republic
E-mail: milangedeon@gmail.com

***Abstract:*** *IFRS 16 Leases was issued by the International Accounting Standards Board (IASB) on 13 January 2016. The European Union effective date was approved for periods beginning on or after 1 January 2019. The standard brings fundamental changes to lease accounting that replace previous accounting and no longer distinguishes between an operating lease and a finance lease. Accounting entities have to make many judgments and apply estimates in order to implement IFRS 16. The IASB and the Financial Accounting Standards Board (FASB) have been working jointly to improve the accounting for leases in International Financial Reporting Standards (IFRS) and US Generally Accepted Accounting Principles (US GAAP). The FASB issued a similar standard as ASC 842. The aim of the paper is to explain the impact of IFRS 16 on the financial statements and to determine the main differences between IFRS 16 and ASC 842. The aim was achieved by an analysis of IFRS 16 and comparison of the articles in IFRS 16 and ASC 842. Despite an effort to convergence IFRS and US GAAP, the standard-setters have reached the divergence regarding some aspects in the lease accounting. Companies that report under both IFRS and US GAAP will have to deal mainly with the different classification of a lease from the lessee´s point of view lessee.*

*Keywords: IFRS 16, ASC 842, lease accounting, financial statements*

*JEL codes: G32, M41, M48*

## 1 Introduction

In 2005, the U.S. Security and Exchange Commission (SEC) reported that approximately $ 1.25 trillion of off-balance sheet leases are within the financial statement of US public companies (Osei, 2017). Responding to those concerns, the IASB and the FASB initiated a project to improve the accounting for leases. In 2015, the IASB conducted a survey on the potential impact of the new accounting standard on the financial statements of 30,000 listed companies, where approximately 14,000 reported information related to unrecognised operating lease liabilities amounting to $ 2.86 trillion (Magli et al., 2018). The absence of information about leases on the balance sheet causes an uncompleted picture of the financial position of a company for investors and other users of financial statements. In respect of this absence, they are unable to properly compare companies that borrow to buy assets with those that lease assets, without adjusting. The stated reasons resulted in the adoption of the new standard. Although the IASB and the US national standard-setter were collaborating with intention to support worldwide convergence of accounting standards, cooperation was resulted to different standards with the similar basis but some differences.

On 13 January 2016, the IASB issued the new accounting standard IFRS 16 - Leases, which became effective for annual periods beginning on or after 1 January 2019. The EU adopted IFRS 16 with the same effective date as the IASB. The new approach of recognition of leases in the US GAAP is contained in ASC 842, which is effective for annual periods beginning after 15 December 2018 for a public business entity, a not-for-profit entity that has issued or is a conduit bond obligor for securities that are traded, listed, or quoted on an exchange or an over-the-counter market, and an employee benefit plan that files or furnishes financial statements with or to the U.S. Securities and Exchange Commission. All other entities have to apply this standard for annual periods

beginning after 15 December 2019 (FASB, 2018). The new leasing standard in IFRS as well as in the US GAAP brings fundamental changes to lease accounting.

Many studies assessed the impact of IFRS 16 on company´s financial reporting. Zamora-Ramírez and Morales-Díaz (2018) dealt with effects of IFRS 16 on key financial ratios of Spanish companies, Stancheva-Todorova and Velinova-Sokolova (2019) analyzed impact on Company's Financial Reporting, Financial Ratios and Performance Metrics, Liviu-Alexandru (2018) presented the impact of the new international financial reporting standards "Leases" based on an analysis related to the implementation costs and also a comparison between IAS 17 and IFRS 16. Ramírez and Morales-Díaz (2018) also dealt with the impact of entities decisions on financial statements while implementation IFRS 16.

This contribution is focused on a determination of significant differences between IFRS 16 and ASC 842. The more differences there are, the less comparability will be ensured. The divergence of lease accounting in IFRS and US GAAP may interfere with the consistency of the application of IFRS 16. As the application consists of many judgments and estimates, it can lead to the compromises or diversions in order to adjust the IFRS report package as little as possible when a company also submits the US GAAP report package.

## 2 Methodology and Data

IFRS 16 is expected to (IFRS Foundation, 2016):

- reduce the need (i) for investors and analysts to make adjustments to amounts reported by a lessee and (ii) for lessees to provide non-GAAP information about leases;
- improve comparability between companies that lease assets and companies that borrow to buy assets; and
- create a more level playing field in providing transparent information about leases to all market participants.

The aim of the contribution is to explain the impact of IFRS 16 on the financial statements with emphasis on determination the main differences between IFRS 16 and ASC 842.

The paper is based on an analysis of IFRS 16 and a comparative analysis of the lease accounting model in IFRS and US GAAP. To achieve that a legal and functional point of view is applied. The basis for the comparison of standards were version of IFRS 16 in red book of IFRS Standards Issued at 1 January 2019 and version of ASC 842 in an Accounting Standards Update No. 2016-02, Leases (Topic 842). Based on this, it is possible to assess if the joint IASB - FASB project designed to eliminate a variety of differences between IFRS and US GAAP lead to greater comparability.

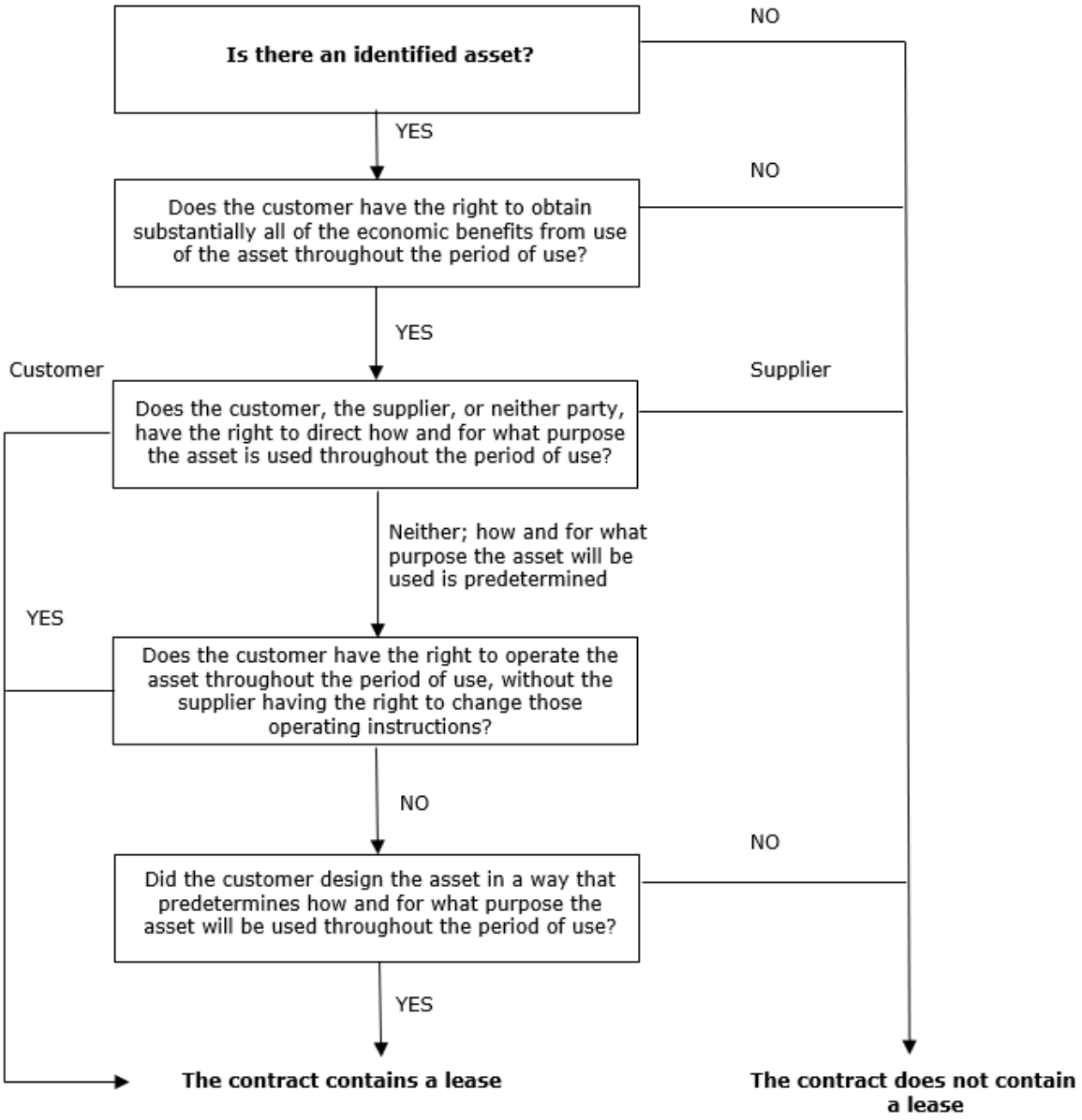
## 3 Results and Discussion

### IFRS 16

A contract is, or contains, a lease if "*the contract conveys the right to control the use of an identified asset for a period of time in exchange for consideration"* (IFRS, 16.9). A finance lease is a lease that transfers substantially all the risks and rewards incidental to ownership of an underlying asset. An operating lease is defined negatively as a lease which does not meet a definition of the finance lease. These two types of lease are relevant for a lessor. A lessee disclosure all leases by the single accounting model based on a finance lease. An accounting entity shall assess whether the contract is, or contains, a lease.

Even-though the fundamental change consists in the recognition of all leases in the balance sheet of lessees, which is done through a single accounting model, there are many transactions that could evocate a risk of disruption to the consistent application the new model. Judgments and estimates are needed to assess whether IFRS 16 should be applied. The entire assessment process is shown in the Figure 1 below.

**Figure 1** The Assessment of Whether a Contract is, or Contains, a Lease

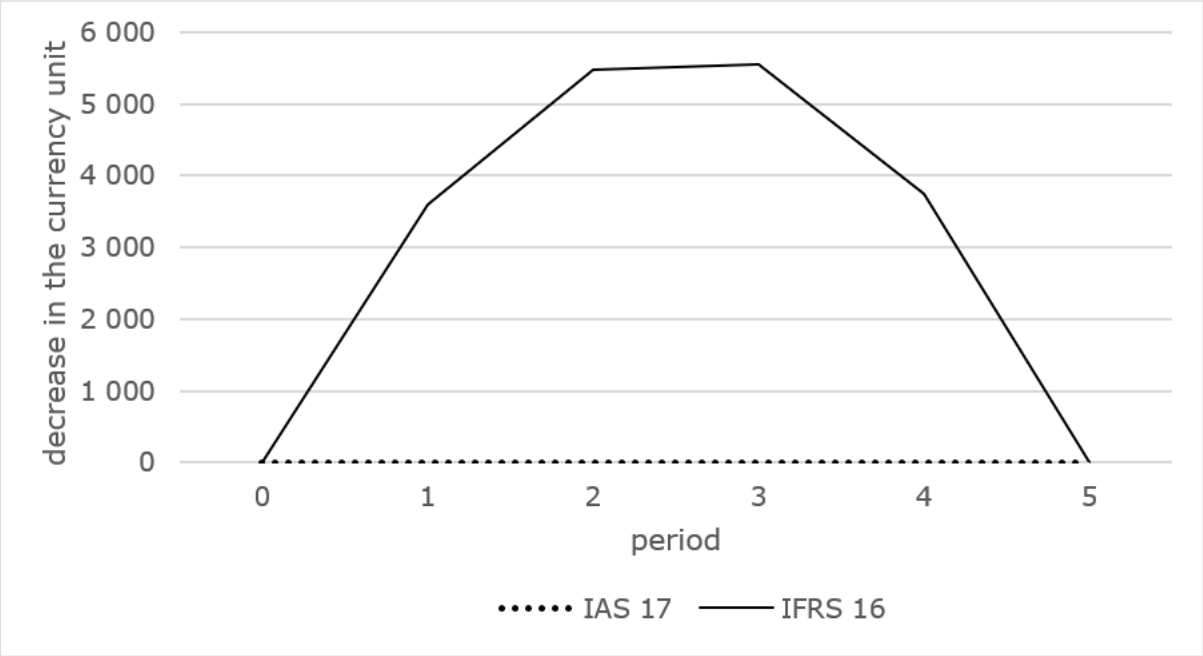



Source: IFRS 16.B31

According to the single accounting model a lessee shall recognise a right-of-use asset and a lease liability at the commencement date (IFRS 16.22). At the commencement date, a lessee shall measure the right-of-use asset at cost (IFRS 16.23) and the lease liability at the present value of the lease payments that are not paid at that date. The lease payments shall be discounted using the interest rate implicit in the lease, if that rate can be readily determined. If that rate cannot be readily determined, the lessee shall use the lessee's incremental borrowing rate (IFRS 16.26). After the commencement date, a lessee shall measure the right-of-use asset applying a cost model, unless it applies either of the measurement models (the fair value model according to IAS 40, the revaluation model according to IAS 16).

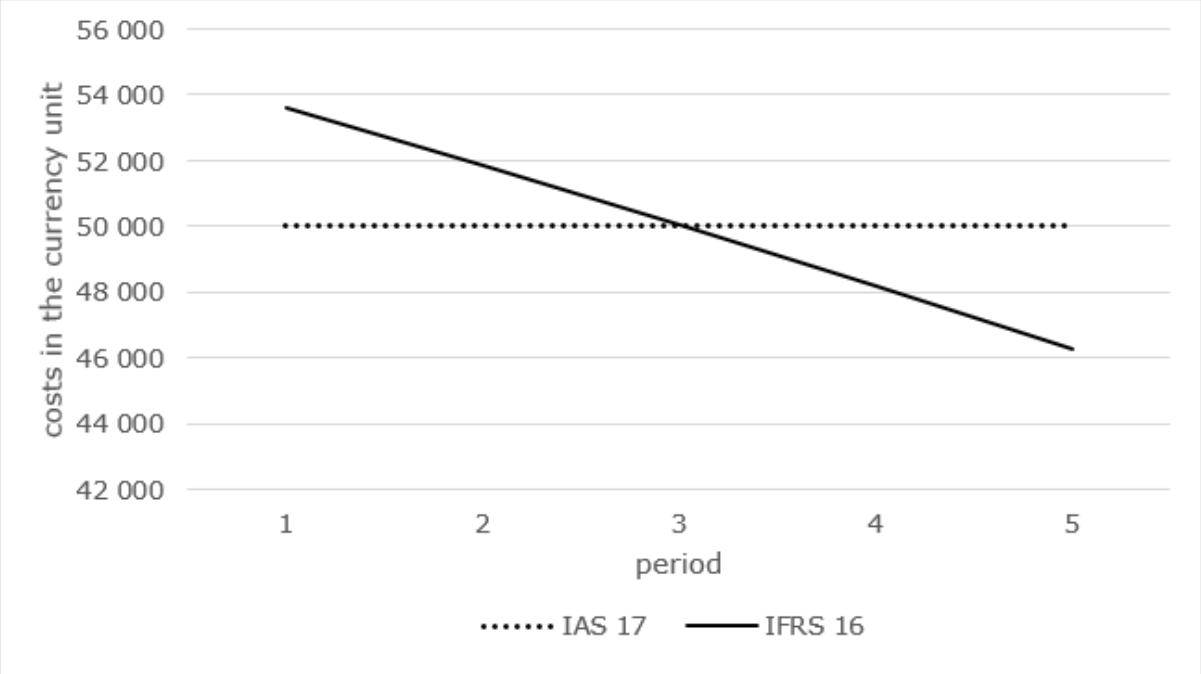
Figure 2 and Figure 3 show an impact on the financial statements of a lessee.

**Figure 2** A Decrease of Net Assets in the Lessee's Balance Sheet




Source: author's elaboration

**Figure 3** The Lessee's Profit and Loss Statement (Impact on Costs)




Source: author's elaboration

**Differences between IFRS 16 and ASC 842**

The new standard ASC 842 was subject of many studies. Bloom (2016) or Freeman (2018) compiled implementation the new leasing standard, Lezinski and Thacker (2019) have written a study focused on perspectives from the equipment finance software providers for lessors. Emphasis of this study is put on differences between IFRS 16 and ASC 842 which are presented in Table 1.

**Table 1** Differences between IFRS 16 and ASC 842

| | IFRS | US GAAP |
|---|---|---|
| **Non application (exclusion from the scope)** | biological assets | biological assets and explicitly excluded leases of timber |
| | x | leases of inventory |
| | licences of intellectual property granted by a lessor (in the scope of the new revenue standard IFRS 15)<br><br>rights held by a lessee under licensing agreements within the scope of IAS 38 Intangible Assets for items such as motion picture films, video recordings, plays, manuscripts, patents and copyrights | all leases of intangible |
| | x | leases of assets under construction when the lessee does not control the asset before the lease commencement date |
| **Lease and non-lease components** | no specific guidance for lessees on suitable methods for estimating the stand-alone selling price | explicitly allows a residual estimation approach if the stand-alone price for a component is highly variable or uncertain |
| **Lease payments** | lease payments include any residual value guarantees[3] provided to the lessor | lease payments exclude any residual value guarantees provided to the lessor; the residual value guarantees are included in the calculation of the lease receivable for sales-type and direct financing leases |
| **Classification of a lease - Lessor** | either an operating lease or a finance lease | either an operating lease, sales-type lease or direct financing lease |
| **Determination of a lease** | At the inception which is earlier date of: a lease agreement and a commitment by the parties to the principal terms and conditions. | At the commencement which is the date from which the lessee is entitled to exercise the right to use the leased asset. |
| **Classification of a lease - Lessee** | **a single lease accounting model** | **a finance lease and an operating lease** |
| **Recognition exemptions** | (1) short-terms leases except leases that contains a purchase option | (1) short terms leases; a lease that contains a purchase option can qualify as a short term if the lessee is not reasonably certain to exercise its option to purchase the underlying asset |
| | (2) leases for which the underlying asset is of low value when it is new | (2) no exception for which the underlying asset is of low value |

Source: author's processing according to IFRS 16 and ASC 842

As mentioned above in Table 1, ASC 842 distinguishes three types of leases from the lessor´s point of view. A lease is distinguished by some indicators mentioned in the standard. The lease term for the major part of the economic life of the underlying asset indicates other than an operating lease. The present value of the lease payments and any residual value guarantee that equals or exceeds substantially all of the underlying asset´s fair value indicates other than an operating lease, too. Lease term and lease

[3] A guarantee made to a lessor by a party unrelated to the lessor that the value (or part of the value) of an underlying asset at the end of a lease will be at least a specified amount.

payments criteria may be evaluated using brigt-line thresholds. For assessing whether the lease term is for the major part of the economic life of the underlying asset is decisive a threshold of 75 percent of the remaining economic life. This criterion does not apply when the asset is at or near the end of its economic life (within the last 25 percent of its total economic life).

The present value of the lease payments and any residual value guarantee equals or exceeds substantially all of the underlying asset´s fair value is when a threshold of 90 percent or more of the asset´s fair value is met. This threshold may, but is not required to, be used.

Besides an operating lease, the US GAAP recognises a sales-type lease and a direct financing lease instead of a finance lease. If the lease effectively transfers control of the underlying asset to the lessee, it is a sales-type lease (title to the asset by the end of the lease term). A control covers the ability to direct the use and obtain substantially the remaining benefits. A sales-type lease does result in initial selling profit from the sales revenue and costs of goods sold. The sales revenue is the lower of: the fair value of the underlying asset at the commencement date and the sum of the lease receivable including any lease payments prepaid by the lessee.

If the lease transfers substantially all of the risks and rewards incidental to ownership of an underlying asset to the lessee and one or more third parties unrelated to the lessor, it is a direct financing lease. The transaction does not result in a profit, only interest revenue for the lessor. Any selling profit is recognised as a reduction in the measurement of the net investment in the lease. Any selling loss is recognised at the commencement. This arrangement is analogous to booking a loan. We summarize the recognition into following Table 2.

**Table 2** Recognition of a Direct financing lease and a Sales-type lease (from the Lessor´s point of view)

| Direct-financing lease | Recognition | | Sales-type lease | Recognition | |
|---|---|---|---|---|---|
| **Gross Investment (lease receivable)** | xxx | | **Gross Investment** (lease receivable) | xxx | |
| **Net Investment (leased asset)** | | xxx | **Costs of goods sold** (carrying amount + initial direct costs – unguaranteed residual value) | xxx | |
| **The interest revenue (Gross – Net)** | | xxx | **Carrying amount of the leased asset** | | xxx |
| | | | **The sales revenue** (present value of the minimum lease payments) | | xxx |
| | | | **The interest revenue** | | xxx |
| | | | **Accumulated depreciation of the leased asset** | | xxx |

Source: author's processing ASC 842

It is important to point out that IFRS put emphasis on reassessment of the lease liability (IFRS 16.39 – 16.43). As a result, the liability under IFRS could grow to be significantly greater than the liability under US GAAP, which would exaggerate the income statement difference in the case that a lease is recognised as an operating lease under US GAAP from the lessee point of view.

Differences between IFRS 16 and ASC 842 which were pointed out may be some risk for consistency of application IFRS 16. Accounting entities that keep accounting entries in both accounting systems may erase differences between them to facilitate accounting. This may lead to incomparability of IFRS financial statements.

## 4 Conclusions

The study that focused on assessment of the impact of available financial reporting data on the decisions taken by the creditors has concluded that accounting data may be considered to be relevant to some extent for creditors - either by using it directly to determine the interest rate or by leading to the same conclusions as would be reached if creditors used data other than the financial statements (Tumpach et al., 2014). IFRS 16 and the new lease accounting model could help to raise the relevance of reporting financial data.

Since the application of IFRS 16 the assets and liabilities will increase in the lessee's balance sheet due to leases which were previously recognised in the off-balance sheet. Lease liabilities will generally exceed the amount of assets in the balance sheet. On the other hand, financial costs will increase, and operating costs will decrease in the profit and loss statement. As a result, EBITDA will increase.

Considering the occurrence of kinds of lease in practice, both finance and operating leases are selected depending on the type of asset, the company's specific operations, the sector, etc. It may sometimes be more economical and cost-efficient to lease various kinds of assets rather than buying them. An operating lease is a flexible solution to obtain assets according to the company's current requirements. Given its frequent use, the major rebuilding of the financial recognition will impact on many companies.

Despite an effort to convergence IFRS and US GAAP, the standard-setters have reached the divergence regarding some aspects in the lease accounting. Companies that report under both IFRS and US GAAP will have to deal mainly with the different classification of a lease from the lessee´s point of view. Companies will need to maintain different processes, controls and accounting systems for each framework to comply with the different lessee reporting requirements. It is difficult to conclude which framework is more appropriate. Based on commented letters that were submitted to public review in the context of the revised Exposure Draft in 2013, there is no uniform understanding in practice either (Ferreira et al., 2018).

## Acknowledgments

The paper is an output of the research project "Globalization of Accounting Standards in context of the Development of Foreign Direct Investment" no. I-19-107-00.

## References

Act. No 595/2003 Coll. Income Tax, as amended.

Bloom, R. (2016). Finance and Operating Leases under ASC Topic 842. *Pennsylvania CPA Journal*, vol 87(3), pp. 1-3.

Commission Regulation (EC) No 1126/2008 of 3 November 2008 adopting certain international accounting standards in accordance with Regulation (EC) No 1606/2002 of the European Parliament and of the Council European Commission.

Dvořáková, D. (2019). *Finanční účetnictví a výkaznictví podle mezinárodních standardů IFRS*, 5th ed. Brno: Bizbooks.

FASB (2018). *Accounting Standards Update.* Financial Accounting Standards Board. Retrieved from: https://asc.fasb.org/imageRoot/39/117422939.pdf.

Ferreira, F. H., Marcelino, M. M., Rodrigues, N. M. B., Rodrigues A. J. (2018). Accounting for lease transactions: analysis of possible lobbying in the issuing of IFRS 16. *Revista de Educação e Pesquisa em Contabilidade*, vol. 11(4), pp. 453–470.

Freeman, M. (2018). ASC 842: Implementing the New Leasing Standard. *Management Accounting Quarterly*, vol. 20(1), pp. 27–37.

IASB (2019). *IFRS® Standards Issued at 1 January 2019 (Red book).* London: IFRS Foundation.

IFRS 16. *Leases*. IASB, 2016.

IFRS Foundation (2016). *Project Summary and Feedback Statement*. Retrieved from: https://www.ifrs.org/-/media/project/leases/ifrs/published-documents/ifrs16-project-summary.pdf.

KPMG (2017). *IFRS compared to US GAAP.* Retrieved from: https://frv.kpmg.us/content/dam/frv/en/pdfs/2017/ifrs-us-gaap-2017.pdf.

Lezinski, J., Thacker, S. (2019). ASC Topic 842 and Lessor Software Systems: Perspectives from the equipment finance software providers. *Equipment Leasing & Finance*, vol. 35(2), pp. 49–50.

Liviu-Alexandru, T. (2018). The Advantages that IFRS 16 Brings to the Economic Environment. *Economic Sciences Series*, vol. 18(1), pp. 510–513.

Magli, F., Nobolo, A., Ogliari, M. (2018). The Effects on Financial Leverage and Performance: The IFRS 16. *International Business Research*, vol. 11(8), pp. 76–89.

Osei, E. (2017). The financial accounting standards board (FASB), and the international accounting standards board (IASB) sings similar tune: comparing the accounting treatment of new IFRS 16 with the IAS 17, and the new FASB model on leases. *Journal of Theoretical Accounting Research*, vol. 13(1), pp. 1–23.

Stancheva-Todorova, E., Velinova-Sokolova, N. (2019). IFRS 16 Leases and Its Impact on Company's Financial Reporting, Financial Ratios and Performance Metrics. *Economic Alternatives*, No. 1, pp. 44–62.

Topic 842. *Leases*. FASB, 2016.

Tumpach, M., Manová, E., Meluchová, J. (2014). Relevance of System of National Financial Reporting from the Point of View of Creditors as Non-privileged Users. *Ekonomický časopis*, vol. 62(5), pp. 495–507.

Zamora-Ramírez, C., Morales-Díaz, J. (2018). Effects of IFRS 16 on Key Financial Ratios of Spanish Companies. *Estudios de economía aplicada*, vol. 36(2), pp. 385–406.

Zamora-Ramírez, C., Morales-Díaz, J. (2018). IFRS 16 (leases) implementation: Impact of entities' decisions on financial statements. *Aestimatio: The IEB International Journal of Finance*, vol. 17(4), pp. 60–97.

# Robotic Process Automation for Investment Modelling

**Ján Gogola, Petr Šild**

University of Pardubice
Faculty of Economics and Administration,
Institute of Mathematics and Quantitative Methods
Address: University of Pardubice
Faculty of Economics and Administration
Studentská 84, 532 10 Pardubice
E-mail: jan.gogola@upce.cz, st44571@student.upce.cz, sild.petr@gmail.com

**Abstract:** *The developments in data science, machine learning and artificial intelligence force us to revisit the question "What should be automated and what should be done by humans?" The main objective of our contribution is to apply Robotic Process Automation (RPA) to create a model which identifies risk situations on the model based on the market prices and external data such as M2 Money Stock, Consumer Confidence Index (CCI), Daily Treasury Yield Curve etc., and recommend a proportion of assets in the portfolio. Our goal is to build a model that will beat its benchmark, the S&P 500 index, for that purpose we create a portfolio composed of individual stock titles contained in the S&P 500 index and compare the model rate of return with the real rate of the S&P 500 for the period from 1.1. 2004 to 1.1. 2019. As a result we can show that the cumulative yield of the model beats its benchmark approx. 7 times during the period under review.*

*Key words: robotic process automation (RPA), theory of portfolio, data mining,*

*JEL Classifications: C55, C61, G11*

## 1 Introduction

The main goal of this paper is to apply Robotic Process Automation (RPA) to create a model that determines the ratio of assets that it is appropriate to hold in the portfolio. The development in data science, machine learning and Artificial Intelligence (AI) force us to ask the question: „What should be automated and what should be done by human?"

RPA is one of these developments. It is a tool that operate on the user interface of other computer systems in the way a human would do.

When robot inclusion occurred in manufacturer industry, empowering factories with robots that are more capable, reliable, and with 24–7 working capacity. (Willcocks et al., 2015)

What could be robotized? Simply put, any process that could be documented, which can be considered as being repetitive. In a more technical language, any process that can grab or introduce data via a desktop application or web page could be robotized, as well as manipulation of data, persistence in excel worksheets or interactions with 3rd party systems and emailing. (van der Aalst, 2018).

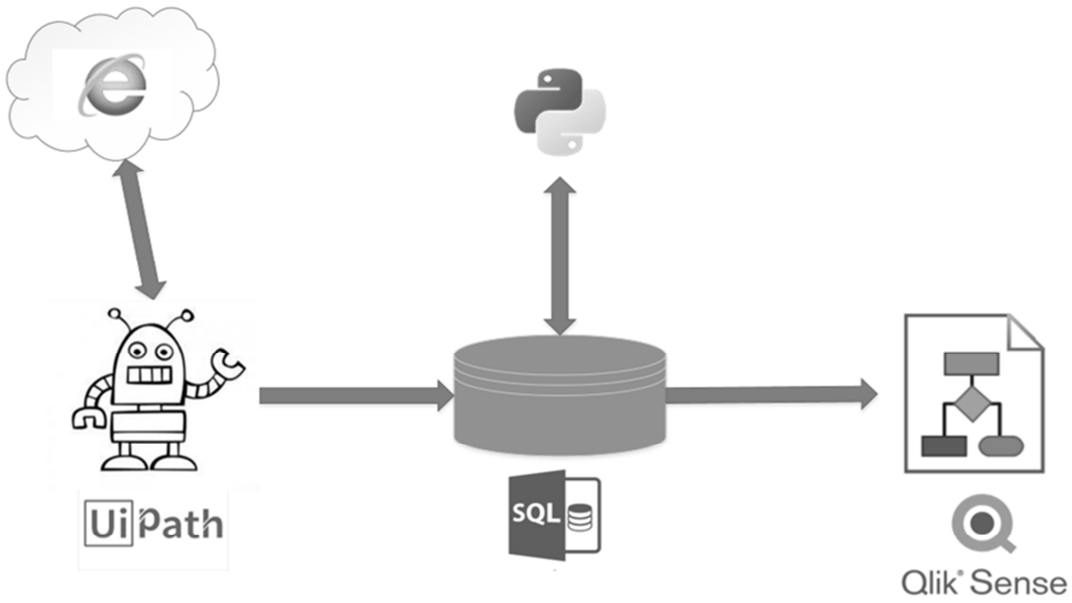
RPA aims to replace human by automation done in an „outside-in" manner. RPA provides agents that interact with different information systems thus interact partly replacing humans. Using Artificial Intelligence (AI) and Machine learning (ML), this can be done in a fairly robust manner. There are many vendors offering RPA tools we decided to use UiPath. UiPath is a global software company that develops a platform for Robotic Process Automation (RPA), a pretty cool concept that intends to automate repetitive tasks made by humans allowing them to focus on work that requires intelligence and judgment.
UI Path comes with open source version for medium business and a more complete enterprise solution with server software for multiple robots execution in background.
Consider the fact that in most cases, actively managed funds are lagging behind their benchmark our goal is to build a model that will beat its benchmark, the S&P 500 index.

## 2 Methodology and Data

Since the types of assets are innumerable, let's define the individual sectors of the US economy. Therefore, the model will model how to have the most preferably distributed portfolio across sectors. We can then imagine the assets either as funds that replicate the development of the sector or purchased individual titles from the S&P 500. Stocks are selected from the US market as the US market is the most effective market and have the longest available relevant data series. The ratio of stocks in the portfolio will determine the risk shareholding due to overbought market or overvaluation of stocks. We will then model this risk from two perspectives: the aggregation of stock titles and the investment horizon. As part of the aggregation of stock titles, we will look at the market as a whole, the individual sectors and further to the level of individual stock titles contained in the S&P 500 index. If someone is looking for a very complex approach to analyzing the stock, there is a fundamental analysis for him. (Fanta, 2001) Indeed, fundamental analysis has a great deal of focus, not just purely corporate factors such as debt, historical gains, dividends, profitability, or liquidity. In addition to these factors, it also examines global factors that affect the market as a whole or sectoral factors that affect a particular industry in which it operates. Therefore, our approach is to model at three levels: stock, sector and market.

Since our model will use a large amount of data and the model will need to be updated on a daily basis, it would be very time-consuming to do this manually. (Petr, 2014) and (Dietrich, 2015). For this purpose, Ui Path robots will be configured to retrieve, download, and load the required data into the model into. The entire system will look like in the Figure 1.

**Figure 1** Scheme of our Model




Source: own processing

First of all, you needed to get a list of 505 tickers of companies that make up the S&P 500, and save that list in a csv file. The robot then loads the file and downloads company data one by one. The source is the finance.yahoo.com. (Yahoo Finance, 2019) By a similar algorithm, as we gained market data, we can also obtained macroeconomic data such as M2 Money Stock, Consumer Confidence Index (CCI), Daily Treasury Yield Curve, Commercial and Industrial Loans, Gold prices.

The SQL database was chosen as data storage and analysis will be performed in Python programming (Stewart, 2014) environment using Numpy, Pandas and SciPy modules. The outputs will then be visualized into the dashboard using Qlik Sense for better clarity.

NumPy is a library for the Python programming language, adding support for large, multi-dimensional arrays and matrices, along with a large collection of high-level mathematical functions to operate on these arrays. NumPy is open-source software and has many contributors. Pandas is a software library written for the Python programming language for data manipulation and analysis. In particular, it offers data structures and operations for manipulating numerical tables and time series. It is free software.

- **Model of individual stocks**

Since the linking of macroeconomic factors directly to an individual stock is relatively weak, it does not make sense to include these indicators in the stock model. We will try to predict the profitability of holding stocks through purchase and sale signals of technical analysis. (Márton and Adamko, 2011) and (Meerschaert, 2013). For this purpose, we were chosen 5 methods of technical analysis: Bollinger bands, Relative Strength Index, MACD, Stochastic Oscilator and Money Flow Index.

So how do we define the profitability of holding a stock? As the methods of technical analysis generally focus on a short period of time, we will model whether a month later we will realize a return when holding a stock. In the first step, it is necessary to create auxiliary indicators such as moving averages, exponential moving averages and others, and then identify the purchasing and sales signals for the entire time series for each company. Then determine the sales and purchasing signals and decide when to hold the stock. Our modelled variable will take values 0 and 1, depending on whether the shares are worth or not worth to keep. The modeled variable is obtained by twenty-one day moving average of daily changes. The result is a logistic regression model that, based on technical analysis indicators, models the likelihood that each of the 505 stocks of the S&P 500 index is beneficial to keep.

- **Sector model**

The influence of macroeconomic indicators can already be reflected in the development of the share price of the entire sector, so it makes sense to include it here. Besides them, we will use the knowledge from the technical analysis of the previous model and include its output among the input variables. But it is necessary to first obtain a modeled variable, i.e. a yield by sector. So we need a weighted average of corporate earnings by their weightings in the S&P 500 index within each sector. The output of this model is a probability vector, which determines the likelihood that the acquisition of the values is preferable to keep the sector index.

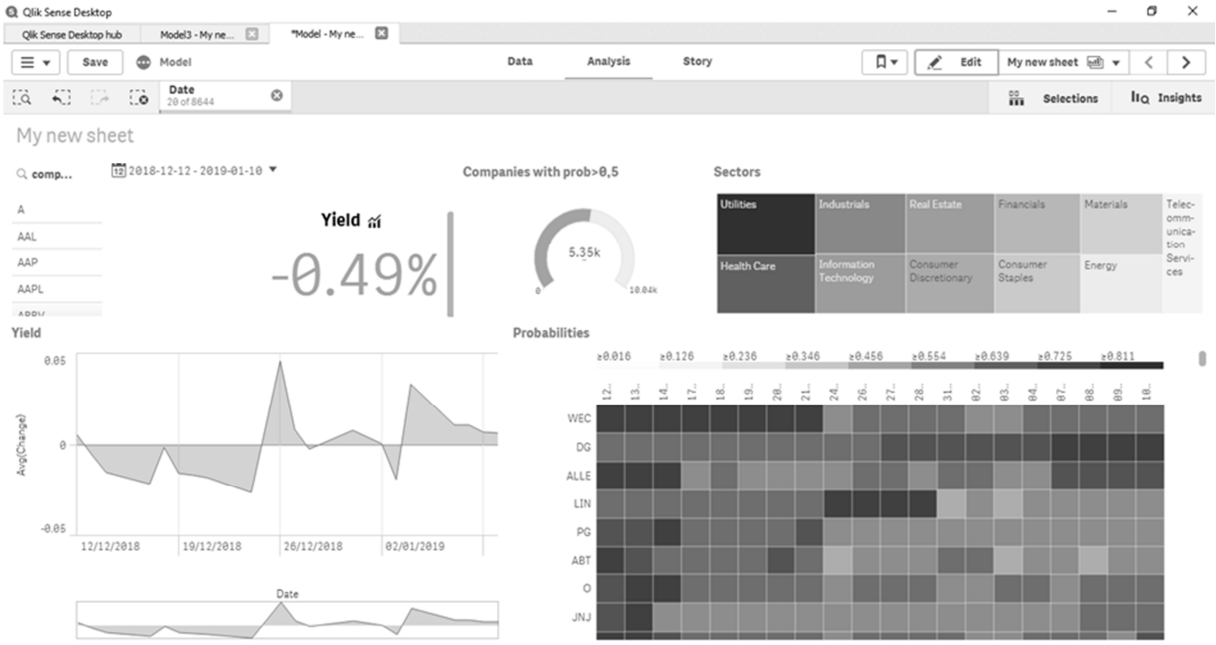
- **Model of the entire market**

This model is based on the results of the previous model, which models the probability of profitability of holding the sector's shares by day. We transform these probabilities into portfolio portions.
So we have a model, in three levels, that is bound together and at the end of which is the composition of the investor's portfolio. The investor can further analyze individual risks within sectors, markets or directly at the level of individual stocks.

## 3 Results

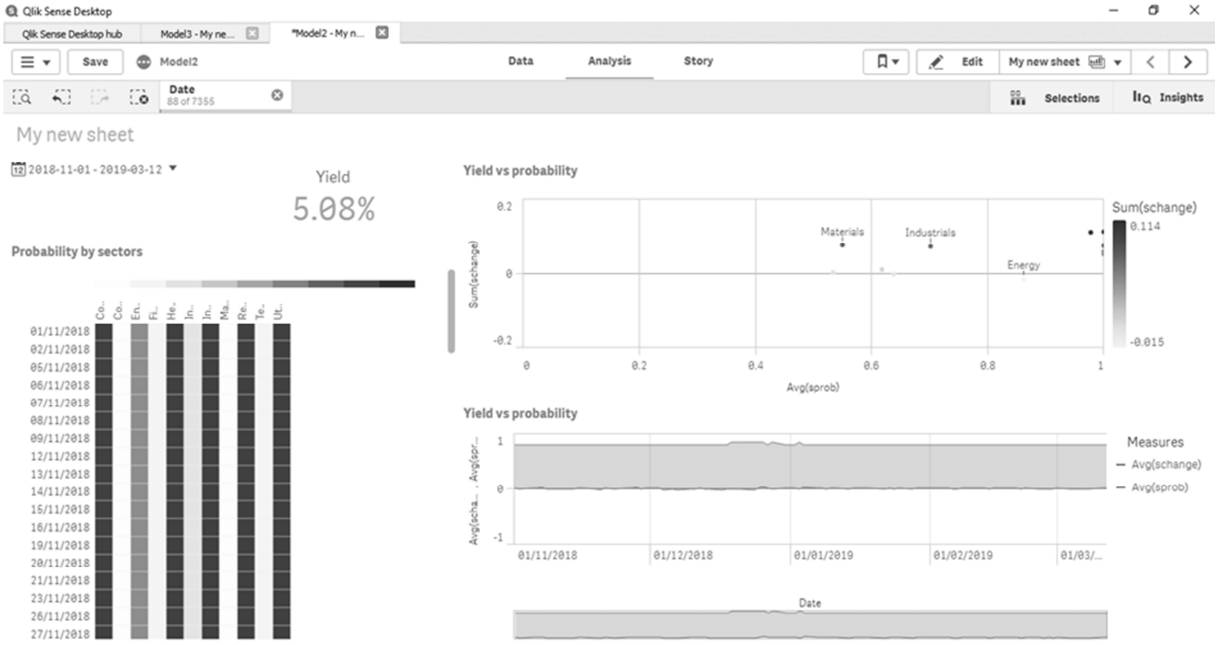
We will visualize our results in Qlik Sense. Figure 2 shows a visualization of the stock model. At the bottom right, we see a heat map where the color of the paint shows for each stocks the probability of holding them for the selected period. These titles can either be manually scrolled or filtered using the filter at the top left. Another important filter is next to it, which is used to select the time period. Bottom left we can see the development of average daily changes for all stock titles. In addition to filters, we can find revenue or loss for the selected time period. The last indicator is the division of sectors where the size and shade of the field indicate the average probability. The advantage is that almost every object can filter by clicking. For example, if we click on the health care sector, we will only see data for health care companies.

**Figure 2** Result Visualisation - Stock Model




Source: own processing in Qlik Sense

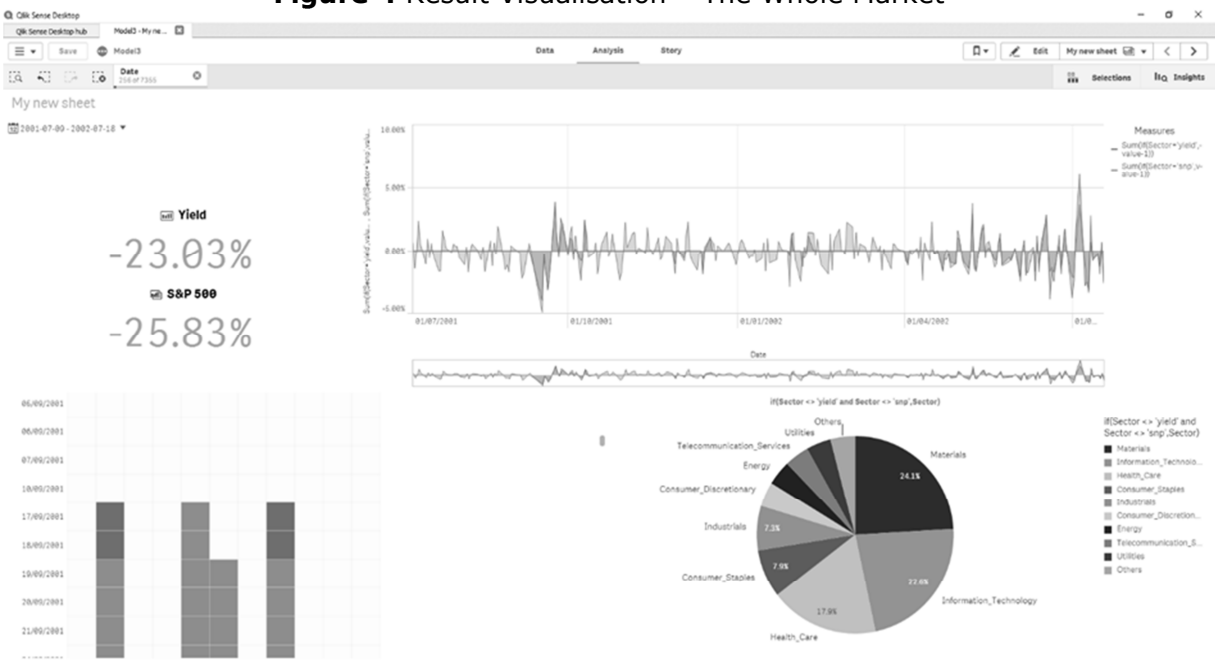
**Figure 3** Result Visualisation - Sector Model




Source: own processing in Qlik Sense

Figure 3 contains outputs from the sector model. On the bottom left there is a heat map again, but the stock titles have replaced the sectors here. Again, we have a yield and filter period.

**Figure 4** Result Visualisation – The Whole Market



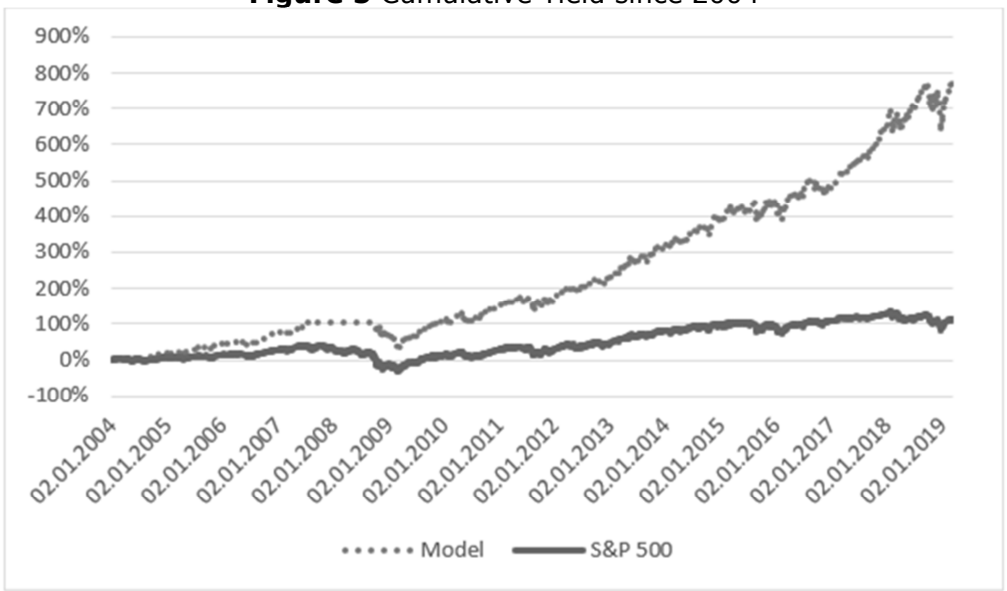

Source: own processing in Qlik Sense

The final result is a model that determines the proportion of assets in the portfolio. The new feature is the pie chart. This chart makes the most sense, if one day is selected, then it shows the exact composition for that day. Part of the output is a comparison of the model with its benchmark, i.e. the S&P 500 index, both in graphical form and in the form of yield for the given period. The particular period here is chosen for the course of 2001, so we can notice a very bright heat map and very negative profits because of the technological crisis.

Finally, the remaining question is whether our model beats its benchmark, ie the S&P 500. As can be seen in Figure 5 - the cumulative yield, the model really beat its benchmark.

It is also important to take into account the risk of this yield. Although the risk (shown in Figure 6) varies considerably over time, it cannot be claimed to be significantly higher than the S&P 500.

**Figure 5** Cumulative Yield since 2004




Source: own processing

## 4 Conclusions

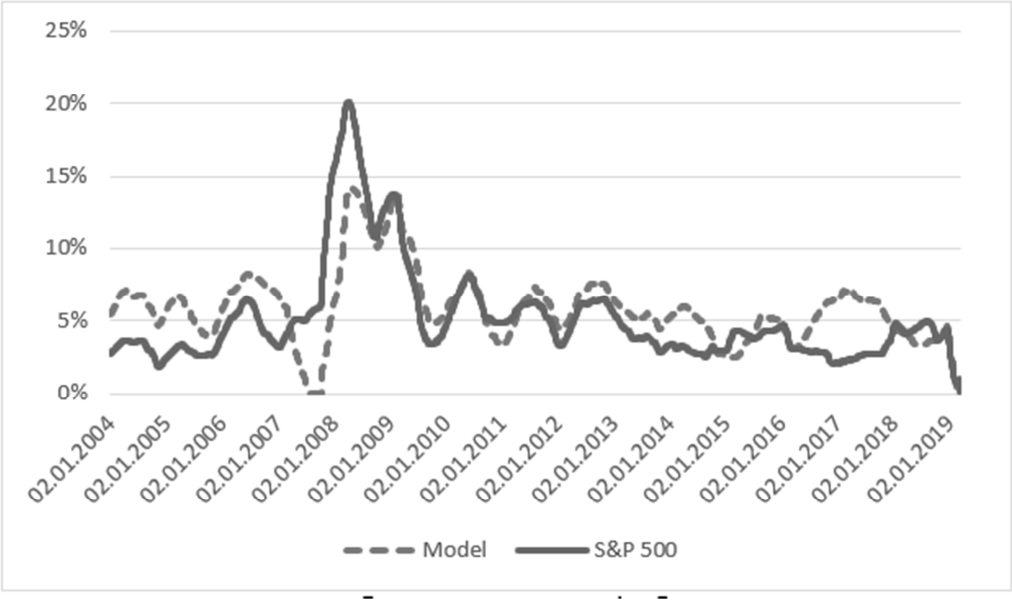
Our conclusion contains more open questions than information about our findings. Most of the times, the effort to robotize every client processes could be significantly higher than the potential gains to him, so this topic requires negotiation. Another topic that must be addressed during a negotiation phase is related with the criticality of tasks made by the robot: what happens if the robot fails? What is the client business impact? Robots are accurate but the systems that they deal with aren't. Imagine that the robot is extracting data from a page and that page server fails exactly in the moment the robot is executing. You could spend time making your robot more robust and error prone, but that represents a cost. The use of RPA brings many interesting questions. How to control RPA agents and avoid security, compliance and economic risk? Who is responsible when RPA agent "misbehave"?

As part of data preparation, it is necessary to add that when modeling future development, it is necessary to take into account the time delay with which we obtain the data. In the case of the market, it is only one day, but in the case of the consumer expectation index it can be up to two months.

There is also a need for awareness of model risk.

Last but not least, it should be added that, although technology permeates the world of finance increasingly, the human factor cannot be completely replaced. There will always be a need for experts to make decisions based on their own experience and on the recommendations of the system.

**Figure 6** Comparison of Volatility since 2004




Source: own processing

## Acknowledgments

This research could be performed due to the support of the University of Pardubice student project grant no. SGS_2019_018, Dynamika ekonomických aspektů veřejných politik v kontextu efektivnosti a udržitelnosti. (Faculty of Economics and Administration).

## References

Dietrich, D. (Ed.). (2015). *Data science & big data analytics: discovering, analyzing, visualizing and presenting data*. Wiley. ISBN 978-1-118-87613-8.

Fanta, J. (2001). *Psychologie, algoritmy a umělá inteligence na kapitálových trzích*. Grada, Finance, Praha. ISBN 80-247-0024-7.

Márton, P., Adamko, N. (2011). *Praktický úvod do modelovania a simulácie*. EDIS - vydavatel'stvo ŽU, Žilina. ISBN 978-80-554-0387-8.

Meerschaert, M. M. (2013). *Mathematical modeling*. 4th ed. Waltham: Academic Press, Cambridge, Massachusetts, USA. ISBN 978-0-12-386912-8.

Petr, P. (2014). *Metody Data Miningu*. Univerzita Pardubice, Pardubice. ISBN 978-80-7395-872-5.

Stewart, J. M. (2014). *Python for scientists*. Cambridge: Cambridge University Press. ISBN 978-1-107-68642-7.

van der Aalst, W. M., Bichler, M., Heinzl, A. (2018). *Robotic process Automation*. Retrieved from: https://link.springer.com/content/pdf/10.1007%2Fs12599-018-0542-4.pdf.

Willcocks, L. P., Lacity, M., Craig, A. (2015). *The IT function and robotic process automation*. Retrieved from: http://eprints.lse.ac.uk/64519/1/OUWRPS_15_05_published.pdf.

Yahoo Finance (2019). *Bussines Finance, Stock Market, Quotes, News*. Retrieved from: https://finance.yahoo.com/.

# Excessive Debt of Households and Financial Exclusion

**Ewa Gubernat**

Wroclaw University of Economics
Finance Department,
ul. Komandorska 118-120, 53-345 Wrocław,
email: ewa.gubernat@ue.wroc.pl

***Abstract:*** *The issue of financial exclusion and excessive indebtedness is increasingly the subject of actions taken at the national level. The growing interest in overindebtedness problem is a response to the observed systematic increase in household indebtedness, which in a situation of economic slowdown may lead to lower income of households and threaten timely settlement of liabilities incurred. Awareness of the scale of financial exclusion and excessive indebtedness and the negative consequences of what they involve on a micro-economic scale for households and as well for on a macro-economic for the whole economy, is not reflected in considerations on the basis of identification of interdependencies and concomitance of both phenomena. Currently, there are no studies which, based on the identification of determinants of both phenomena, would indicate the existence of a relationship between them. The aim of the article is to indicate the relationships that occur between the phenomenon of excessive indebtedness and financial exclusion, especially banking. For its implementation, it will be necessary to outline the size of household debt and financial exclusion in Poland, and then to identify the causes and effects of both phenomena, with an indication of the relationship between them. The author accepted the hypothesis that the emergence of debt is the effect of incurring liabilities of households as a natural stage of its development. Loans improve the quality of life and provide better access to the necessary goods and services. By contrast, over-indebtedness means a deterioration in the financial situation that leads to financial exclusion. The analysis of aggregated financial data was used to verify hypotheses.*

*Keywords: household debts, financial exclusion, overindebtedness*

*JEL codes: G21, H24, H71*

## 1 Introduction

Households make their financial decisions based on their economic knowledge. The basic factor of financial decisions is consumption, which means consumption of goods and services to meet needs. Consumption depends on personal income, preferences and budget constraints. Consumption changes over time. Its structure is changing due to the improvement of the quality of life and changes in the environment. The distribution of expenses depends on priorities and needs. In a situation where the household doesn't have sufficient resources to meet needs, it becomes necessary to incur liabilities. Therefore, it may be formal - if the debt is created in banks and informal when the debt arises outside the banking sector (Świecka, 2009).

In the economics literature, the levels of financial indebtedness are following (European Commission, 2010):

- Normal debt - occurs when the debt is serviced in a timely manner;
- Over-indebtedness debt - means that there are problems in timely debt service, but these problems are temporary;
- Excessive permanent debt - there are long-term problems in repayment of debt;
- Lack of payment ability - it is in a situation of total inability to pay its liabilities;
- Lack of the possibility to maintain the standard of living - the inability to simultaneously settle obligations and maintain the current standard of living;

- Insolvency - when the value of assets held does not cover the amount of liabilities incurred.

The phenomenon of overindebtedness arises when the debtor is unable to pay all his debts in the long-term or when there is a serious risk that this may happen. Individuals are considered to be overindebted when their net income is insufficient to cover their current costs of maintenance and repay the debt within the required timeframe. Due to the different interpretation of overindebtedness, the EU has developed a set of criteria that are used in defining overindebtedness (European Commission, 2008a):

- The unit of measurement is households;
- Measurement indicators should cover all financial liabilities of households;
- Overindebtedness means no cost coverage and should be seen as a progressive process, not as a temporary phenomenon;
- It is not possible to solve the problem of overindebtedness by incurring further obligations;
- Adjusting liabilities by households requires reducing expenditure or increasing income.

However, excessive indebtedness is the total deterioration of the financial situation of the household, which gradually leads to social and financial exclusion.

Financial exclusion is such process that limit access to the financial system. According to one of the most popular definitions, financial exclusion applies to people who have no relationship with financial institutions. The European Commission states in the European Commission (2008b) that financial exclusion is a process in which citizens experience problems in accessing financial products and services in the main market that are relevant to their needs and enable them to live a normal life society. It can also be assumed that financial exclusion is the difficulty experienced by people with low incomes and are at a disadvantageous social position in using the financial services they need, taking into account the unstable job situation.

Financial exclusion can have the following reasons (Kempson and Whyley, 1999):

- Exclusion due to geographic availability (geographical access) - associated with the physical availability of bank branches in specific parts of cities or regions; problems with physical access may occur in the case of banks closing branches in unattractive locations;
- Access exclusion - occurring in the case when access restrictions result from the risk assessment process by a financial institution is connected with the lack of access to financial services due to the scale of the risk taken by the financial institution;
- Exclusion due to conditions (condition exclusion) - occurring in a situation where the product offer is not properly adapted to the needs of a group of people results from the inadequacy of the conditions of the services offered to the needs of people using financial services;
- Price exclusion - related to the existence of excessively high prices, which are a barrier to access to financial services, due to the excessive price of services for people with a given level of income;
- Marketing exclusion - existing in a situation when a group of people is excluded in accordance with the marketing policy of a financial institution, is associated with a lack of interest on the part of financial institutions to a this social group;
- Self exclusion.

There is very important to indicate the relationship between financial exclusion and overindebtedness to distinguish price exclusion, exclusion due to conditions, exclusion due to availability and self-exclusion. Financial exclusion sensu stricte may mean difficulties in access and difficulties in using financial services. But financial exclusion sensu largo means the effects of difficulties in accessing financial services that prevent the financial inclusion of a person who would be interested in it.

Financial exclusion and overindebtedness are often analyzed separately. However, there are several factors that are common to these processes. The first of these is the relationship between the consequences of financial exclusion and overindebtedness, and the economic and social status. The causes of both phenomena may be (Sarma, 2008):

- Socio-demographic - aging of the society, poverty of society, raising the quality of life;
- Economic - unemployment, changes in the structure of the household, failure of independent business activity, improper management of the household budget, excessive use of credit, roll-over of debt, increase in interest rates, economic slowdown;
- Psychological - lack of propensity to save, excessive propensity to risk, prone to excessive shopping.

Excessive indebtedness leads to the exclusion of the resulting difficulties in accessing credit products. Such difficulties result from factors lying on the demand side, behind which households are responsible and supply understood as banks' readiness to grant loans. Summarizing the considerations of financial exclusion and excessive indebtedness, it can be concluded that they are the cause and effect of poverty.

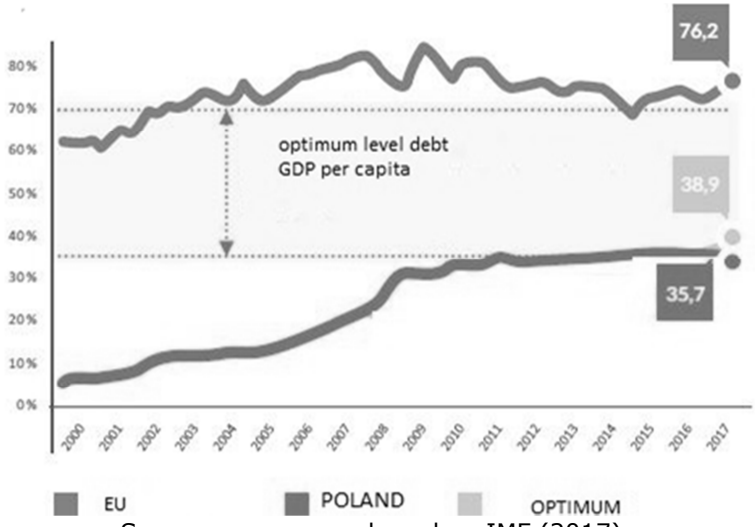
## 2 Methodology and Data

The theoretical part of the work was based on a study of the subject literature, while the empirical part based on data obtained from the financial supervision committee. Empirical studies covered the years 2011 - 2018 and they concerned the entire banking sector in Poland and debt of households. The test results are presented in graph and descriptive form.

## 3 Results and Discussion

The tendency to consumption in Poland is still growing. Lifestyle changes cause: the development of services and products as well as the availability of new financial products such as renewable loans or credit cards. Household debt in Poland in 2018 exceeded PLN 810 billion and was higher by approx. 3.9% until 2017. Households incur liabilities mainly to finance consumption, but also to purchase real estate. The credit situation of households should be considered in the long-term perspective. The value of amounts due to banks from households is constantly growing, but it is still relatively lower than in EU countries, figure 1 and 2 (IMF, 2017). Household debt in Poland is relatively low. In 2017, it was around 35 percent GDP. It was exactly on the border of the lower range indicated in the IMF research as the optimal range for economic growth. For many years, the debt to GDP ratio is constance.

**Figure 1** Households Debt in Poland Via GDP



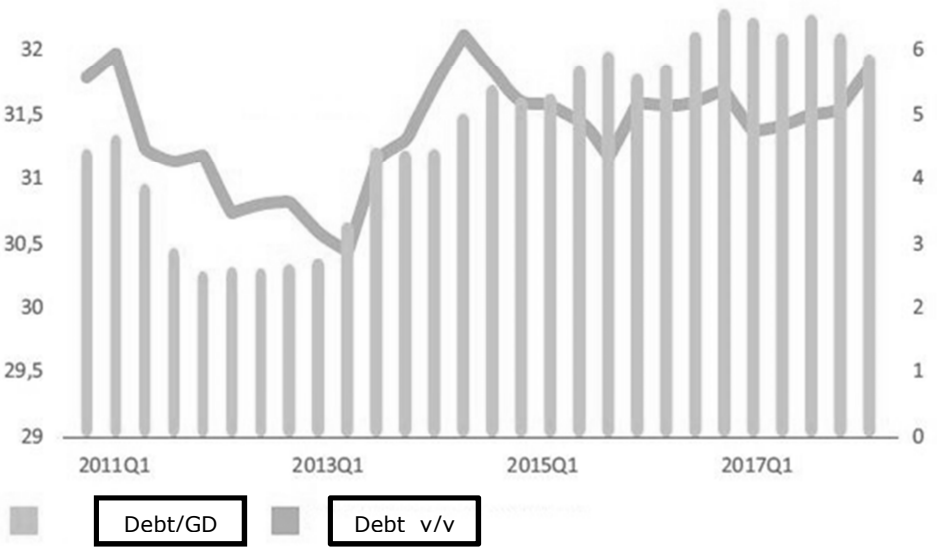

Source: own source based on IMF (2017)

Poles' behavior in terms of indebtedness is changing. Households use debt to finance current needs to a lesser extent than in the past, and to a greater extent to finance investments and purchases of goods and services related to social aspirations (Agarwal et al., 2019).

The general debt ratio, which is constance in relation to GDP for many years, there are many changes that show the evolution of the role of debt in the lives of Poles. In the last decade, and especially in the years after the financial crisis, a number of regulations were introduced in Poland, the aim of which was to increase consumer safety and the entire financial system.

- these are regulations that respond to the problem of the lack of financial knowledge of the majority of consumers and are aimed at reducing the asymmetry of information between the lender and the borrower.
- these are regulations that protect financial institution customers against unexpected fluctuations in the business climate, forcing financial institutions (mainly banks in this case) to adequately test clients' resilience to changes in their income.
- these are regulations protecting the security of the financial system, by introducing requirements regarding capital levels, the structure of liabilities and assets, liquidity management, risk policy, or increased payments to the deposit guarantee system

**Figure 2** Households Debt in Poland




Source: own source based on NBP 2018

In 2017, the indebtedness of Poles amounted to 35 percent. GDP. It was on the border of the range indicated in the IMF's research. This allows us to put forward a preliminary thesis that the indebtedness of Poles is at the optimal level for the economy, with a relatively large buffer of security. The approach to the importance of debt has undergone significant changes in recent years. Before the financial crisis of 2008, the dominant view was that debt is a matter of household preferences regarding the transfer of consumption between different phases of life. After the crisis, the trend was reversed. However, regardless of trends in the treatment of debt by economists, there is general agreement that debt creates both opportunities and risks. Regulatory pressure has undoubtedly considerable impact on debt ratios, by limiting the supply of credit. Nowadays banks reduce balance sheets, conduct a more stringent risk policy, and regulatory institutions are more sensitive to over-indebtedness. More over the level of interest rates and the growth of house prices will be important - research shows that these are important factors affecting household debt.

In 2018, over 2.78 million Poles had problems with the timely repayment of credit and non-credit obligations. The total value of their overdue debts amounted to almost PLN 74 billion. For a year, taking into account 30-day delays, the number of debtors increased by nearly 93.8 thousand. and the amount of arrears by PLN 6.8 billion. Debts and debtors have come despite improvement in the financial condition of households. It is supported by the next year of the 500+ program, as well as by the economy, which according to preliminary estimates grew at the rate of 5.1 percent. against 4.8% in 2017 and 2.9 per cent in 2016. There is also a rise in wages. The average wage in the national economy in 2018 increased by 7.3 percent. up to PLN 4585 gross (BIG, 2019).

National statistics show that higher wages are not allocated by Poles in the first place to repay outstanding liabilities. So far, the increase in income has a greater impact on the increase in consumption, improvement of creditworthiness and the possibility of incurring higher amounts.

In 2018, the amount of past due liabilities increased by 10.2 percent and the number of unreliable liabilities payers by 3.5 percent. For comparison, in 2017, compared to 2016, the value of debts increased by 20%, and the number of people with problems increased by more than 8%. In 2016, it was 26%, respectively and 13 percent. There are mainly people with debts of at least 10,000. zł. Currently there are 1.13 million of them, they constitute almost 41 percent the total number of unreliable debtors.

At present, the amount of PLN 74 billion in arrears presented in the InfoDług Report (BIG, 2019) is made up of non-credit liabilities - PLN 39.92 billion (54%) than credit - PLN 34.04 billion (46%). Better quality service and sale of bad loans resulted in a decrease in the number of unreliable creditors.

## 4 Conclusions

- Over-indebtedness of households is still an important social and economic problem;
- availability of credit products, consumer lifestyle determines the risk of non-repayment of debt;
- An important factor limiting the dynamics of household debt is increased regulatory pressure;
- Regulatory authorities attach greater importance to financial stability and generally show greater caution towards debt;
- The cost-effectiveness ratio of banks has a major impact on the household debt ratio. A more efficient financial system means more loan supply and lower prices, which raises the debt ratio;
- The level and dynamics of debt have a significant impact on the well-being of households, especially in crisis situations;
- The rate of increase in the level of household debt depends on the lending policy of banks;
- With the increase in debt, the scale of overdue receivables is also growing;
- Over-indebtedness is caused by a sudden deterioration in the financial situation of the household and low incomes;
- The high amount of overdue receivables may indicate that there is still a low level of economic knowledge in Poland for many households.

## References

Agarwal, S., Driscoll, J. S., Gabaix, X., LAibson, D. (2019). The age of reason: financial decisions over the life – cycle with implicatons for regulation. *Brookings Papers on Economic Activity*, pp. 51-101.

European Commission (2008a). *Towards a common operational definitione of over – indebtedness*. Manuscript - February 2008. Retrieved from: http://www.oee.fr/files/study_overindebtedness_en.pdf.

European Commission (2008b). *Financial Services Provision and Prevention of Financial Exclusion*, VC/2006/0183, March 2008. Retrieved from: https://www.finance-watch.org/wp-content/uploads/2018/06/FINANCIAL-SERVICES-PROVISION-AND-PREVENTION-OF-FINANCIAL-EXCLUSION-Executive-summary.pdf.

European Commission (2010). *Over-indebtedness: New evidence from the EU-SILC special module*. Research note 4/2010. Retrieved from: https://ec.europa.eu/social/BlobServlet?docId=9817&langId=en.

IMF (2017). Chapter 2: Household Debt and Financial Stability. In: *Global Financial Stability Report: IS Grwoth at Risk*. International Monetary Fund.

BIG (2019). *InfoDług: Ogólnopolski raport o zaległym zadłużeniu i niesolidnych dłużnikach*. 35. Edition. BIG, InfoMonitor.

Kempson, E., Whyley, C. (1999). *Kept Out or Opted Out?: Understanding and Combating Financial Exclusion*. Bristol: Policy Press.

Sarma, M. (2008). Index of Financial Inclusion. *Working Paper No 215*. Indian Council for Research of International Economic Relations.

Stamp, S. (2009). *A policy framework for addressing over indebtedness*, Dublin: Combat Poverty Agency.

Świecka, B. (2009). *Niewypłacalność gospodarstw domowych: Przyczyny- skutki – przeciwdziałanie*. DIFIN, Warszawa.

# Implications of IFRS 9-based Multi-Year Risk Parameters for Bank Management

**Peter Haiss, Alexandra Brandstaedter**

WU University of Economics and Business
Department of Global Business and Trade, Institute of Export Management
Welthandelsplatz 1, Building D1, A-1020 Vienna, Austria
E-mail: peter.haiss@wu.ac.at; alexandra.brandstaedter@gmail.com

***Abstract:*** *What is the impact of the International Financial Reporting Standards 9 - based multi-year risk parameters on banks? We find that the main innovation brought on by IFRS 9 is a fundamental change of the risk assessment process. This process is based on the so-called Impairment Model and incorporates Expected Loss (EL) measures. Financial assets are allocated into assumed risk categories according to their estimated risk level. IFRS9 also requires immediate recognition of credit losses. Though intended to stabilize markets, this may have ambiguous effects. We argue that banks need to adapt not only risk management, but also lending processes accordingly.*

*Keywords: IFRS 9; expected credit loss model, provisioning*

JEL-Classification: G01; G12; G21; G18

## 1 Introduction

The 2008 Global Financial Crisis causes financial markets to go through an ongoing restructuring process. Among the regulatory innovations for banks driven by the crisis is the IFRS 9 – Financial Instruments, a redemption of the IAS 39, that was implemented in January 2018 after its release in 2014 by the International Accounting Standard Board (IAS). The aim of this supervision mechanism is to monitor the financial stability of financial institutions within the Euro Zone as well as to enable transparency. The adoption of this standard is mandatory for Eurozone States while Member States outside the Euro Zone mainly comply with local generally accepted accounting principles (GAAP) (Halep, 2015, p. 931) (Leventis et al., 2010, p. 104).

The requirements of the new IFRS 9 Financial Instruments standard are based on an *expected credit loss model* and replace the IAS 39 Recognition and Measurement incurred loss model (Halep, 2015, p. 932). According to the new model, entities are required to accept an allowance of either 12 month or lifetime expected credit losses, depending on the level of credit risk of the financial asset. The guiding principle is to reflect the general development of credit risk quality of financial instruments. The measurement of this expected credit loss model incorporates a probability-weighted outcome, the time value of money and the best available forward looking information, such as macroeconomic data, credit spreads and external as well as internal ratings for each reporting period (Halep, 2015, p. 933). This new approach is called "point-in-time" estimation and is replacing the "through-the-cycle" estimation under IAS 39 (Ernst&Young, 2014, p. 7).

Based on a literature review of the conceptual framework and of impact assessments, we want to find out what are the implications of IFRS9 on bank management. The aim of the IFRS9 standard is to avoid the delayed recognition of credit losses, reduce the pro-cyclical effect of banking capital and create more stability within the financial markets. We find that the new IFRS 9 principles require larger loss allowances for financial institutions, i.e. lead to higher equity requirements in terms of regulatory capital. Depending on the available information, the allowances and thus bank´s balance sheets also become more volatile as forecasts change (Halep, 2015, p. 934).

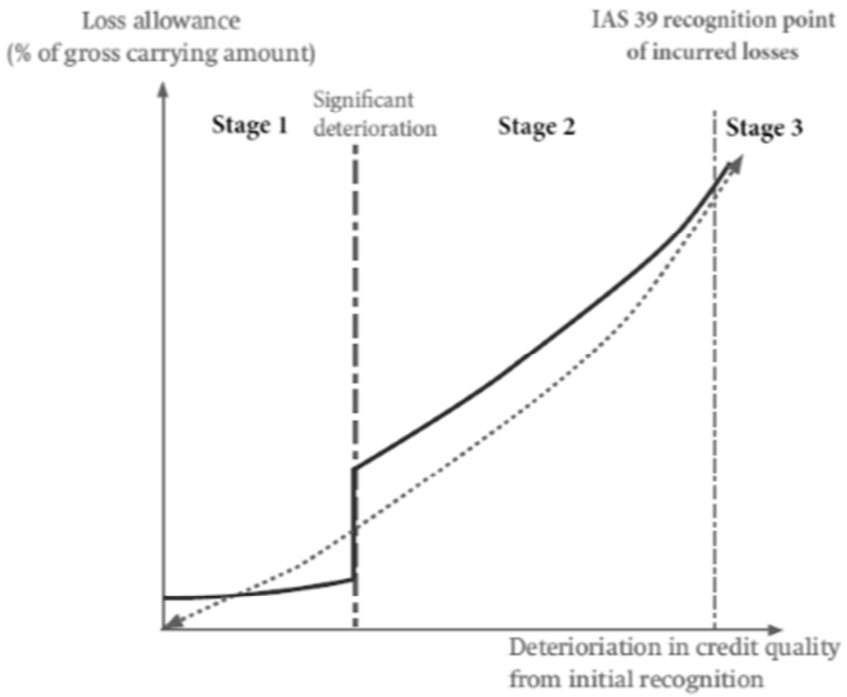
The remainder of the paper is organized as follows. First we will explain the origin of the Expected Credit Loss (EL) model and the new IFRS9 requirements. Then we will discuss findings about challenges and implications for bank management and conclude.

## 2 The Expected Credit Loss Model

The financial crisis of 2008 has brought to light weaknesses of the existing accounting standards for banking management. The delayed recognition of credit losses caused by the incurred loss model of IAS 39 is seen as one of the main reasons for the severe extent of the crisis (Ernst&Young, 2014, p. 4). In the incurred loss model, expected credit losses caused by likely future events are not taken into account until the loss event actually occurs (Ernst&Young, 2014, p. 4). Additionally, the incurred loss model was generally criticised to enforce the pro-cyclical effects of banking capital which also contributed to the birth of the financial crisis (Novotny-Farkas, 2015, p. 7).

Based on principles, the model requires entities to recognize a loss allowance or provision at an amount equal to 12-month expected credit losses for those financial assets without any significant increase in credit risk since initial recognition. Once a significant increase in credit risk occurred, the model proposes to recognize a loan allowance equal to a lifetime expected credit loss instead of the 12 month expected credit loss (Ernst&Young, 2014, p. 7). When comparing the loan loss allowances to the yearly estimated expected credit losses, the shortfall between ECL and loan loss allowances gets subtracted from the Capital equity Tier 1 and Tier 2. Any excess of loss provisions over expected credit losses will result in an addition of a specified value of up to 0.6% to the liable equity (Hlawatsch and Ostrowski, 2010, p. 133). The main benefits of this model are a timely recognition of expected credit losses and a possibility to distinguish between deteriorated financial assets and assets with a stable credit quality (Ernst&Young, 2014, p. 8). The main difference in provisions is shown in **Chyba! Nenalezen zdroj odkazů.**.

**Figure 1** Provisioning under IFRS9 and FASB




Source: Cohen and Edwards (2017)

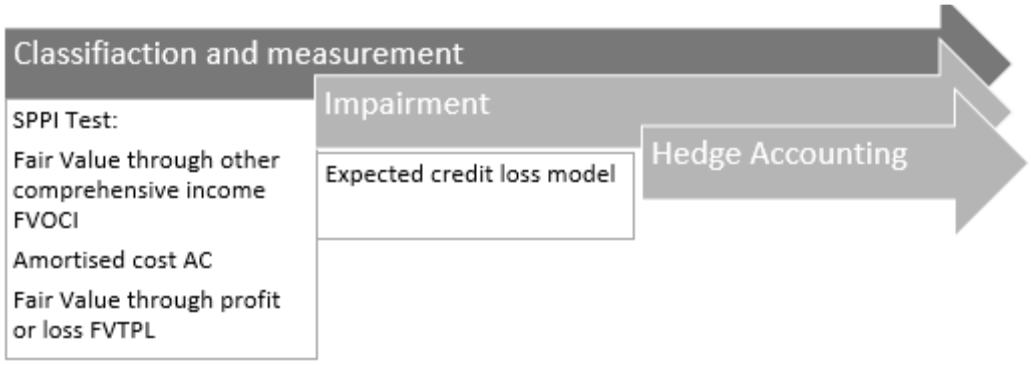
At the beginning, the loan loss allowances under IFRS 9 overstate the ones under the FASB. The deterioration in credit quality from initial recognition causes the move of the financial assets to Stage 2, where loan loss allowances slightly understate the ones from the FASB. In the end, when impairment occurs and the loss gets finally recognized within the incurred loss model, the expected credit loss model under IFRS 9 again overstates the one of the Financial Accounting Standard Board (Novotny-Farkas, 2015, p. 14). As can be derived from figure 1, IFRS 9 will definitely lead to a higher loan loss allowances than other standards due to the earlier recognition of 12-month expected credit losses,

as well as lifetime losses and the incorporation of past, current and forecast information. The precipitous increase of loss allowances after the significant deterioration of the financial asset is also called "cliff effect", as the financial asset will be reclassified and categorized within Stage 2 (Ernst&Young, 2014, p. 5).

## 3 IFRS 9 Requirements

IFRS 9 introduces three different sections of requirements: the classification and measurement requirements, the impairment requirements and the hedge accounting requirements (the latter is outside the scope of this paper and will thus not be covered here).

**Figure 2** Implementation Process of IFRS 9

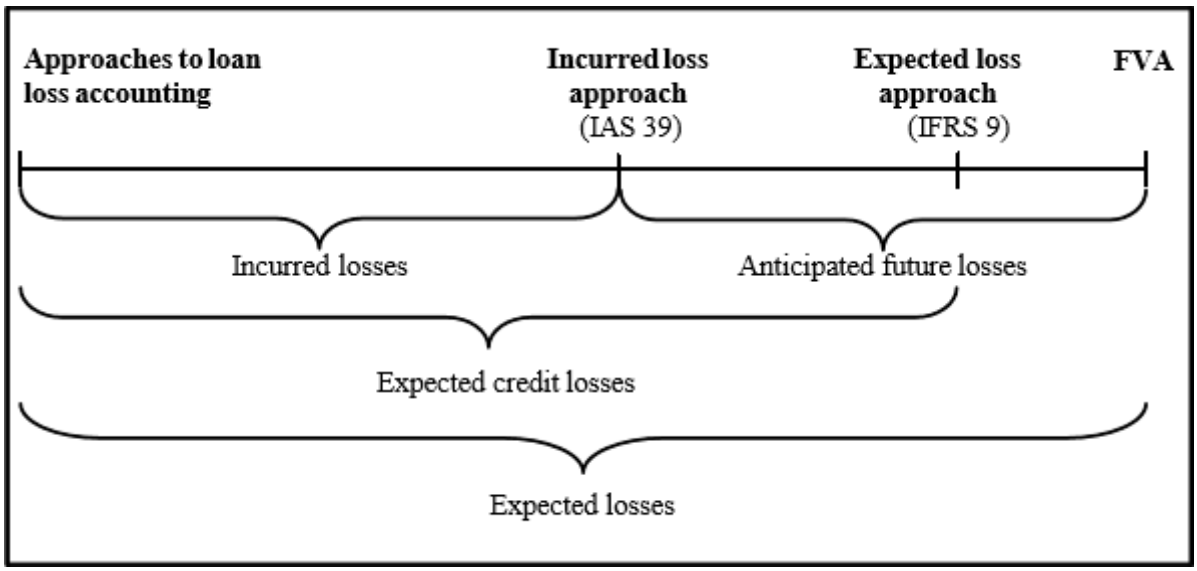



Source: Ha (2017)

Within the first part, banks have to define the "business model" for each financial asset they are holding as well as assessing the cash flow characteristics. In this case, business model refers to the way a bank is managing its financial assets for the purpose to generate cash flows. Financial assets can be either categorized as "held to collect" or "collecting-and-selling" (Chidawaya et al., 2016, p. 2). To identify the respective category, banks need to specify the following six factors: business objectives, risks, sales activities, the use of forward-looking information, compensation, and sources of income (Ha, 2017, p. 4). Additionally, banks need to verify whether the contractual cash flows are solely payments of principal and interest (SPPI - test). All financial assets that can be classified through their business model as well as the SPPI-test are measured either at amortized cost (AC) or at fair value through other comprehensive income (FVOCI) instead of being automatically measured at AC as under IAS 39. Financial assets not meeting those restrictions are measured at fair value through profit or loss (FVTPL) (Chidawaya et al., 2016, p. 3).

IFRS 9 requires banks to timely recognize changes in the possibilities of default, incorporate all available past, current and forecast information and classify the financial assets according to their expected credit loss (International Accounting Standards Board, 2014, p. 22). To make reasonable decisions, the fair value approach is seen as the only method that considers all these factors. Thereby, fair value measurement is best practice to evaluate the economic value of a loan and its expected credit loss (Novotny-Farkas, 2015, p. 11). The different approaches of classification models and the extent to which the fair value approach contributes to the timely and precise estimation of the expected losses is shown in **Chyba! Nenalezen zdroj odkazů.**.

**Figure 3** Loan Loss Recognition under Alternative Regimes




Source: Novotny-Farkas (2015)

**Classification and Measurement**

On the first date of annual reporting, all financial assets will be measured at fair value (the amount by which an asset could be exchanged between two different parties (Gornjak, 2017, p. 6) plus the respective transactions costs (Huian, 2012, p. 30). This net value is expected to be lower than the economic value of an asset which causes an immediate loss for performing loans sold at fair value (Reitgruber, 2016, p. 338). The assets will be classified depending on the business model as well as on the contractual cash flow characteristics of the asset (Huian, 2012, p. 31), which will be evaluated through the SPPI-test (Ha, 2017, p. 4). According to this test, a financial asset will be measured at amortized cost (AC) if the business model is to solely collect contractual cash flows e.g.: debt instruments (Halep, 2015, p. 932). If the business model is to collect cash flows as well as to sell the asset, the asset will be measured at fair value through other comprehensive income (FVOCI). A financial asset without solely payments of principal and interest or which business model is to sell the asset, are measured at fair value through profit or loss (FVTPL) e.g.: derivatives or equity instruments hold for trading (Huian, 2012, p. 31). The business model of the financial instruments remains unchanged, unless reclassification criteria are not met, even if the criteria of solely payments of principal and interest is changing reclassification is not applicable (Huian, 2012, p. 34).

The main impact of the new financial standards is the timely recognition of deterioration or improvement in credit quality of financial assets. The amount of loan loss provisioning will depend on the estimated extent of deterioration or improvement since initial recognition. The occurrence of a loss event is not necessarily needed anymore to recognize a credit loss.

**Modification and de-recognition**

The de-recognition requirements under IFRS 9 remain unchanged from the IAS 39 – Recognition and Measurement requirements. De-recognition in this context refers to the elimination of a financial asset or liability from an entity's balance sheet (Deloitte, 2010, p. 1). According to the standard, de-recognition is applicable on financial assets if either the contractual rights to the cash flows expire or a transfer of the financial asset it necessary (International Accounting Standards Board, 2014, p. 10). A transfer is carried out whenever the contractual rights are transferred or the respective cash flows are transferred to another recipient. To evaluate the transfer of risk and rewards, the entity's

exposure, before and after the transfer, will be compared with the variability in the amounts of the respective cash flows. If the exposure in comparison to the variability does not change significantly, the entity has retained all the risks and rewards of ownership. The profit or loss resulting from this transfer and the de-recognition needs to be recognized at fair value. This amount is calculated by the difference between the carrying amount and the consideration received (International Accounting Standards Board, 2014, p. 12).

A modification or exchange of a financial asset or liability that does not lead to a de-recognition of the asset, requires a recalculation of the amortized cost (IFRS Interpretations Committee, 2017, p. 1). The entity needs to recalculate the amortized cost of the modified asset by discounting the new cash flows with the original effective interest rate. The adjustments to the amortized cost that result in a gain or loss, are recognized as profit or loss at the date of modification or exchange (IFRS Interpretations Committee, 2017, p. 2).

**Impairment Requirements**

According to the new impairment model, entities are required to calculate, on the one hand, the 12-month expected credit loss (Stage 1) which applies to all financial assets without any significant change in credit quality since initial recognition and, on the other hand, the lifetime expected credit loss (Stage 2 and 3) (International Accounting Standards Board, 2014, p. 22). Lifetime expected credit loss is defined as the expected present value of losses caused by a default event at any time during the life of the financial instrument (Cohen and Edwards, 2017, p. 5). The calculation of these lifetime expected credit losses incudes the estimation of multi – period (lifetime) probabilities of default. Previous frameworks such as Basel, only estimated one – year probabilities of default which did not display any future prospects and, therefore, were not suitable to calculate the actual expected credit loss of the financial assets (Vanek, 2016, p. 123).

Whenever a financial asset is originated or purchased, it is classified as Stage 1, the expected credit loss is calculated as an expense and a loss allowance needs to be established. This stage will only have a limited impact on an entities' financial statements, as there is no considerable change in classification expected (Cohen and Edwards, 2017, p. 4). Stage 2 consists of financial assets encountering a significant increase in credit risk since initial recognition, which is not considered low. The financial assets of this category are usually slightly deteriorated risk assets but are still not impaired (Ernst&Young, 2014, p. 7). If, for example, the principal payments of an asset are at least 30 days past due, the financial asset can be classified as Stage 2 and is still not seen as credit impaired (Ernst&Young, 2014, p. 13). The resulting lifetime expected credit loss, which needs to be calculated, leads to a significant increase in loan loss provisioning. This rise in provisioning depends on different factors such as the maturity as well as the development of risk factors over the life of the loan (Cohen and Edwards, 2017, p. 43). Short-term loans are generally less affected by the move from Stage 1 to Stage 2 than long term assets (for example in real estate), as provisioning increases equivalently with respect to the credit quality as well as the term of the loan (Ernst&Young, 2015, p. 14). Another transfer criteria provided by the framework depends on the internal scoring and rating systems of the bank, moving the financial asset to Stage 2 once the level of credit risk has gone beyond a given threshold (Brunel, 2016b, p. 2). This applies in principle independently from the initial rating level (for both sub-investment-grade ratings as well as investment grade ratings) if the credit institution cannot prove that the rating that changed does not indicate higher risk (Ernst&Young, 2015, p. 22). Stage 3, however, consists of financial assets where credit risks increases in a way that leads to it being considered credit impaired, which means that the possibility of default is equal to a 100 percent. This case is given once a loss event occurs such as significant financial difficulties of the issuer or the obligor; a breach of contract; general default in principal payments (more than 90 days past due) or special concessions granted to the borrower due to financial difficulties (International Accounting Standard Board, 2011, p. 16).

Loss allowance will be determined by the forecast of economic conditions. During economic downturns, banks are already writing off their loans to absorb losses. This will burden capital ratios, as the expected credit loss model also requires banks to increase provisions when moving financial assets from Stage 1 to Stage 2 due to an increase in credit risk within this period. The caused volatility in loan loss provisions needs to be taken into account as a negative impact when implementing the standard (Damyanova and Garrido, 2017b, p. 1). This, however, is not the only obstacle arising with IFRS. Because of the over-provisioning and the need to write off loans depending on the economic situations, the banks cost of equity is likely to increase (Harrison and Sigee, 2017, p. 4).

**Measurement Approaches**

In order to comply with the new model, the Basel Committee requires banks to have a credit risk management process, including approaches to identify, monitor, evaluate, measure, report and control credit risk accurately, covering the full credit life cycle. These strategies need to identify problem assets before a loss event occurred (Basel Committee of Banking Supervision, 2015, p. 7).

The first approach is called the "general approach". Under this method, an entity has to report its loss allowance based on either 12-month expected credit losses or lifetime expected credit losses at each reporting date (Ernst&Young, 2014, p. 12). The second approach is called "simplified approach" and requires entities to report the loss allowance based on lifetime expected credit losses right from the beginning. This approach is applicable on trade receivables as well as contract assets with a maturity of less than a year or without including a significant financing component (Ernst&Young, 2014, p. 14). Thirdly, the "30 days past due" approach allows for a simplification of adapting IFRS 9. This rebuttable presumption sets out that the credit risk of financial instruments increases as soon as the contractual payments are more than 30 days past due. Permitting delinquency status of those financial assets simplifies the identification of significant increase in credit risk (European Banking Authority, 2016a, p. 47). If the entity is able to prove that there is no significant increase in credit risk although the payments are already 30 days past due, this approach does not necessarily need to be applicable. Reasons for this can be for example a procedural error not resulting from financial difficulties (Ernst&Young, 2015, p. 66). Although this approach deviates mainly from the original concept of the expected credit loss model, the IASB emphasizes that the recognition of an increase in credit risk due to past due payments and therefore, past due information, is reasonable as supportable forward looking information might not always be available to assess credit risk (European Banking Authority, 2016a, p. 47).

## 4 Challenges from IFRS9 for Banks

The implementation of IFRS 9 causes different obstacles for entities, including a significant increase in credit risk (and thus regulatory capital requirements, the difficult and expensive task of developing models to assess expected credit losses, and the need to manage the manifold interactions of IFRS9 with other supervisory rules, particularly the Basel "Capital Requirements Regulation (CRR).

The major challenge will be to determine whether a financial instrument has been affected by a significant increase in credit risk since initial recognition. To track this increase, entities need to assess affected financial assets earlier than when they become impaired. This is only achieved by the high disclosure requirements under IFRS 9, where entities need to provide both qualitative and quantitative disclosure and any changes in those assumptions. The assessment is solely based on the changes in credit risk, not the total amount of expected credit losses (Ernst&Young, 2014, p. 30). Overall, the transfer criteria to move an asset from Stage 1 to Stage 2 is based on rating and scoring systems. A financial asset will be transferred once the level of risk has gone beyond a certain threshold (Brunel, 2016a, p. 77). There is no general approach for how entities should assess a significant increase in credit risk but using a multifactor and historic analysis is recommended. The main challenge is to collect relevant and reasonable

information. As those factors are sometimes only relevant for individual assets and not related to an increase in credit risk for financial assets or even too forward looking to be relevant, it is difficult to make a stable and encouraging decision whether there has been an increase in credit risk or not (European Banking Authority, 2016a, p. 17).

It might differ how the word "significant" is interpreted between entities because IFRS 9 does not propose a significant percentage by which the credit risk of a financial asset has to increase, due to not all of the entities are using the same assessment approach and only entities with similar interpretations are comparable. A bank is required to adjust its estimation about expected credit losses in any case, even if the increase in credit is not interpreted as significant (Basel Committee of Banking Supervision, 2015, p. 26). The same challenge arises with regard to the definition of "default". While the IASB decided not to define default, the capital adequacy framework (particularly Basel/CRR) defined it as the unlikeliness of the obligor to pay its obligations as well as an obligation which is already 90 days past due. A consistent definition of default would lead to a more stable estimation and is a key term regarding the calculation of expected credit losses (Novotny-Farkas, 2015, p. 21).

## 5 Discussion and Conclusion

The introduction of IFRS 9- Financial Instruments in January 2018 caused major changes within the classification and measurement of financial assets as well as the impairment and hedge accounting requirements compared to the current IAS 39 issued by the International Accounting Standard Board (IASB). These changes are mainly driven by the introduction of the expected credit loss model that replaces the previous incurred loss model under IAS 39. This model not only reclassifies financial assets depending on their development of credit risk, it also requires banks to estimate the expected credit losses according to the "point-in-time" approach rather than "through-the-cycle". While preparing for all those changes, banks were facing different obstacles. Apart from interpretation challenges arising from unclear definitions used by IFRS 9, banks also had to deal with the extent of disclosure requirements, which are necessary to improve transparency within the whole system. To disclose reliable and logical information, banks are required to collect not only historical but also forward looking information. This poses an obstacle, as not all of the necessary information is available in legacy systems. To account for all the findings in their existing processes, systems and data models, banks had to adapt their practices to the new standard.

Under IFRS 9, loss allowances and provision are expected to increase by 18% especially because of the existence of Stage 2 of the three-bucket approach (European Banking Authority, 2016b, p. 31). The extent of loss allowances will vary between entities depending on their portfolio and current financial situation. Entities handling short term financial assets with high credit quality are likely to be less affected than financial institutions with unsecured retail loans (Ernst&Young, 2014, p. 9). Additionally, the Basel Committee decided to ease the restrictions for less complex banks, in the way, that they only have to adopt to a proportionate approach with respect to their size and complexity of their portfolio (Basel Committee of Banking Supervision, 2015, p. 8). Independently from the banks portfolios, loss allowance will be determined by the forecast of economic conditions, increasing when the economy is forecasted to deteriorate and decreasing when the economy is stable. Highlighting the current economic situations, banks may increase their provisions when bank loans and profits generally grow, as a higher number of loans leads to a growing risk of expected credit losses (Leventis et al., 2010, p. 118). Due to the separation of 12 month expected credit losses and lifetime expected credit losses, the comparability of the reported results of different entities will mainly decrease. However, the information disclosure will provide greater transparency to the system, resulting in a better application of the new reporting standards under IFRS 9.

Apart from all the expected positive effects of IFRS 9, one may realize, that although the standard is intended to reduce pro-cyclicality, it in fact increases volatility in provisions overall. As entities need to adapt their provisions at each reporting date according to the

current financial situations, provisions are likely to increase or decrease more often than under the previous incurred loss model. This volatility will lead to a higher amount of financial resources required. Banks will need to rethink their product landscape because of the loss of profitability of specific products, particularly long-term lending (for example in real estate), as short term lending is not that affected. To avoid any negative impact while implementing the new standard and adopting to the new requirements, the European Banking Authority agreed on a phased-in transitional period of four years to smoothen the implementation process. During this period, the Basel Committee on Banking Supervision will offer guidance to further encourage the implementation process. It is highly recommended to carry out a parallel run of the previous and the new requirements in order to properly leverage off the previous models in compliance with IFRS.

*The opinions expressed are the authors‘ personal views

## References


Basel Committee of Banking Supervision (2015). *Guidance on accounting for expected credit losses*. Settlements, BIS Basle Committee on Banking Supervision, Consultative Document. Retrieved from: http://www.bis.org/bcbs/publ/d311.pdf.

Brunel, V. (2016a). Loan classification under IFRS 9. *Risk*, vol. 29(5), pp. 73-76.

Brunel, V. (2016b). Sizing the Stage 2 Portfolio for IFRS 9 Provisions. *Working paper*. Retrieved from: https://ssrn.com/abstract=2606080.

Chidawaya, L., Bajaj, A., Dai, K., Ha, Y. S., Martin, D., Nq, S., Shotter, R., Li, Y. (2016). *Applying IFRS 9 to Central Banks foreign reserves*. The Worldbank, Study Nr 102852. Retrieved from: http://documents.worldbank.org/curated/en/982181467999355382/pdf/102852-WP-Box394847B-PUBLIC-20-1-2016-16-8-46-Applying-IFRS-9-to-Central-Banks-Foreign-Reserve.pdf.

Cohen, B. H., Edwards, G. A. (2017). The new era of expected credit loss provisioning. *BIS Quarterly Review*. Retrieved from: http://www.bis.org/publ/qtrpdf/r_qt1703f.pdf.

Damyanova, V., Garrido, F. (2017a). *Day 1 Impact Of IFRS 9 On Banks Less Worrying Than Future Risks, Experts Say, Standard & Poors Global Market Intelligence*. Retrieved from: https://marketintelligence.spglobal.com/our-thinking/ideas/day-1-impact-of-ifrs-9-on-banks-less-worrying-than-future-risks-experts-say.

Damyanova, V., Garrido, F. (2017b). *IFRS 9 Implementation Challenge For Low Default Portfolios: One Possible Approach To Compute PDs, Standard & Poors Global Market Intelligence*. Retrieved from: https://marketintelligence.spglobal.com/our-thinking/ideas/day-1-impact-of-ifrs-9-on-banks-less-worrying-than-future-risks-experts-say.

Deloitte (2010). *Financial Instruments – Derecognition*. Deloitte. Retrieved from: https://www.iasplus.com/en/projects/completed/fi/derecognition.

Deloitte (2016). *Sixth Gloabl IFRS Banking Survey - No time like the present*. Deloitte.

Ernst&Young (2014). *Impairment of Financial Instruments under IFRS.* Retrieved from: http://www.ey.com/Publication/vwLUAssets/Applying_IFRS:_Impairment_of_financial_instruments_under_IFRS_9/$FILE/Apply-FI-Dec2014.pdf.

Ernst&Young (2015). *Wertminderungen finanzieller Vermögenswerte nach IFRS 9*. Retrieved from: http://www.ey.com/Publication/vwLUAssets/EY_Wertminderungen_finanzieller_Vermoegenswerte_nach_IFRS_9/$FILE/EY-Wertminderungen-finanzieller-Vermoegenswerte-%20nach-IFRS9.pdf.

European Banking Authority (EBA, 2016a). *Draft Guidelines on credit institutions' credit risk management practices and accounting for expected credit losses*. Retrieved from: http://www.eba.europa.eu/documents/10180/1532063/EBA-CP-2016-10+%28CP+on+Guidelines+on+Accounting+for+Expected+Credit%29.pdf.

European Banking Authority (2016b). *Report on results from the EBA impact assessmen of IFRS9.* EBA. Retrieved from: http://www.eba.europa.eu/documents/10180/1360107/EBA+Report+on+impact+assessment+of+IFRS9.

Ha, Y. S. (2017). *Transition to IFRS 9: Practical Guidance for foreign Reserves of Central Banks* (27471). The World Bank. Retrieved from: https://openknowledge.worldbank.org/bitstream/handle/10986/27471/116375-REVISED-14p-Transition-to-IFRS-9-Practical-Guidance-for-the-Foreign-Reserves-of-Cent.pdf?sequence=1.

Halep, M. (2015). The IFRS9 Standard: Assessment of the Impacts on the European Banking Industry. *Ovidius University Annals, Series Economic Sciences*, vol. 15(1), pp. 930-935.

Harrison, M., Sigee, J. (2017). *IFRS 9 - Bigger than Basel IV*. Barclays Equity Research. Retrieved from: http://www.eifr.eu/document/file/download/1877/barclays-european-banks-ifrs9-bigger-than-basel-iv-jan-17-pdf.

Hlawatsch, S., Ostrowski, S. (2010). Economic Loan Loss Provision and Expected Loss. *BuR Business Research Journal*, vol. 3(2), pp. 133-149.

Huian, M. C. (2012). Accounting for financial assets and financial liabiliies according to IFRS 9. *Economic Sciences*, vol. 59(1), pp. 27-47.

IFRS Interpretations Committee (2017). IFRS 9 Financial Instruments - Modifications and exchanges of financial liabilities, *IFRS Interpretations Committee Meeting*, pp. 51. Retrieved from: http://www.ifrs.org/-/media/feature/meetings/2017/june/ifric/ifrs-9-financialinstruments/ap6e-financial-instruments-modification-of-financial-liabilities.pdf.

International Accounting Standard Board (2011). *International Accounting Standard 39 – Financial Instruments: Recognition and Measurement*. Retrieved from: http://ec.europa.eu/internal_market/accounting/docs/consolidated/ias39_en.pdf.

International Accounting Standards Board (2014). *IFRS 9 - Financial Instruments*. Retrieved from: https://www.ifrs.org/issued-standards/list-of-standards/ifrs-9-financial-instruments/.

Leventis, S., Dimitropoulos, P., Anandarajan, A. (2010). Loan Loss Provisioning, Earnings Management and Capital Management under IFRS: The Case of EU Commercial Banks. *Journal of Financial Services Research*, vol. 40, pp. 103-122.

Novotny-Farkas, Z. (2015). The Significance of IFRS 9 for Financial Stability and Supervisory Rules. *European Parliament, Directorate General for the Internal Policies Department A: Economic and Scientific Policy, for ECON Committee.* IP/A/ECON/2015-14. Retrieved from: http://www.europarl.europa.eu/RegData/etudes/STUD/2015/563461/IPOL_STU%282015%29563461_EN.pdf.

Reitgruber, W. (2016). Expected loss provisioning under upcoming IFRS 9 Impairment Standards: A new source of P&L volatility -- can we tame it? *Journal of Risk Management in Financial Institutions*, vol. 9(4), pp. 332-343.

Vanek, T. (2016). Economic Adjustment of Default Probabilities. *European Journal of Business Science and Technology*, vol. 2(2), pp. 122-130.

# Excise Tax Harmonization in the EU

**Taťána Hajdíková[1], Karel Janák[2], Olga Oberreiterová[3]**

[1]University of Economics, Prague, Faculty of Management, Department of Management, Jarosovska 1117/II, 37701, Jindrichuv Hradec, Czech Republic
E-mail: hajdikova@fm.vse.cz

[2]University of Economics, Prague, Faculty of Management, Department of Management, Jarosovska 1117/II, 37701, Jindrichuv Hradec, Czech Republic
E-mail: janak69@seznam.cz

[3]University of Economics, Prague, Faculty of Management, Department of Management, Jarosovska 1117/II, 37701, Jindrichuv Hradec, Czech Republic
E-mail: obeo00@vse.cz

***Abstract**: Excise taxes are a constant part of state budget revenue. They represent a stable income that governments can influence by raising the tax rate. Despite the fact that excise duties are mainly burdened with products that negatively affect our health and the environment, governments must increase their tax burden with caution. For most of these products it is not possible to find suitable substitutes and therefore the elasticity of demand is very small. The application of a change in the rate of excise duties can significantly affect the overall impact of taxes on taxpayers and the distribution of income in a company of a particular state. In trade between states, different procedures can be used to include or exclude excise duties on the prices of taxed products and tax competition between states can occur. The paper comments on its findings from the unfulfilled partial objective of excise tax harmonization, which consists in unifying the rate for individual selected products. The main reason for this failure is the collection of excise duty in the state where the selected product is put into circulation. Thus, the choice of excise duty remains the responsibility of national governments. States are also influenced by the historical development of the country in the rate setting, where certain types of alcoholic and tobacco products may be preferred. Yet harmonization in this tax area is successful in unifying the structure of selective taxes. A comparison of the taxation of individual groups of alcoholic beverages in selected European Union countries shows that these countries comply with the prescribed minimum rates for these selected products.*

*Keywords: fiscal benefits, harmonization, excise duty, tax rate*

*JEL codes: H20, H21*

## 1 Introduction

The concept of excise duties is used in European Union legislation. Excise taxes are an important part of state budget revenue. It is a stable income that the government can also influence by raising tax rates. Despite the fact that excise taxes are mainly burdened with products that negatively affect our health and the environment, the government must increase tax burden cautiously (Kubátová, 2015) (Berkhout et al., 2014). It is not possible to find suitable substitutes for most of these products. The elasticity of demand is therefore very small (Legierska, 2013). Nevertheless, too high a rise in tax rates could lead to a reduction in consumption and no expected increase in excise tax revenues (Široký, 2013).

The aim of harmonization is related to the idea of creating a single internal market for EU member countries. The main condition is to remove the trade barrier. The obstacles to the creation of the single market included different systems for collecting and setting indirect taxes. In the case of excise duties, the focus was mainly on the leveling of individual rates. Therefore, a number of excise tax directives were adopted in the 1990s. Tax rates have been gradually phased out of efforts to unify their rates and only minimum rates have been set. The main reason for this solution was significant historical

differences in the choice and determination of excise duties in individual countries (Nerudová, 2008). In connection with the introduction of the single market on 1 January 1993, Council Directive 92/12 /EEC was adopted in 1992, which regulates the handling of excisable products in general. This Directive has been substantially amended several times (92/12 / EEC).

The excise tax theme is still relevant in the EU. A positive benefit for collection to the state budget is the prediction of their income, contrary to badly predicted pension taxes (Hamerníková, 1999). Berkhout (2014) leads the contradictory opposition in his study. The influence of the tax control function directly on consumers was elaborated by a team of authors Chaloupka et al. (2002). When the excise duty on alcohol increases, consumer behavior of selected groups of consumers changes (Chaloupka et al., 2002). In the long run, however, other factors than the excise duty rate have a major impact on consumer behavior (Lisický, 2017). The impact on the reduction of the negative redistributive effects of VAT and excise duty is wider beyond the scope of the indirect tax reform (Krajewska, 2018).

## 2 Methodology and Data

For the purposes of research, the secondary longitudinal data was used. The Eurostat database for 2017 is used to obtain data. These data are processed by individual EU Member States according to a unified methodology (ČSÚ, 2011). Since some Member States of the European Union use the Euro currency and some still use their national currencies, the data for all states are denominated in Euros. A comparison of the amount of excise duty collected is made on a sample of 12 countries. States are chosen so that the differences in access to excise duties are clear, because a different approach is expected in different parts of the European Union, mainly due to historical developments. The selection thus includes the following 12 countries: Czech Republic, France, Germany, Finland, Poland, Romania, Austria, Greece, Slovakia, Spain, Sweden and the United Kingdom. The most recent data are used for comparison, as the excise tax area is relatively stable in terms of these taxes and there are no rapid and significant changes. After the analysis, the data will be compared between countries. It is possible to determine the same or different aspects of the phenomenon.

**Beer**

Beer is a product containing more than 0.5% by volume of alcohol included in the Combined Nomenclature under code 2203. Furthermore, it includes mixtures of beer with non-alcoholic beverages containing more than 0.5% by volume of alcohol. These mixtures are classified under nomenclature code 2206 (Directive 92/83/EHS). Furthermore, the Directive provides that small independent breweries whose annual beer production is not more than 200 000 hl and fulfill the conditions of independence may benefit from a reduced tax rate. This reduced rate may not be less than 50% of the stated national base rate. At the same time, Member States may choose to calculate the excise duty on the beer unit.

**Wine**

For tax purposes, wines are divided into silent and sparkling wines, listed under nomenclature codes 2204, 2205, 2206, containing 1.2% - 22% by volume of alcohol. Taxation of wine is governed by Directive 92/84/EHS, which sets a minimum rate of EUR 0 for both silent and sparkling wines. Some Member States also apply a reduced rate for low alcohol wines in accordance with Directive 92/83/EHS. This option is used by Germany, Finland, Sweden and the United Kingdom. Most selected countries use a different rate for silent and sparkling wines, only Spain has a zero rate for wine. The Czech Republic, Germany, Romania, Austria and Slovakia use zero rate for quiet wines. Other states tax silent wines at a rate of EUR 3.77 to EUR 377.14 / hl. Sparkling wines are taxed by all selected countries, again very different taxation from 9.33 to 483.06 EUR / hl.

**Spirits**

In the case of ethyl alcohol, alcohol contained in any product other than those listed under nomenclature codes 2203, 2204, 2205, 2206 is subject to taxation if these contain more than 1,2% by volume of ethanol. The subject of the tax is also alcohol contained in the products with nomenclature codes 2204, 2205, 2206 if they contain more than 22% by volume of ethanol (Act No. 353/2003 Coll.). These are products classified under nomenclature codes 2207. The minimum rate is set at EUR 550 or EUR 1000 / hl. The reduced rate in this case shall not be less than 50% of the standard rate (Directive 92/84/EHS).

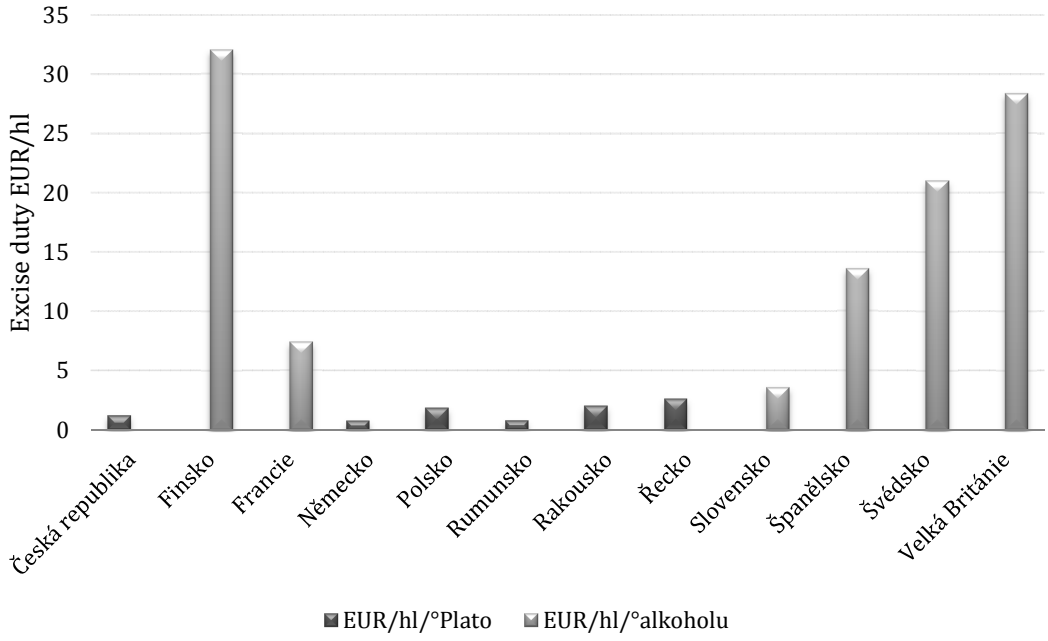
**Cigarettes**

The sum of the fixed and the percentage is used to calculate the excise duty on cigarettes. At the same time, Council Directive 2011/64/EU provides that, as from 1 January 2014, the total excise duty on cigarettes may not be less than 60% of the weighted average retail price, but notwithstanding this price, it shall not be less than EUR 90 per 1000 cigarettes. In all the countries under comparison, the excise duty exceeds the set minimum rate. Individual states use very different fixed and percentage ratios, and the total tax varies greatly. The lowest total tax in the Czech Republic is EUR 95.50 and the highest in the UK is EUR 311.99 per 1000 cigarettes. The difference is therefore € 217.49 per 1000 cigarettes.

## 3 Results and Discussion

Figure 1 shows that Finland has the highest excise duty on beer. On the other hand, Germany, Romania and the Czech Republic set the lowest tax. The low excise tax is historically given in the case of the Czech Republic and Germany. Beer is perceived as a national drink in these states and governments take this into account when setting the tax. There is no room for a higher tax burden in Romania because the tax burden must be in line with the economic situation of the population.

**Figure 1** Excise Duty on Beer in Selected EU Countries

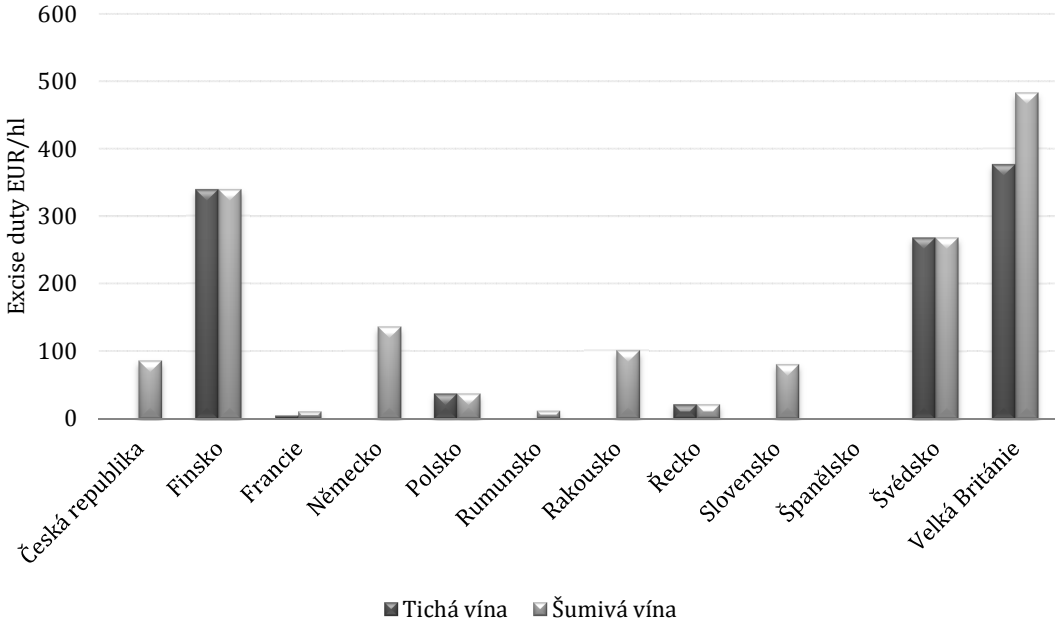



Source: own research

Figure 2 shows that the highest wine tax is in the UK, Finland and Sweden. Of these three countries, Great Britain has the highest taxation for both silent and sparkling wines. On the other side of this imaginary ranking is Spain, which does not levy any tax

on wine and France, Romania and Greece, where it is rather symbolic taxation. The remaining countries are taxed only by sparkling wines. We consider the fact that most of the monitored states use low rates for wine taxation is a result of historical development, because in these states wine production has a long tradition and winemakers have managed to enforce low taxes. In the figure, only the basic tax rate data has been used because the reduced rate is used only to a limited extent by 4 states and is rather informative.

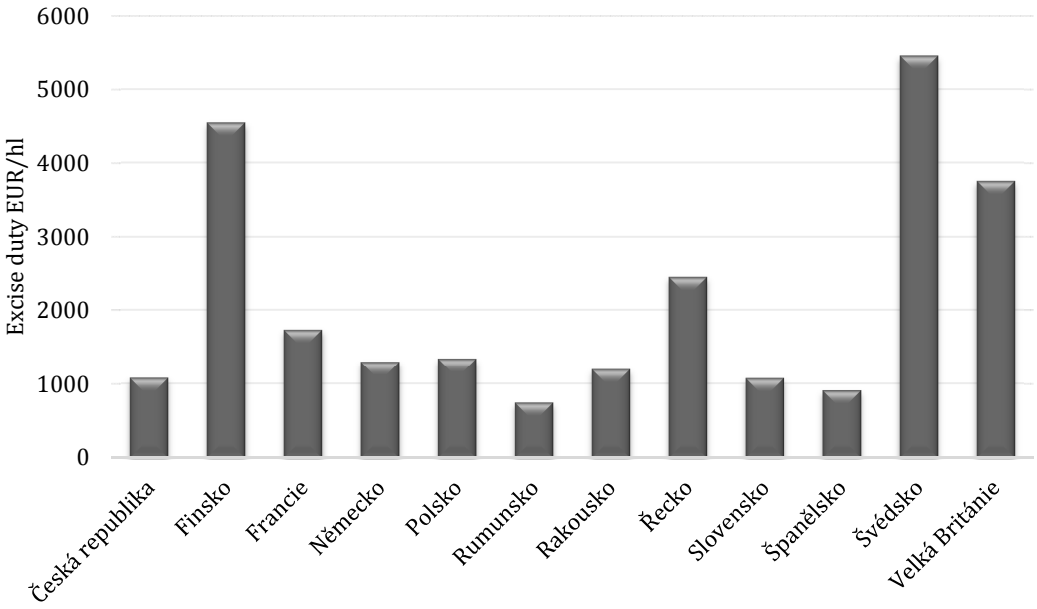
**Figure 2** Excise Duty on Still and Sparkling Wines in Selected EU Countries




Source: own research

Figure 3 shows that Sweden, Finland, Great Britain and Greece use the highest alcohol tax. The rate of taxation in other states is almost the same. Quite surprising is the amount of taxation in Greece, because the taxation of other alcoholic beverages is very low here. The reason for high taxation of alcohol can be to try to support the consumption of wine from domestic producers. Only the base rate is shown in the figure, as not all states use reduced rates. The reduced rate is used for specific products or for the taxation of cultivation.

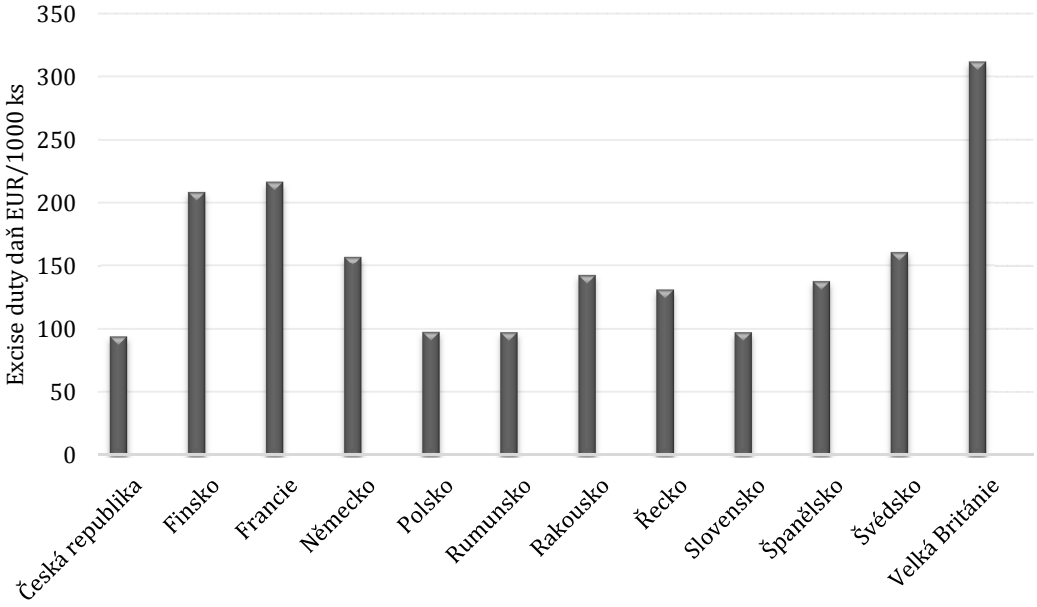
**Figure 3** Excise Duty on Spirits in Selected EU Countries




Source: own research

For the graphical representation, the data on the total excise duty per 1000 cigarettes are used. Figure 4 shows that even in the countries with the lowest taxation, the excise tax reaches almost EUR 100 per 1000 cigarettes. This is due to the fixing of a minimum rate of not less than EUR 90 per 1000 cigarettes. The lowest tax on cigarettes is applied by the Czech Republic, Poland, Romania and Slovakia. Great Britain has the highest tax, followed by France and Finland. The level of taxation in France is quite surprising, as in the case of other selected products, taxation in France is low.

**Figure 4** Excise Duty on Cigarettes in Selected EU Countries




Source: own research

## 4 Conclusions

A comparison of the taxation of individual groups of alcoholic beverages in selected European Union countries shows that these countries comply with the prescribed

minimum rates for these selected products. But this is the only common feature. The rate of taxation in different groups of alcoholic beverages is very different. The highest rates of taxation for all groups are used by Finland, Great Britain and Sweden. For these countries, the tax rate is well above the base rate and is much higher than for the other selected states. In the case of low taxation, the situation is not so clear, in some cases the situation is affected by historical developments in individual countries, where some drinks are considered national. One example is the low taxation of beer in the Czech Republic and Germany, or the low taxation of wine in Spain and France, where the tax is zero in Spain. However, other examples can be found, such as the low taxation of cider and perry in the UK and Ouzo in Greece. It follows that the only result of the harmonization of excise duty for alcoholic beverages is the establishment and observance of minimum rates for individual groups of alcoholic beverages.

For tobacco products, the situation is similar to alcoholic beverages. All selected countries adhere to the minimum set rates for each type of tobacco product. Some states, however, exceed this minimum rate very little. It is the Czech Republic for cigarettes and Germany for cigars and cigarillos. In general, tobacco products are mostly taxed by Great Britain, France, Sweden and Finland. In particular, the UK and Sweden in all tobacco product groups exceed several times the minimum rate. The taxation of tobacco products in other selected countries does not significantly exceed the set minimum rates and is about the same.

## Acknowledgments

This paper was funded from the resources of the project IG632039, a negotiated contract between the researchers and IGC (Internal Grant Competition), University of Economics in Prague.

## References

Act No 353/2003 Coll., on Excise Duties, as amended.

Berkhout, B., Bleeker, Y., Kruis, G., de Wit, W. (2014). Economic effects of high excise duties
on beer. *The Brewers of Europe.* Retrieved from: www.brewersofeurope.org/site/mediacentre/index.php?doc_id=862&class_id=31&detail=true.

Hamerníková, B., Kubátová, K. (1999). *Veřejné finance*. Praha: Eurolex Bohemia.

Chaloupka, F. J., Grossman, M., Saffer, H. (2002). The effects of price on alcohol consumption and alcohol-related problems. *Alcohol research and health*, vol. 26(1), pp. 22-34.

Krajewska, A., Osiecka K. (2018). Taxation of Consumption in Poland. Redistribution and Fiscal Effects. In: Nešleha, J., Plíhal, T., Urbanovský, K., ed., *European Financial Systems 2018. Proceedings of the 15th International Scientific Conference. Part 2*. Brno: Masarykova univerzita, pp. 315-322.

Kubátová, K. (2015). *Daňová teorie a politika*. Praha: Wolters Kluwer. ISBN 978-80-7478- 841-3.

Legierská, Y. (2013). Analýza zdaňování spotřeby v ČR a v zemích OECD. In: *Teoretické a praktické aspekty veřejných financí*. Praha: Vysoká škola ekonomická. ISBN 978-80-245- 1929-6.

Lisicky, A., David, P. (2017). Relationship between import and export of beer withrate of excise duty on beer in EU countries. *Proceedings of the 12th Annual International Scientific Conference NEW TRENDS 2017 New Trends in Economics, Management, Marketing and Public Administration*. Znojmo: Private College of Economic Studies Znojmo, pp. 259-266.

Nerudová, D. (2008). *Harmonizace daňových systémů zemí Evropské unie*. 2. aktualizované vydání. Praha: ASPI.

ČSÚ (2011). *Evropská unie - Eurostat | ČSÚ.* Odbor mezinárodní spolupráce. Retrieved from: https://www.czso.cz/csu/czso/evropska_unie_eurostat (Accessed on 27. 12. 2016)

Council Directive 2011/64/EU of 21 June 2011 on the structure and rates of excise duty applied to manufactured tobacco.

Council Directive 92/12/EEC of 25 February 1992 on the general arrangements for products subject to excise duty and on the holding, movement and monitoring of such products. Special edition in Czech: Chapter 09 Volume 001, pp. 179 - 191.

Council Directive 92/83/EEC of 19 October 1992 on the harmonization of the structures of excise duties on alcohol and alcoholic beverages. Special edition in Czech: Chapter 09 Volume 001. pp. 206 – 212.

Council Directive 92/84/EEC of 19 October 1992 on the approximation of the rates of excise duty on alcohol and alcoholic beverages. Special edition in Czech: Chapter 09 Volume 001, pp. 213 – 215.

ŠIROKÝ, J. (2013). *Daně v Evropské unii: daňové systémy všech 28 členských států EU, legislativní základy daňové harmonizace včetně judikátů SD, odraz ekonomické krize v daňové politice EU, zdanění finančního sektoru*. Praha: Linde Praha. ISBN 978-80-7201-925-0.

# Searchability and Machine-Readability of the Financial Statements of the Czech Business Corporations and Their Influence on the Financial Performance

**Filip Hampl, Elena Láncošová, Zuzana Rakovská**

Masaryk University
Faculty of Economics and Administration, Department of Finance
Lipová 41a, 602 00 Brno-Pisárky, Czech Republic
E-mail: filip.hampl@mail.muni.cz; lancosovaelena@gmail.com; zuzana.rakovska@mail.muni.cz

***Abstract:*** *Financial and non-financial data presented in the financial statements and annual reports represent a valuable information source capturing economic activities in business corporations, accounting units. Machine-readable (or at least searchable) financial statements allow software equipment to find, to recognise and to extract easily data and valuable information about, e.g. ownership of risk-assets, cryptocurrencies or research and development activities. The paper aims to find out whether the Czech business corporations prepare their financial statements in the machine-readable/searchable format and whether the machine-readability/searchability is connected to their financial performance. The examined period was 2015-2017, and logistic regression was used. The data was obtained from the Czech Business Register by using a software script written by the authors and from the database of Czech and Slovak economic entities Bisnode Magnusweb. We discovered that most business corporations prepare non-searchable financial statements (no company prepares machine-readable statements). The ratio of searchable statements decreases each year. More companies change their statements from searchable to non-searchable than vice versa during the examined period. We found out that companies with non-searchable statements are more likely to have higher future long-term performance.*

*Keywords: financial analysis indicators, financial performance, financial statements, logistic regression, machine-readability, non-searchability, searchability*

*JEL codes: M14, M41, M48*

## 1 Introduction

Financial and non-financial information contained in the financial statements and annual reports (from now on referred to as "financial statements") are the crucial input for the financial or other types of analyses. These reports are often standardized for a human review but not for a computer processing allowing cheap and effortless automatic location, acquisition, arrangement of data for the digital processing of the analyses (Yoon et al., 2011). Manual data transfer from the statements to the software is time-consuming, causes significant risk of non-systematic errors and high costs (Ištvánfyová and Mejzlík, 2006). These costs are not connected only with the transfer of numerical (often structured) data but particularly textual data which contains valuable information about e.g. ownership of risk assets like investments in start-ups or cryptocurrencies (Bitcoins, Litecoins, Ethereum), activities related to cryptocurrency mining, research and development activities or the course of future development.

Computer data processing facilitates information location and acquisition, reduces the time and costs of such processing and, thus supports making more informed decisions and judgements (Hodge and Maines, 2004). We can distinguish limited computer data processing allowed by searchable data and full computer processing allowed by machine-readable data. *Searchable* financial statements can be searched by software – thus, it is possible to search for words, numbers and information in this data, but it is complicated or even not possible to connect, e.g. numbers with their meaning (whether they are cash, receivables or revenues). Contrary to searchable data, *machine-readable* data can be fully computer processed. Machine-readable data can be defined as a data in such a structured format that allows software equipment to find, to recognise and to extract

easily from this data particular information and to understand its meaning (Czech Act No. 106/1999 Coll., § 3; Warner, 2016). Thanks to that, machine-readable data format allows the analysis without extensible and burdensome manual data processing (ESMA, 2017a) and to extract and to simultaneously exhibit all identically coded information from financial statements. For example, a search on "long-term financial assets" would retrieve not only numbers from the balance sheet but also information related to financial assets disclosed in the notes (Hodge and Maines, 2004).

There are two types of machine-readable data:

1. Human-readable data (convenient for humans to read and understand) that is marked up to be machine-readable (e.g. HTML/XHTML, PDF/A-3, RDFa or newly designed ESEF). ESEF (European Single Electronic Format) represents a format prepared by the European Securities and Market Authority (ESMA) in 2017 (ESMA, 2017b). All issuers of securities traded on regulated markets within the European Union have to use it for the preparation of their financial statements from 1 January 2020 (1 January 2022 regarding notes). ESEF requires preparation of all annual financial reports in XHTML format, that is human-readable, and tagging the data using iXBRL (inline eXtensible Business Reporting Language) (ESMA, 2019). These iXBRL "tags" give meaning to the figures and statements in a format that can be understood by computer software (XBRL, 2019).
2. Data primary designed as machine-readable. This data is not human-readable – it is structured and primarily intended for processing by machines (e.g. RDF, XML, JSON) (Austin and Sallabank, 2011).

It should be noted that text document formats like DOCX or PDF are primary human-readable and can be searchable as well, but usually, they are not machine-readable because of lack of machine-understandable structure (Hendler, 2012; Remsen et al., 2012).

Preparation of machine-readable financial statements is compulsory for issuers in many countries like United States, United Kingdom, Japan or Denmark. There are a lot of studies discussing the costs and benefits of machine-readable financial statements, especially in (i)XBRL format. According to Yoon et al. (2011) in the Korean capital market and Liu et al. (2017) in the European securities market, adoption of machine-readability reduced information asymmetry and increased market liquidity. On the other hand, Cong et al. (2014) or Yen and Wang (2015) demonstrated the increase in information asymmetry and trading volumes. Cormier et al. (2018) stated a significant effect of machine-readability implementation on transparency and reliability of information produced for market participants and on the ability of investors and financial analysts to receive and to analyse data rapidly and efficiently. According to Birt et al. (2017), financial information presented with iXBRL is significantly more relevant, understandable and comparable even to non-professional investors.

In the Czech Republic, business corporations are not obliged to disclose their financial statements in the searchable or machine-readable format in the Business Register. Based on continuing digitalisation, further development of the computer technologies and the public pressure on companies to disclose financial statements in the machine-readable (or at least searchable form), we stated the first hypothesis H1:

**H1:** *During the examined period of 2015-2017, the number of companies disclosing their financial statements in the machine-readable form, or at least searchable form, was increasing.*

After the company once implements in its accounting department the preparation of the financial statements in the machine-readable/searchable form, it continues preparing them that way. That's why we express the second hypothesis H2:

**H2:** *Once the company has started disclosing its data in machine-readable/searchable form, it will continue preparing their statements in that form.*

We were also interested in influence of machine-readability/searchability on financial performance of business corporations. We assume that more efficient and profitable companies have more resources for the implementation of machine-readability/searchability. The more profitable companies usually have no reason to hide their financial results from the accounting data and other non-financial data users, e.g. business partners, financial analysts or the public. And vice versa, machine-readable/searchable statements show transparency and can motivate business partners to make deals with a company. Based on the above mentioned, we assume the third hypothesis divided into two sub-hypotheses H3a and H3b:

**H3a:** *The more efficient and profitable companies measured by financial performance indicators disclose their financial statements in the machine-readable/searchable form.*

**H3b:** *The machine-readable/searchable statements increase the financial performance of companies.*

## 2 Methodology and Data

The analysis performed in this paper has been based on the disclosed financial statements and accounting data of selected business corporations – legal entities, operating in the territory of the Czech Republic. Disclosed financial statements for assessing their machine-readability (or at least searchability) were obtained from the Czech Business Register maintained by the Ministry of Justice of the Czech Republic. Over 3.000 financial statements were downloaded by using a script written by the authors in Python programming language. Accounting data for performance evaluation was retrieved from the database of Czech and Slovak economic entities Bisnode Magnusweb. The examined period is 2015-2017 (the year 2018 is not included as the financial statements and accounting data are unavailable). The companies with missing data required for the analysis (i.e. unavailability of disclosed financial statements during the whole period considered) were excluded from the dataset. The final sample comprises a total of 989 financial statements. This sample was subsequently evaluated using a script created by the authors in R Programming Language.

The first hypothesis was assessed by observing the development of the following Ratio of the financial statement readability/searchability (1) in the period 2015-2017:

$$Readability/Searchability\ Ratio = \frac{Machine{-}readable\ (searchable)\ statements}{Total\ number\ of\ companies' statements} \quad (1)$$

For the assessment of the second hypothesis, we calculated the Change Ratios defined by the following formula (2). These ratios express whether companies prepare their financial statements consistently with the chosen way of preparing statements.

$$Change\ Ratios = \frac{Defined\ change}{Total\ number\ of\ companies' statements} \quad (2)$$

where "defined change" represents:

a) machine-readable/searchable in the whole period 2015-2017,
b) non-machine-readable/non-searchable in the whole period 2015-2017,
c) change from machine-readable/searchable to non-machine-readable/non-searchable,
d) change from non-machine-readable/non-searchable to machine readable/searchable, or
e) multiple changes during the period 2015-2017.

Based on Knápková et al. (2017), the third hypothesis was evaluated by using the selected financial performance indicators: return on assets (ROA), return on sales (ROS), debt ratio (DR), current ratio (CR) and asset turnover ratio (ATR). To calculate ROS and

ROA, the earnings before interest and taxes (EBIT) were used as this allows analysing the performance of a company's core operations without the influence of taxes and costs of the capital structure. Růžičková (2010) considers it as the most important since it is based on the main activity of the entity. For the purposes of the analysis, the mean values of the following indicators for the period 2015-2017 were applied:

- ROS (EBIT over sales) is an indicator of profitability measuring how efficiently a company generates profits from its sales;
- ROA (EBIT over assets) is a measure of profitability which evaluates how efficiently a company can manage its assets to generate profits;
- DR (liabilities over total assets) is a measure of the financial leverage;
- CR (current assets over current liabilities) is a liquidity ratio that measures the ability of a company to cover its short-term liabilities with its current assets;
- ATR (sales over total assets) measures the efficiency of using assets to generate profits.

These indicators mentioned above were used as an input for the logistic regression model. This model was estimated to assess the influence of a company's performance on the probability that its financial statements will be presented in machine-readable, or at least searchable, form. We used the logistic regression in this paper because of need to model the posterior probabilities of the two classes via linear functions (as in linear regression), while at the same time ensuring that they sum to one and prediction remains between zero and one. Machine-readability/searchability of the statements for each year was used as the predicted variable and mean values of financial performance indicators were used as predictors. The model has the form (Hastie et al., 2009)

$$log\,\frac{\Pr(G=K-1|X=x)}{\Pr(G=K\,|X=x)} = \beta_{(K-1)0} + \beta_{K-1}^{T}\,x \tag{3}$$

To test the hypothesis, that a particular coefficient $\beta_j = 0$, we form the standardised coefficient:

$$z_j = \frac{\beta_j}{\sigma\sqrt{v_j}} \tag{4}$$

where: $v_j$ is the $j^{th}$ diagonal element of $(\mathbf{X}^T\mathbf{X})^{-1}$.

Under the null hypothesis that $\beta_j = 0$, $z_j$ is distributed as t distribution with N-p-1 degrees of freedom (Hastie et al., 2009).

MS Excel was used to calculate financial performance indicators and R programming language employing Stats v3.6.0 package was used to evaluate data and to perform logistic regression estimation (R Core Team, 2013).

## 3 Results and Discussion

Based on the evaluation of downloaded financial statements in R Programming Language, we found out that no business company discloses its financial statements in the machine-readable form – we discovered only searchable forms of the financial statements. Thus, solely searchability of financial statements is considered in this paper from now on.

To assess the first hypothesis, the Searchability Ratio (1) was calculated. Results for each year of the examined period are shown in Table 1.

**Table 1** Results of Searchability Ratio for each year of the period 2015-2017

| | **2015** | **2016** | **2017** |
|---|---|---|---|
| **Searchability Ratio** | 26.14% | 23.43% | 21.76% |

Source: own calculations

As we can see from Table 1, the Searchability Ratio decreases every year. Therefore, we reject our first hypothesis. One possible reason behind this unexpected trend could be an increasing focus on internet privacy. Searchable financial statements can be easily

scanned by the computer software or scraped[4] by bots, while non-searchable can be read only by human analysts, especially in the Czech language. Another possible explanation could be increasing competition on the market forcing companies to restrict information publicly shared. In addition, legislation could be the reason causing that on average over the whole period, only 23,78% of selected companies disclosure their statements in the searchable form. In the Czech Republic, all financial statements have to be uploaded to Business Register in the PDF format (Czech Government Decree No. 351/2013 Coll., § 18) but there is no obligation to upload them in the searchable form. Ministry of Justice of the Czech Republic (2014) published just recommendation that PDF ought to be searchable (it is not a legal obligation).

To evaluate the second hypothesis, the Change Ratios (2) were calculated. The results are presented in Table 2.

**Table 2** Results of Change Ratios for the period 2015-2017

| | |
|---|---|
| Searchable in the whole period | 15.2% |
| Non-searchable in the whole period | 64.7% |
| Change from searchable to non-searchable | 9.1% |
| Change from non-searchable to searchable | 5.9% |
| Multiple changes during the period | 5.0% |

Source: own calculations

Table 2 shows that the majority (64.7%) of companies present their financial statements in non-searchable form over the whole period 2015-2017. Only 15.2% of companies prepare their statements in searchable form over the whole period. There were 5.9% of companies in our sample which started preparing their statements in the searchable form. On the other hand, 9.1% of companies stopped disclosing searchable statements during the examined period as our previous findings suggested it. Based on these results, we reject our second hypothesis as the changes in the form are considerable during the period.

The results of the logistic regression model are presented in Table 3. The results do not confirm our H3a hypothesis, which states that more profitable companies disclose their financial statements in the searchable form. The coefficients of statistically significant (at 0.1 in 2015 and 2016) ROA indicator are negative. The results show that better-performing companies are less likely to disclose their financial statements in the searchable form – companies with ROA by 1 unit higher have the probability of searchable statements lower by 84,57% (2015) and 87,88% (2016). On the other hand, the result of DR in the logistic regression model with the searchability in 2015 used as the predicted variable (A) suggests that companies with DR by 1 unit higher are 2.6 times more likely to have searchable statements. This could be explained by banks and other stakeholders requiring higher transparency. Results of the regression (B) show that the debt ratio is no longer significant. This could be given by the trend observed in the previous hypothesis causing even indebted companies to hide their privacy.

**Table 3** Results of the logistic regression model estimation for the period 2015-2017

| | **coefficient** | **std. dev.** | **Z-value** | **p-value** | **sig.** |
|---|---|---|---|---|---|
| (A) Predicted variable: searchability 2015 | | | | | |
| Intercept | -0.261 | 0.311 | -0.837 | 0.402 | ns |
| ROA | -1.869 | 0.906 | -2.064 | 0.039 | * |
| ROS | -0.001 | 0.001 | -0.930 | 0.353 | ns |
| DR | 0.955 | 0.478 | -1.999 | 0.046 | * |
| CR | -0.016 | 0.017 | -0.948 | 0.343 | ns |
| ATR | -0.057 | 0.085 | -0.670 | 0.503 | ns |

[4] Term typically refers to automated processes implemented using a bot used for extracting data from websites.

| | | | | | |
|---|---|---|---|---|---|
| (B) Predicted variable: searchability 2016 | | | | | |
| Intercept | -0.252 | 0.296 | -0.852 | 0.394 | ns |
| ROA | -2.111 | 0.916 | -2.304 | 0.021 | * |
| ROS | -0.001 | 0.001 | -0.876 | 0.381 | ns |
| DR | -0.817 | 0.465 | -1.758 | 0.079 | ns |
| CR | -0.007 | 0.009 | -0.770 | 0.441 | ns |
| ATR | -0.102 | 0.091 | -1.125 | 0.261 | ns |
| (C) Predicted variable: searchability 2017 | | | | | |
| Intercept | -0.445 | 0.299 | -1.488 | 0.137 | ns |
| ROA | -1.426 | 0.943 | -1.512 | 0.130 | ns |
| ROS | -0.001 | 0.001 | -0.890 | 0.373 | ns |
| DR | -0.699 | 0.480 | -1.458 | 0.145 | ns |
| CR | 0.003 | 0.002 | 1.142 | 0.254 | ns |
| ATR | -0.190 | 0.106 | -1.798 | 0.072 | ns |

Source: own calculations processed in R Programming Language; Note: The asterisks indicate statistical significance levels at 0.1 (*), 0.05 (**) and 0.01 (***); "ns" indicates no statistical significance. Mean values of financial performance indicators were used as predictors.

We estimated the logistic regression model using searchability information as the predicted variable for the year 2015 (A) while the mean values of predictors were calculated from data over the whole period 2015-2017. Therefore, we can say that non-searchability is connected to higher future long-term performance. Thus, we reject our last hypothesis, H3b.

## 4 Conclusions

The machine-readability (or at least searchability) of financial statements could be beneficial for financial and non-financial data users because it enables computer processing of the contained data. Computer processing allows cheap and effortless automatic location, acquisition, arrangement of data for the analyses processing and to obtain valuable information, e.g. about ownership of risk-assets, employees or cryptocurrencies like Bitcoins, Litecoins etc.

Searchable financial statements allow limited computer data processing – it is possible to search for words, numbers and information in that data, but it is complicated or even not possible to connect, e.g. numbers with their meaning. On the other hand, machine-readable data can be fully computer processed. Thanks to its structure, computers are able to understand it and to use data in its context.

We examined financial statements and accounting data of 989 business corporations over the period 2015-2017. We found out no machine-readable financial statements. Thus, we assessed only the searchability. We have seen that searchability of the financial statements decreases over the years 2015-2017; possibly due to a sharpened focus on privacy, stronger competition on the market and no legal obligation to prepare searchable statements. We discovered that more companies changed their statements form from searchable to non-searchable than vice versa. Most companies used either searchable or non-searchable format over the whole observed period. The probability that a company prepares searchable financial statements is negatively influenced by higher ROA indicator and positively influenced by higher DR. This relationship grows weaker as we move further in the observed period, either due to pressure on privacy or by opposite causality, i.e. companies with non-searchable statements will reach better performance in the future.

## Acknowledgements

The paper was created with support from the Masaryk University in the context of the specific research project MUNI/A/1029/2018 – Financial Reporting and Tax Aspects of Cryptocurrencies.

## References


Austin, P. K., Sallabank, J. (eds) (2011). *The Cambridge Handbook of Endangered Languages*. 1st ed. Cambridge: Cambridge University Press.

Birt, J. L., Muthusamy, K., Bir, P. (2017). An Evaluation of the Usefulness of Financial Reports with eXtensible Business Reporting Language (XBRL)-tagged information. *Accounting Research Journal*, vol. 30(1), pp. 107-126.

Cong, Y., Hao, J., Zou, L. (2014). The Impact of XBRL Reporting on Market Efficiency. *Journal of Information Systems*, vol. 28(2), pp. 181-207.

Cormier, D., Dufour, D., Luu, P., Teller, P., Teller, R. (2018). The Relevance of XBRL Voluntary Disclosure for Stock Market Valuation: The Role of Corporate Governance. *Canadian Journal of Administrative Sciences*, vol. 36(1), pp. 113-127.

Czech Act No. 563/1991 Coll., on accounting, as amended.

Czech Government Decree No. 351/2013 Coll., determining the amount of default interest and the costs associated with the claim, determining the remuneration of the liquidator and the member of the body of the legal entity appointed by the court and regulating some issues of the Commercial Bulletin, public registers of legal and natural persons and the evidence of trusts and records of the actual owners, as amended.

Hastie, T., Tibshirani, R., Friedman, J. (2009). *The Elements of Statistical Learning: Data Mining, Inference, and Prediction.* 2nd ed. New York: Springer Science.

Hodge, F. D., Maines, L. A. (2004). Does Search-Facilitating Technology Improve the Transparency of Financial Reporting? *The Accounting Review*, vol. 79(3), pp. 687-703.

ESMA (2017a). *New Rules Make EU Issuers' Annual Financial Reports Machine-Readable*. Retrieved from: https://www.esma.europa.eu/press-news/esma-news/new-rules-make-eu-issuers'-annual-financial-reports-machine-readable. (Accessed on 04. 06. 2019)

ESMA (2017b). *Final Report on the RTS on the European Single Electronic Format*. Retrieved from: https://www.esma.europa.eu/sites/default/files/library/esma32-60-204_final_report_on_rts_on_esef.pdf. (Accessed on 04. 06. 2019)

ESMA (2019). *European Single Electronic Format*. Retrieved from: https://www.esma.europa.eu/policy-activities/corporate-disclosure/european-single-electronic-format. (Accessed on 04. 06. 2019)

Hendler, J. (2012). *A Primer on Machine Readability for Online Documents and Data*. Retrieved from: https://www.data.gov/developers/blog/primer-machine-readability-online-documents-and-data. (Accessed on 04. 06. 2019)

Ištvánfyová, J., Mejzlík, L. (2006). Vykazování podnikových dat v elektronické podobě (Reporting of Business Data in the Electronic Form). *Český finanční a účetní časopis*, vol. 1(2), pp. 124-129.

Knápková, A., Pavelková, D., Remeš, D., Stěker, K. (2017). *Finanční analýza* (Financial analysis), 3rd ed. Praha: Grada.

Ministry of Justice of the Czech Republic (2014). *Technická specifikace pro předávání digitalizovaných listin do Sbírky listin veřejného rejstříku (Technical specification for the Transmission of Digitized Documents to the Collection of Documents of the Public Register)*. Retrieved from: https://or.justice.cz/ias/ui/specifikaceSL. (Accessed on 04. 06. 2019)

Liu, Ch., Luo, X. R., Wang, F. L. (2017). An Empirical Investigation on the Impact of XBRL Adoption on Information Asymmetry: Evidence from Europe. *Decision Support Systems*, vol. 93, pp. 42-50.

R Core Team (2013). R: A language and environment for statistical computing. 1st ed. Vienna: R Foundation for Statistical Computing.

Remsen, D., Knapp, S., Georgiev, T., Stoev, P., Penev, L. (2012). From Text to Structured Data: Converting a Word-Processed Floristic Checklist into Darwin Core Archive Format. *PhytoKeys*, vol. 2012(9), pp. 1-13.

Warner, T. (2016). *Understanding XML: The Human's Guide to Machine-Readable Data*. Retrieved from: https://www.safe.com/blog/2016/07/understanding-xml-humans-guide-machine-readable-data/. (Accessed on 04. 06. 2019)

XBRL (2019). *iXBRL*. Retrieved from: https://www.xbrl.org/the-standard/what/ixbrl/. (Accessed on 04. 06. 2019)

Růžičková, P. (2010). *Finanční analýza: metody, ukazatele, využití v praxi* (Financial Analysis: Methods, Indicators, Use in Practice), 1st ed. Praha: Grada.

Yen, J., Wang, T. (2015). The Association between XBRL Adoption and Market Reactions to Earnings Surprises. *Journal of Information Systems*, vol. 29(3), pp. 51-71.

Yoon, H., Zo, H., Ciganek, A. P. (2011). Does XBRL adoption reduce information asymmetry? *Journal of Business Research*, vol. 64(2), pp. 157-163.

# The CBA Analysis of IFRS Implementation in the Czech Republic

**Irena Honková**

[1] University of Pardubice
Faculty of Economics and Magementy, Institute of Business Economics and Management
Studentská 95, 532 10 Pardubice, Czech Republic
E-mail: irena.honkova@upce.cz

***Abstract**: As part of the ongoing harmonization of accounting system there is an increasing tendency to keep the accounts under IAS/IFRS. Consequently, a research in companies following the IAS/IFRS has been conducted. The aim of the research was to identify information, financial and time demands and also the benefits of the IAS/IFRS implementation. It was found that more companies use the services of an external consultant than an internal employee. Businesses normally do not share their knowledge. The costs of the implementation process are most often up to 100 thousand Euros, but most businesses acknowledged additional unquantified costs. The duration of the implementation process was to one year. There are different views of the respondents on the level of individual standards. Most respondents admitted making mistakes in the first years of the implementation, but these were rather minor flaws. Regarding the perceived benefits, the majority of respondents agreed that the IAS/IFRS enable good comparability. However, when it comes to their brand and financial statements, they stated that for the company's reputation the brand was more important than financial statements. It was found, however, that the majority of businesses have not experienced a reduction in the cost of capital.*

*Keywords: International Financial Reporting Standards (IFRS), International Accounting Standards (IAS).*

*JEL codes: M41, M42*

## Introduction

A majority of countries have permitted public listed companies to be included in the process of implementing IFRS and to prepare consolidated financial statements. (Uzma, 2016). Since 2003, the International Accounting Standards (hereinafter referred to as IAS) have been gradually replaced by the International Financial Reporting Standards (hereinafter referred to as IFRS) (Šrámková and Janoušková, 2008). Those IAS, that have not been replaced by the IFRS yet, still apply, and therefore, these accounting standards are referred to as IAS/IFRS.

Primary sources of information in the IAS/IFRS implementation are the standards themselves issued annually by the International Accounting Standards Board (IASB) in the form of books (Jílek, 2013). The International Accounting Standards as adopted by the European Union (2016) are freely accessible on the toll-free websites in 23 languages, and amendments are available only in English for some time. There are some remarkable resources available on the Internet, most of which are free of cost. The first place anyone should start researching IFRS is the Web site of the International Accounting Standards Board (www.iasb.org). Meanwhile, the major accounting firms have all spent a great deal of money preparing outstanding Web-based resources for both clients and educators. PricewaterhouseCoopers has excellent tools available for faculty and students at www.pwc.com/faculty. KPMG has a Web site dedicated to IFRS, www.kpmgifrsinstitute.com, which provides links to news articles and KPMG insights and technical publications on current issues related to IFRS. Ernst & Young has an IFRS-related Web site as well, www.ey.com/ifrs. Rounding out the Big Four, Deloitte also has a Web site dedicated to IFRS, www.iasplus.com. (Krom, 2009)

The costs associated with the IAS/IFRS implementation have been determined by the The Institute of Chartered Accountants in England and Wales (ICAEW, 2016) as follows: the establishment of a project team, training of other employees, such as IT staff,

internal audit and management, training of staff, external technical advise, tax advise, software and information systems changes, communications with third parties, external audit costs, renegotiating debt covenants and other external data requirements. Jermakowicz and Gornik-Tomaszewski (2006) consider these costs to be too high.The above costs are evident. There are other costs, however, that are not immediately obvious (Meek et al., 1995), e.g. a lack of well-trained people (PWC, 2016). Using a comprehensive dataset of all publicly traded Australian companies, we quantify an economy-wide increase in the mean level of audit costs of 23 percent in the year of IFRS transition. We estimate an abnormal IFRS-related increase in audit costs in excess of 8 percent, beyond the normal yearly fee increases in the pre-IFRS period. Further analysis provides evidence that small firms incur disproportionately higher IFRS-related audit fees (De George et al., 2013). IFRS adoption has led to an increase in audit fees. We also find that the IFRS-related audit fee premium increases with the increase in audit complexity brought about by IFRS adoption, and decreases with the improvement in financial reporting quality arising from IFRS adoption. Finally, we find some evidence that the IFRS-related audit fee premium is lower in countries with stronger legal regimes. (Jeong-Bon et al., 2012). Kovanicová (2008) stresses that IAS/IFRS fundamentally avoid any binding adjustments of financial statements, let alone a determination of the accounting model, chart of accounts or a specific correlation. Strouhal et al. (2012) points out that the aim of the CAS is to determine the accounting procedures (not IAS/IFRS). Dvořáková (2009) admits the incompatibility of standards. The biggest obstacle for compatibility (Haverals, 2007) is the fact that the EU has 25 different tax regimes.

Not only turbulent development, but also the imperfection of the original IAS has resulted in their gradual replacement by the IFRS. In order to make information contained in the published standards more accurate, their interpretations (acronyms SIC/IFRIC) have been produced, which are, however, time-delayed. The process of creating standards is very time-consuming. Dvořáková (2009) indicates 11 steps, Jílek (2013) states that adoption of a standard, an amendment or an interpretation usually lasts more than one year, therefore, there is a risk that a business would be missing information for the period of approving. Oremusová (2007) defines the general benefits of the international accounting standards as follows: easier access to foreign capital markets, higher credibility of foreign companies on domestic capital markets, global comparability of financial data, increased transparency, greater clarity due to „common accounting language", simpler regulation on capital markets, lower influence of accounting standards by political pressures. Landsman et al. (2012) declares that the adoption of IFRS benefits in three aspects: improves the information content, reduces the lag in reporting and augments the flow of foreign investment. Our results suggest that mandatory IFRS adoption improves cross-country information comparability by making similar things look more alike without making different things look less different. Our results also suggest that both accounting convergence and higher quality information under IFRS are the likely drivers of the comparability improvement. In addition, we find some evidence that cross-country comparability improvement is affected by firms' institutional environment. (Yip and Danqing, 2012). We broadly summarize the development of the IFRS literature as follows: The majority of early studies paint IFRS as bringing significant benefits to adopting firms and countries in terms of improved transparency, lower costs of capital, improved cross-country investments, better comparability of financial reports, and increased following by foreign analysts. However, these documented benefits tended to vary significantly across firms and countries. More recent studies now attribute at least some of the earlier documented benefits to factors other than adoption of new accounting standards per se, such as enforcement changes (De George, 2016). We find evidence that, unlike previous studies, Spanish listed companies show a significant reduction in their cost of equity capital after the mandatory adoption of IFRS in 2005, after controlling by a set of firm-risk and market variables. According to our results, increased financial disclosure and enhanced information comparability, along with changes in legal and institutional enforcement, seem to have a joint effect on the cost of capital, leading to a large decrease in expected equity returns (Castilo-Merino, 2014).The IFRS mandate significantly reduces the cost of equity for mandatory adopters by 47 basis

points. I also find that this reduction is present only in countries with strong legal enforcement, and that increased disclosure and enhanced information comparability are two mechanisms behind the cost of equity reduction. Taken together, these findings suggest that while mandatory IFRS adoption significantly lowers firms' cost of equity, the effects depend on the strength of the countries' legal enforcement (Li, 2010). Further literature research showed the following possible benefits of the IAS/IFRS implementation: O'Connell and Sullivan (2008) state the impact on the business income, Verrecchia (1999) says lower costs of capital, higher value of the shares, Chalmers and Godfrey (2004) indicate reputation and credibility for investors, greater explanatory power of foreign models designed to assess the level of financial stability of a company, Kuběnka (2014), Hrdý and Strouhal (2010) state the reporting of relevant information, particularly in reporting risks, Jermakowicz and Gornik-Tomaszewski (2006) emphasize better investment opportunities, increased transparency, Cairns et al. (2011) points out the comparability of the reporting information, Cornell and Sirri (1992) state the reduction in information asymmetry to improve market liquidity of company shares, De Jong et al. (2006) stresses the increase in debt. De Jong et al. (2006) describes the increase in debt as a result of the IAS/IFRS implementation, and Verrecchia (1999) even refers to reducing the cost of capital. Jílek (2013) lists the measures, so-called prudential filters, which should neutralize the impact of the IAS/IFRS on capital. The cost of capital is one of the key indicators, not only with regard to the implementation of the principle of optimizing the capital structure, but also for setting corporate discount rate, in evaluation of economic performance of the company, and in investment planning and selection (Kuběnka, 2015). Therefore, one of the questions concerning the benefits included the impact of the IAS/IFRS implementation on reducing the cost of capital.

## 2 Methodology and Data

Between October 2017 and January 2018, all twenty-three public listed companies on Praque Stock Exchange (on the Prime, Second and Free Market) were interviewed by means of semi-structured interview. They were auditors, project managers preparing the implementation process and accountants themselves (users). The main areas of these interviews were information sources, legislation, and costs and benefits of the IAS/IFRS introduction. The particular function of individual respondents within the IAS/IFRS and the sector of their activity are included in the Table 1.

**Table 1:** Information about the persons interviewed

| Code | Function | Sector |
|---|---|---|
| **A1-A2** | Auditor | Energy Supply |
| **A3-A4** | Auditor | Consumer Services |
| **A5** | Auditor | Consumer Goods |
| **A6** | Auditor | Finance |
| **P1** | Project manager | Chemical Industry |
| **P2** | Project manager | Consumer Goods |
| **U1** | Accountant | Energy Supply |
| **U2** | Accountant | Consumer Goods |
| **U3-U8** | Accountant | Finance |
| **U9** | Accountant | Technology and telecommunication |
| **U10** | Accountant | Consumer Services |
| **U11** | Accountant | Consumer Goods |
| **U12-U14** | Accountant | Energy Supply |
| **U15** | Accountant | Basic Industry |

Source: own

The interview included thirteen questions divided by areas: information sources, costs and duration of the implementation process, legislation and benefits, see Table 2.

**Table 2:** Information about the persons interviewed

| Question number | Area | Question |
|---|---|---|
| **1** | Information sources | Have you ever used the external services? |
| **2** | Information sources | With whom have you consulted? |
| **3** | Information sources | Have you observed the implementation process of others? Have you collaborated with other businesses? Have you learned from it? |
| **4** | Costs and duration of the process | How costly the process of the IAS/IFRS implementation has been? |
| **5** | Costs and duration of the process | Have you seen any costs in the implementation process that could not be quantified? |
| **6** | Costs and duration of the process | What was the duration of the implementation process? |
| **7** | Legislation | Did you make mistakes resulting from the misunderstandings in the early years? |
| **8** | Legislation | Have you found any of the IAS/IFRS to be better processed than others? |
| **9** | Legislation | Have you received enough information from the IAS/IFRS or have you improvised during the implementation? |
| **10** | Benefits | Do you think that the existence of several options in the IAS/IFRS does not preclude the comparison of financial statements among companies? |
| **11** | Benefits | Comment on the brand & financial statements links and their importance for the reputation. |
| **12** | Benefits | Specify the perceived benefits of implementation. |
| **13** | Benefits | Do you believe that the implementation reduces the cost of capital? |

Source: own

Respondents were encouraged to express on the topic as fully as possible so that the most of their views could be captured. Therefore, direct speech is included in the paper making it even more interesting. The next chapter presents the results of the research. By virtue of their positions, not all respondents were able to answer all the questions so the sum of responses in the following results subsections will not be equal to the total number of twenty-three respondents.

## 3 Results and Discussion

As already mentioned, as for information sources, the aim of the interviews conducted was to determine whether businesses used the published standards without assistance of an external consultant, with whom they consulted, and whether there was any direct or indirect collaboration with other businesses that implement, see questions 1 – 3, Table 2. Thirteen respondents stated they had worked with an external consultant while 8 respondents had used only internal staff. Cooperation with the supplier of information systems and training in IAS/IFRS were commonplace. These responses, however, were not included for the assessment of the number of external consultants.

Respondents were asked about other sources of information, but further communication regarding the IAS/IFRS implementation took place mostly within the holding (mentioned by ten respondents). The question about benchmarking in the IAS/IFRS was very interesting. Eight respondents, i.e. half of the interviewees said they had been truly interested in how other businesses implemented. However, there was no direct

cooperation. Rather, it was only on the level of studying companies' publicly available financial statements and attachments thereof. Only respondents from the banking field admitted they had actively shared information among themselves. P2 project manager stated: "The others also did not know whether they were doing it well or not, and there was minimal willingness to share anything". A partial aim of this paper was to quantify the evident costs, to uncover the hidden costs and to determine the duration of the implementation process. They are generally up to 100 thousand Euros, only 3 respondents had costs over 100 thousand Euros.

In addition to these quantified costs, eleven respondents out of seventeen said there had been some extra costs that could not be quantified or had not been quantified yet. These were mostly salary bonuses for overtime resulting from the inexperience of staff, and wage compensations for the time spent on training. Several respondents simply named time to be one of those "invisible costs". U8 respondent even said these costs had exceeded the calculated costs. Regarding the duration of the implementation, A6 auditor characterized it the best. He stated the implementation process in the smaller units had taken about three months, and in the larger units it had been from fifteen to eighteen months. There was even an answer that the implementation process took only a few weeks. U1 user, on the other hand, said the implementation process had been ongoing since 2013 and was steadily improving. As for this area of the research, the aim was to obtain an opinion from the implementing businesses on the IAS/IFRS and to determine whether and to what extent they improvised and whether they faced misunderstandings of the IAS/IFRS resulting in making mistakes when reporting under the IAS/IFRS, see questions 7, 8, 9 in Table 2.Half of respondents (ten respondents) stated that individual standards had the same level of processing. On the contrary, eleven respondents believed that certain standards were better understood than others. A2 auditor also agreed with this statement, but added he was positive about the creation of interpretations. U15 user felt good about the present level of standards. Initially, however, he lacked a sufficient number of examples and accurate interpretations of allowances, for example. U4 user lacked information regarding the property.Thirteen respondents said the standards had provided them with sufficient information, ten respondents improvised. According to U14 user, improvisation and own judgment is necessary when working with the IAS/IFRS. U7 and U8 users admitted a certain detachment, but in accordance with fundamental ideas. A6 auditor concluded: „It is necessary to get accustomed to their language and the method of processing which differs from the CAS. It is so because the IAS/IFRS rather deal with the number in the final account than the means how to get to it. The IAS/IFRS definitely do not contain any accounting correlations Czech accountants have been used to." When asked whether they made mistakes in the early years, fifteen respondents admitted it. six of them added that these were minor things, such as inaccurate estimates and immaterial errors. Six respondents were not aware of any misconduct. A3 auditor said the most frequent mistakes were the faulty methods of evaluating and reporting data to the wrong parts of statements. A6 auditor noticed that profits from the sale of treasury shares were misreported in the income statement, as well as mistakes in the use of hedge accounting when conditions were not satisfied, and ignoring the principle of priority of substance over form. Above, I have summarized those findings from the IAS/IFRS implementation which represent a certain burden for a company – information, time and financial demands and legislation. The following text will show whether these negatives may be outweighed by some benefits for implementing businesses. Questions 10 – 13 see Table 2 were focused on the benefits. Generally declared positives of the IAS/IFRS implementation include the comparability of financial statements. This statement was confirmed by eleven respondents. U6 user said that otherwise the IAS/IFRS implementation would be pointless. Three respondents stated that the numbers were not the only one thing to compare. Five respondents disagreed with higher comparability of financial statements in the IAS/IFRS implementation compared to CAS. Here are some respondents' opinions on the comparability, from the positive ones to the negative ones: A6 auditor: "I think that most of the alternatives that prevented the comparison among businesses have been abolished, and where they were kept, it was because of an

adequate distinction." U4 user "The standards can not be custom written." U10 user: "Full comparability can be achieved only in theory." P1 project manager: "There may be some misrepresentation. When comparing the numbers the user must necessarily go through the valuation methods, depreciation methods, materials for estimates, set risk weights, materiality thresholds and more in order to be able to tell what the number means and not compare apples and oranges, as the saying goes." U2 user: "It is impossible to compare without detailed knowledge of the structure, processes and interpretation of the IFRS." U11: "Only businesses with exactly the same structure can be compared." U5: "The reason for the poor comparability is, for example, a disparity in reporting of investment grants." U4: "Due to poor comparability there is still an internal harmonization within the group". In addition to the comparability, the perceived impact of financial statements on the company's reputation was also the subject of research. Eight respondents said that the brand was more important than reputation based on the financial statements. Only two respondents stated that financial statements had a greater impact on the overall reputation. A3 auditor said that it was in case that: "this is not Coca-Cola". Twelve respondents were not able to judge that, but they agreed that the statements are important to corporate reputation. A2 auditor stated: „I see a tendency within reputable companies that they want everyone around to implement the IAS/IFRS." U15 and U16 users believed that the statements are more important when applying for a loan and in negotiations with creditors. U3 user said that the impact of statements on the overall reputation could be seen especially in large companies. In addition to views on the comparability of financial statements and their impact on the reputation the respondents were supposed to name additional benefits associated with the IAS/IFRS implementation. The most commonly perceived benefit is an easier access to capital, which was also confirmed by U16 user: "better capital raising, more realistic budgets, more reliable investment plans, high-quality acquisition analysis". A5 auditor believed that accounting system separated from taxes might have a better explanatory power, as seen in case of the costs, for example. It would not be necessary to take into account whether it was a tax or a non-tax cost but its real nature. A6 auditor added that the IAS/IFRS implementation had improved the results and financial position with modern accounting theory, and that there was a better link with the regulatory requirements for financial Institutions. The last question concerned the benefit which was mostly perceived, i.e. the easier access to capital. It was explored whether the IAS/IFRS implementation has reduced the cost of capital. This phenomenon is not usually seen by businesses, because eleven respondents disagreed and only five respondents confirmed the reducing of the cost of capital. U8 user believed that due to the reducing of the risk for investors, the required return on capital was reduced as well. U5 user said that reporting under the IFRS had enabled to obtain an international rating and favorable financing in international bond markets.

## 4 Conclusions

This paper dealt with the IAS/IFRS implementation. It was found that more companies use the services of an external consultant than an internal employee. The likely reason is to transfer the risks associated with the implementation to an external entity. Businesses normally do not share their knowledge of the implementation and communicate only within the holding. However, half of the respondents confirmed that they used publicly available financial statements of other enterprises during their own implementation process. The costs of the implementation process are most often up to 100 thousand Euros, but most businesses acknowledged additional unquantified costs. The duration of the implementation process, in most cases, was to one year. There are different views of the respondents on the level of individual standards. Half of the respondents believed that the individual IAS/IFRS do not differ. The other half, on the other hand, saw differences in processing and clarity of individual standards. A considerable number of respondents improvised during the implementation process. However, a certain level of detachment is necessary when working with the IAS/IFRS. Most respondents admitted making mistakes in the first years of the implementation, but these were rather minor flaws. Regarding the perceived benefits, the majority of respondents agreed that the

IAS/IFRS enable good comparability. However, when it comes to their brand and financial statements, they stated that for the company's reputation the brand was more important than financial statements. In addition to the comparability the most common benefit was a better access to capital. It was found, however, that the majority of businesses have not experienced a reduction in the cost of capital. This article dealt with the cost and benefits of implementing IAS / IFRS. The biggest problem is the difference between IAS / IFRS and CAS. Its possible solution is the harmonization of accounting regulations.However, for the purpose of taxation, the countries may follow their national accounting system; therefore, it may be costly for companies that run two parallel accounting systems. (Chen et al., 2010). The countries consider IFRS adoption or convergence with IFRS (Brown, 2011). Chen et al. (2010) have advocated the replacement of domestic standards with the IFRS that would increase the quality of financial reporting. A clear sign of convergence of the Czech legislation with international accounting standards is the ongoing harmonization of accounting system. Recently, an essential step in contributing to the harmonization has been the amendment to Decree No. 250/2015 Coll. Amending the existing Decree No. 500/2002 Coll. for entrepreneurs as accounting units who keep double-entry accounting. Pursuant to this Decree, certain provisions of Law No. 563/1991 Coll., on accounting have been implemented. The amendment came into force on January 1st, 2016.Harmonization leads to gradual convergence of both systems and thus to lower costs of IAS / IFRS implementation.

## References


Brown, P. (2011). International Financial Reporting Standards: what are the benefits? *Accounting and Business Research*, vol. 15(3), pp. 269-285.

Cairns, D., Massoudi, D., Taplin, R., Tarca, A. (2011*).* IFRS fair value measurement and accounting policy choice in the United Kingdom and Australia. *The British Accounting Review*, vol. 43 (1), pp. 1-21.

Castilo-Merino, D. (2014). Mandatory IFRS adoption and the cost of Equity Capital. Evidence from Spanish Firms. *Intangible capital*, vol. 10(3), pp. 562-583.

Chalmers, K., Godfrey, J. (2004*).* Reputation costs: the impetus for discretionary derivative financial instrument reporting. *Accounting, Organizations and Society*, vol. 29(2), pp. 95-125.

Chen, H., Tang, Q., Jiang, Y., Lin, Z. (2010). The role of International Financial Reporting Standards in accounting quality: evidence from European Union. *Journal of International Financial Management and Accounting*, vol.21 (3), pp. 22-278.

Christensen, H. B. (2012). Why do firms rarely adopt IFRS voluntary? Academics find benefits and the cost appear to be low. *Review of Accounting Studies*, vol. 17(3), pp. 518-525.

Cornell, B., Sirri, E. (1992). The reaction of investors and stock prices to insider trading. *Journal of Finance*, vol. 47(3), pp. 1031-1059.

De George, E., Ferguson, C., Spear, A. (2013). How Much Does IFRS Cost? IFRS Adoption and Audit Fees. *Accounting Review*, vol. 88(2), pp. 429-462.

De George, E. (2016). A review of the IFRS adoption literature. *Review of accounting studies*, vol. 21(3) pp. 898-1004.

De Jong, A., Rosellón, M. A., Verwijmeren, P. (2006). The economic consequences of IFRS: the impact of IAS 32 on preference shares in the Netherlands. *Accounting in Europe*, vol. 3(2), pp. 196-285.

Dvořáková, D. (2009). *Finanční účetnictví a výkaznictví podle mezinárodních standardů IFRS*. Brno: Computer Press.

European Union (2016). *Právo EU a související dokumenty*. Retrieved from: <http://eur-lex.europa.eu/homepage.html?locale=cs>.

Haverels, J. (2007*).* IAS/IFRS in Belgium: quantitative analysis oft he impact on the tax burden of companies. *Journal of International Accounting, Auditing and Taxation*, vol. 16(1), pp. 69-89.

Hrdý, M., Strouhal, J. (2010). *Finanční řízení*. Praha: Wolters Kluwer ČR.

ICAEW (2007). *EU Implementation of IFRS and the Fair Value Directive*. Retrieved from: <http://www.icaew.com/~/media/corporate/archive/files/technical/financial%20reporting/financial%20reporting%20faculty/executive%20summary.ashx>.

Jeong-Bon, K., Xiaohong, L., Zheng, L. (2012). The Impact of Mandatory IFRS Adoption on Audit Fees: Theory and Evidence. *The Accounting review*, vol. 87(6), pp. 2061-2094.

Jermakowicy, E. K., Gornik-Tomaszewski, S. (2006). Implementing IFRS from the perspective of EU publicly traded companies. *Journal of International Accounting, Auditing and Taxation*, vol. 15(2), pp. 170-196.

Jílek, J., Svobodová, J. (2013). *Účetnictví podle mezinárodních standardů účetního výkaznictví (IFRS) 2013*. Praha: Grada Publishing.

Kovanicová, D. (2008). *Abeceda účetních znalostí pro každého*. Praha: Bova polygon.

Krom, C. (2009). Preparing for IFRS: Great Online Information Sources. *The CPA journal*, vol. 79(4), pp. 9-10.

Kuběnka, M. (2014). The Factors Affecting the Accuracy of Business Failure Prediction models. In: *European Financial Systems 2014. Proceedings of the 11th International Scientific Conference*. Brno:Masarykova Universita, pp. 364-371.

Kuběnka, M. (2015). *Finanční stabilita podniku a její indikátory*. 1. ed. Pardubice: Univerzita Pardubice, Fakulta ekonomicko-správní.

Landsman, W. R., Maydewa, E. L., Thornock, J. R. (2012). The information content of annual earnings announcements and mandatory adoption of IFRS. *Journal of Accounting and Economics*, vol. 53(1), pp. 34-54.

Li, S. (2010*).* Does Mandatory Adoption of International Financial Reporting Standards in the European Union Reduce the Cost of Equity Capital? *The Accounting review*, vol. 85(2), pp. 607-636.

Meek, G., Roberts, C., Gray, S. (1995). Factors influencing voluntary annnual repoert disclosures by US, UK and continental European multinational corporations. *Journal of International Business Studies*, vol. 26(3), pp. 559-572.

O´Connell, V., Sullivan, K. (2008). The impact of mandatory conversion to IFRS on the net income of FTS Euro first 80 Firms. *Journal of Applied Research in Acoounting and Finance*, vol. 3(2), pp. 17-26.

Oremusová, P. (2007). *Meritum téma: Účetní závěrka 2007*. Praha: Wolters Kluwer.

PWC (2006). *The transition from local GAAPs to International Financial Reporting Standards*. Retrieved from: http://www.pwc.com/hu/en/services/ifrs/ifrs_szolgaltatasok.html>.

Šrámková, A., Janoušková, M. (2008). *Mezinárodní standardy účetního výkaznictví*. Praha: Institut svazu účetních.

Strouhal, J., Židlická, R., Knapová, B., Cardová, Z. (2012). *Velká kniha příkladů*. Brno: BizBooks.

Uzma, S. (2016*).* Cost-benefit analysis of IFRS adoption: developed and emerging countries*. Journal of financial reporting & accounting*, vol.14(2), pp. 198-229.

Verrecchia, R. (1999). Disclosure and the cost of capital: a discussion. *Journal of Accounting and Economics*, vol. 26(1), pp. 271-283.

Yip, R., Danqing, Y. (2012). Does Mandatory IFRS Adoption Improve Information Comparability? *The Accounting review*, vol. 87(5), pp. 1767-1789.

# Profitability of Agricultural Entities in Countries of Visegrad Group

**Jana Hvozdenska**

Masaryk University
Faculty of Economics and Administration, Department of Finance
Lipova 41a, 602 00 Brno, Czech Republic
E-mail: 174974@mail.muni.cz

***Abstract:*** *Based on selected individual data obtained from Farm Accountancy Data Network database the output efficiency of agricultural entities in countries of Visegrad Group is evaluated. This paper deals with the relationship between the profitability indicators as return on assets, return on equity, return on sales and the milk yields of agricultural entities in the states. The entities were divided into size categories according to outputs. The aim of the paper is to confirm the relationship between the indicators of profitability, the milk yields and the size of farming units. The survey results show that the profitability indicators with unit size are decreasing, milk yields on the other hand are increasing, however they are not unambiguous.*

*Keywords: financial analysis, agricultural enterprises, financial reports, profitability indicators*

*JEL codes: G21, G31, G32, Q12, Q14*

## 1 Introduction

Some studies find that the key drivers of net profit margins are education, farm size and typology, specialization, and government payments. Profitability change can be decomposed into the product of total factor productivity (TFP) index and index measuring changes in relative prices.

Many TFP indices can be further decomposed into measures of technical change, technical efficiency change, scale efficiency change and mix efficiency change (O'Donnell, 2012).

Especially in times of global crisis, it is extremely important to provide more favourable credit conditions and thus stimulate loans for investments in agriculture. On the other hand, financial support to agriculture through the agrarian budget, even under more favourable credit conditions, is not enough for self-sustainability.

Lack of financial resources is the key limiting factor for the efficient use of agricultural resources, both in transitional and developed. Surely, financial mix in the sector of agriculture is significantly different from those in other industries, due to sectoral specificities (Veselinovic and Drobnjakovic, 2014).

The importance of sustaining agricultural production to improve nutritional standards has been recognized by all countries throughout history. However, in the economic literature of the 1950s and 1960s the role of agriculture in development was considered ancillary to that of the modern industrial sector where most of the accumulation and growth was expected to take place.

Subsequent theoretical investigation and the very disappointing performance of agriculture in many developing countries have led to the belief that the role of agriculture in development should be re-examined. Erratic and unequal growth, persistence of malnutrition, periodic famines together with increased food dependence from abroad, have continued to affect a large number of developing countries.

The current literature on rural development is replete with studies about the effect of farm size on land productivity. The controversy is important for it provides information on the existence of economies of scale in agriculture and on the choice of an optimal farm size, besides supplying ammunition to those who are in favour or against the thorny issue of land reform.

The modern version of the controversy on the size effect started with the publication in the 1950s, which showed that there was an inverse relationship between farm size and land productivity. Subsequent empirical investigation leaves little doubt about the validity and generality of this phenomenon observed in many developing countries.

## 2 Methodology and Data

With the development of the financial institutions and the capital markets, the financial analysis has started to be used as a standard procedure in the assessment of economic entities' creditworthiness (Altman, 1968). Furthermore, this tool allows a determination of economic entities' financial position, which is a base for proposal of new investment activities (Smith and Reilly, 1975).

Because of the long history and wide applicability, as well as the numerous contributors to the development of the financial analysis, this tool is now recognized as a standard financial ratio analysis tool.

Return on assets (ROA) measures the rate of return on assets employed by the company and shows how profitably the company is using its assets. This indicator is also recognized as to return on investments (ROI). The return on equity (ROE) shows the share of the net profit attributable to equity owners for each unit of capital invested in the company. In favorable credit conditions, the amount of ROE should be greater than ROA.

Profitability ratios, ROA and ROE, could be decomposed so to see what the cause of their change is. ROA can be broken down as a product between the net profit margin and the asset turnover so to determine the profitability strategy (is it value-added or volume based). ROE can be broken down as a product between the net profit margin, the asset turnover and the equity multiplier, which is a ratio between the average assets and equity.

The procedure for calculation of the financial indicators is simple, but their interpretation is specific and depends on several factors, especially important is the type of the industry (Helfert, 1997).

There are three main types of comparison for assessing the financial indicators (Horngren et al., 2010), namely: 1) Time series or trend analysis, based on comparisons of past financial indicators; 2) Standard coefficients comparison, or benchmarks analysis, and 3) Cross-industry comparison, performed by comparing industries' average ratios.

According to these authors, each analysis is a case-specific and therefore, it is necessary to consider the following: 1) The structural change of the companies, such as mergers, acquisitions and equity allocations; 2) The generally accepted ratios' variations between industries, which are sensitive to changes that occur over time, and 3) In the cross-industry comparison, it is necessary to identify comparable companies or a set of norms for a particular industry, which is not an easy subject.

**Model Specification**

ROA, ROE and ROS were selected as indicators to verify the performance. They are a ratios used to evaluate a company's operational efficiency. ROA measures the rate of return on assets employed by the company and shows how profitably the company is using its assets. ROE shows the share of the net profit attributable to equity owners for each unit of capital invested in the company. In favourable credit conditions, the amount of ROE should be greater than ROA. ROS is a financial ratio that calculates how efficiently a company is generating profits from its revenues. It measures the performance of a company by analysing the percentage of the total revenue that is converted into the net income.

ROA = farm net income / assets x 100% (1)

ROE = farm net income / equity x 100% (2)

ROS = farm net income / farm revenue × 100% (3)

The data analysed come from the Farm Accountancy Data Network database (FADN) (FADN, 2018). The member states collect the data annually. It uses a sample of farms that are engaged in agriculture. The goal of sampling is to obtain representative data in the dimensions of the region, economic size, and type of farming; the repeated data collection serves as a basis for the time series of the statistics published by the FADN.

The countries which were selected were countries of Visegrad Group – the Czech Republic, Hungary, Poland and Slovakia.

The data come between the years 2004 and 2016.

The ROS, ROA and ROE of the farms focusing on production of milk were compared.

The farms are divided into six groups by size of production in EUR. See Table 1.

**Table 1** Economic size categories of farms in the Visegrad Group

| Economic size | Standard output value of the farm (EUR) | |
|---|---|---|
| **1** | 2 000 | ≤ 8 000 |
| **2** | 8 000 | ≤ 25 000 |
| **3** | 25 000 | ≤ 50 000 |
| **4** | 50 000 | ≤ 100 000 |
| **5** | 100 000 | ≤ 500 000 |
| **6** | | ≥ 500 000 |

Source: author's own calculations based on FADN (2018)

## 3 Results and Discussion

The tests of normality were carried out. For the evaluation of the normality test is probably the easiest to observe the result from graph of the assumed normal distribution in comparison to the actual distribution of residues and analyze p-values of Chi-square test. We test the hypothesis H0: Residuals are normally distributed, against the hypothesis H1: Residuals are not normally distributed, the significance level of α was chosen as 0.01. If the p-value is greater than α then we cannot reject the H0, therefore the residuals are normally distributed. The test contributed that the data have normal distribution.

For the testing of heteroscedasticity we chose the White's test. We test the hypothesis H0: Constant variances of residuals – homoscedasticity, against H1: Heteroscedasticity. The significance level of α was chosen as 0.01. If the p-value is greater than α then we cannot reject H0, therefore it contributes homoscedasticity.

We explored the relationship between the milk yields per cow and year and return on assets, return on equity and return on sales.

**Results ROA**

ROA was the highest in 2007 and 2008. The highest ROA we can find in category 6) >= 500 000 EUR. The lowest ROA we can find in category 1) 2 000 - < 8 000 EUR.

**Table 2** Return on assets of farms in the Visegrad Group

| | (1) 2 000 - < 8 000 EUR | (2) 8 000 - < 25 000 EUR | (3) 25 000 - < 50 000 EUR | (4) 50 000 - < 100 000 EUR | (5) 100 000 - < 500 000 EUR | (6) >= 500 000 EUR | Total (Economic size class (6 classes)) |
|---|---|---|---|---|---|---|---|
| **2016** | 0,0815748 | 0,17561 | 0,15714 | 0,18563 | 0,21312 | 0,24767 | 0,2064518 |
| **2015** | 0,0796063 | 0,16529 | 0,15808 | 0,19132 | 0,20830 | 0,22550 | 0,1895117 |
| **2014** | 0,0764327 | 0,17595 | 0,15477 | 0,19873 | 0,22685 | 0,25319 | 0,2054831 |
| **2013** | 0,0950224 | 0,20026 | 0,21267 | 0,20015 | 0,18511 | 0,22527 | 0,1840341 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **2012** | 0,0959031 | 0,19993 | 0,17088 | 0,23171 | 0,22376 | 0,22396 | 0,1876902 |
| **2011** | 0,1165628 | 0,21376 | 0,21826 | 0,21391 | 0,23208 | 0,24006 | 0,1995422 |
| **2010** | 0,0877966 | 0,17862 | 0,16849 | 0,21165 | 0,21494 | 0,20445 | 0,1699617 |
| **2009** | 0,0754489 | 0,15663 | 0,15740 | 0,18383 | 0,17971 | 0,17600 | 0,1431402 |
| **2008** | 0,1253646 | 0,19269 | 0,21211 | 0,21489 | 0,23742 | 0,23671 | 0,2081158 |
| **2007** | 0,1294752 | 0,23746 | 0,25412 | 0,22802 | 0,23769 | 0,23520 | 0,2066819 |
| **2006** | 0,1238338 | 0,15023 | 0,16574 | 0,18077 | 0,19299 | 0,19971 | 0,1635263 |
| **2005** | 0,0905482 | 0,18726 | 0,15614 | 0,15481 | 0,18261 | 0,20379 | 0,1538522 |
| **2004** | 0,1083034 | 0,16457 | 0,16457 | 0,19141 | 0,18283 | 0,21601 | 0,1504691 |

Source: author's own calculations

**Results ROE**

ROE was the highest in 2007 and 2008. The highest ROE we can find in category (2) 8 000 - < 25 000 EUR and (4) 50 000 - < 100 000 EUR. The lowest ROE we can find in category 1) 2 000 - < 8 000 EUR.

**Table 3** Return on equity of farms in the Visegrad Group

| | **(1) 2 000 - < < 8 000 EUR** | **(2) 8 000 - < 25 000 EUR** | **(3) 25 000 - < 50 000 EUR** | **(4) 50 000 - < 100 000 EUR** | **(5) 100 000 - < 500 000 EUR** | **(6) >= 500 000 EUR** | **Total (Economic size class (6 classes))** |
|---|---|---|---|---|---|---|---|
| **2016** | 0,05221935 | 0,11526 | 0,08623 | 0,10324 | 0,09873 | 0,08362 | 0,0912518 |
| **2015** | 0,05068195 | 0,11372 | 0,10215 | 0,12283 | 0,10539 | 0,04685 | 0,0725949 |
| **2014** | 0,05065172 | 0,11957 | 0,08799 | 0,12286 | 0,13183 | 0,08889 | 0,0906774 |
| **2013** | 0,06161468 | 0,13818 | 0,12713 | 0,11391 | 0,09116 | 0,04794 | 0,0627529 |
| **2012** | 0,06912568 | 0,13813 | 0,08767 | 0,13891 | 0,12119 | 0,05438 | 0,0686154 |
| **2011** | 0,08495005 | 0,15523 | 0,12316 | 0,12309 | 0,11336 | 0,08041 | 0,0819802 |
| **2010** | 0,05116521 | 0,11301 | 0,09146 | 0,10632 | 0,08288 | 0,02544 | 0,0401408 |
| **2009** | 0,02629649 | 0,08573 | 0,07806 | 0,08160 | 0,04746 | -0,02517 | -0,0025611 |
| **2008** | 0,06941079 | 0,12208 | 0,12226 | 0,11432 | 0,09848 | 0,05716 | 0,0689901 |
| **2007** | 0,07487293 | 0,16466 | 0,17243 | 0,14464 | 0,12020 | 0,06910 | 0,0818344 |
| **2006** | 0,06360882 | 0,07355 | 0,07842 | 0,08968 | 0,07418 | 0,02052 | 0,0370730 |
| **2005** | 0,02515903 | 0,11463 | 0,08991 | 0,08259 | 0,08491 | 0,05085 | 0,0470219 |
| **2004** | 0,04314327 | 0,11202 | 0,09832 | 0,12785 | 0,09684 | 0,07670 | 0,0553360 |

Source: author's own calculations

**Results ROS**

ROS is higher every next year. The highest ROS we can find in category 2 (8 000 - < 25 000 EUR). The lowest ROS we can find in category (6) >= 500 000 EUR.

**Table 4** Return on sales of farms in the Visegrad Group

| | **(1) 2 000 - < 8 000 EUR** | **(2) 8 000 - < 25 000 EUR** | **(3) 25 000 - < 50 000 EUR** | **(4) 50 000 - < 100 000 EUR** | **(5) 100 000 - < 500 000 EUR** | **(6) >= 500 000 EUR** | **Total (Economic size class (6 classes))** |
|---|---|---|---|---|---|---|---|
| **2016** | 0,6173781 | 0,96714 | 0,63759 | 0,65670 | 0,59773 | 0,43522 | 0,5398885 |
| **2015** | 0,589897 | 0,98107 | 0,66398 | 0,65751 | 0,56316 | 0,38847 | 0,4978570 |
| **2014** | 0,6076531 | 1,00479 | 0,66203 | 0,65138 | 0,58139 | 0,42467 | 0,5183941 |
| **2013** | 0,6307081 | 1,02317 | 0,68217 | 0,61932 | 0,57190 | 0,42039 | 0,5151771 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **2012** | 0,6333114 | 1,00860 | 0,63888 | 0,62891 | 0,59821 | 0,40723 | 0,5083176 |
| **2011** | 0,6577044 | 0,99302 | 0,69437 | 0,65776 | 0,57729 | 0,42841 | 0,5212846 |
| **2010** | 0,6383341 | 0,97195 | 0,63581 | 0,65066 | 0,59091 | 0,41392 | 0,5137615 |
| **2009** | 0,549283 | 0,88802 | 0,60609 | 0,60089 | 0,54344 | 0,36556 | 0,4546005 |
| **2008** | 0,5534488 | 0,59172 | 0,60439 | 0,58418 | 0,51884 | 0,39718 | 0,4735269 |
| **2007** | 0,5748320 | 0,60682 | 0,61748 | 0,61595 | 0,55421 | 0,44332 | 0,5233813 |
| **2006** | 0,5750338 | 0,53234 | 0,53853 | 0,58203 | 0,52634 | 0,39356 | 0,4780733 |
| **2005** | 0,4835883 | 0,51630 | 0,52191 | 0,53781 | 0,50720 | 0,40693 | 0,4642335 |
| **2004** | 0,4935305 | 0,51538 | 0,48884 | 0,52826 | 0,46506 | 0,38784 | 0,4444298 |

Source: author's own calculations

The comparison of the milk yields per cow and year and the return on assets, return on equity and return on sales show differences. We can observe very similar results in case of return on assets and return on equity. The highest values are observed in years 2007 and 2008. However we cannot conclude which farm size is the best for the highest values of ROA and ROE, because in case of ROA the highest results we got in size category 6) >= 500 000 EUR and in case of ROE in category (2) 8 000 - < 25 000 EUR and (4) 50 000 - < 100 000 EUR. The lowest ROA and also ROE we can find in category 1) 2 000 - < 8 000 EUR.

When we look at the calculations of ROS we can see, that the results are different. ROS is higher every next year. The highest ROS we can find in category 2 (8 000 - < 25 000 EUR). The lowest ROS we can find in category (6) >= 500 000 EUR.

The different results are given mainly by different style of calculations of the ratios. ROA and ROE are quite similar, however ROS is a different, because it uses sales as a flow indicator instead of assets or equity and state indicator.

## 4 Conclusions

The results of the analysis demonstrate that the relationship between the profitability indicators return on sales, return on assets, return on equity and the volume of production measured by the milk yields per cow/year are ambiguous.

Basically, there is a discrepancy in the progress of the volume of indicators of agricultural production.

In case of ROS there is increasing figure every next year, the best results are in size of farming units 2 and the worst in size of farming units 8.

In case of ROA the best results we got in 2007 and 2008, the best results are in size of farming units 6 and the worst in size of farming units 1.

In case of ROE the best results we got in 2007 and 2008, the best results are in size of farming units 2 and 4 and the worst in size of farming units 1.

## Acknowledgments

Support of Masaryk University within the project MUNI/A/0904/2017 Evaluation of farm performance is gratefully acknowledged.

## References

Altman, E. I. (1968). Financial Ratios, Discriminant Analysis and the Prediction of Corporate Bankruptcy Source. *The Journal of Finance*, vol. 23(4), pp. 589-609.

Farm Accountancy Data Network Database (FADN) (2016). Retrieved from: http://ec.europa.eu/agriculture/rica/database/database_en.cfm.

Helfert, E. A. (1997). *Techniques of Financial Analysis: A Practical to Managing and Measuring Business Performance*. 9th ed. USA: McGraw Hill, Richard D. Irwin, A Times Mirror Higher Education Group, Inc.

Horngren, C. T., Sundem, G. L, Elliot, J. A., Philbrick, D.R. (2010). *Introduction to Financial Accounting*, 9th ed. New Jersey, USA: Prentice Hall, Pearson Education, Inc.

O'Donnell, C. (2012). Measuring and decomposing agricultural productivity and profitability change. *Australian Journal of Agricultural and Resource Economics*, vol. 54(4), pp. 527–560.

Smith, R. E., Reilly, F. K. (1975). Price-Level Accounting and Financial Analysis. *Financial Management*, vol. 4(2), pp. 21-26.

Veselinovic, B., Drobnjakovic, M. (2014). Qualitative and quantitative analysis of micro and macro aspects of agricultural finance. *The Economics of Agriculture*, vol. 61(3), pp. 771–786.

# The Yield Curve as a Predictor of Economic Activity – the Case of Germany, Great Britain and France

**Jana Hvozdenska**

Masaryk University
Faculty of Economics and Administration, Department of Finance
Lipova 41a, 602 00 Brno, Czech Republic
E-mail: 174974@mail.muni.cz

***Abstract**: In this paper we study the ability of the yield curve to predict GDP activity in Germany, France and Great Britain. The dataset contains the spread between 10-year and 3-month sovereign bonds and real GDP of the countries mentioned above between the years 2000 and 2018. The natural and probably the most popular measure of economic growth is GDP growth, taken quarterly. The steepness of the bond yield curve should be an excellent indicator of a possible future economic activity. A rise in the short rate tends to flatten the yield curve as well as to slow down real growth the near term. The relationship between the spread and future GDP activity was proved already before. The results showed that the prediction of the GDP growth or decrease was proven after year 2008 (the financial crisis) in all mentioned countries, the predictive power of the yield curve was lowered before the year 2008. Certainly the simple yield curve growth forecast should not serve as a replacement for the complex predictive models, it does, however, provide enough information to serve as a useful check on the more sophisticated forecasts. The results showed that the best predictive lag is a lag of five quarters. The theory says that it should be lag of four quarters. The results presented also confirm that 10-year and 3-month yield spread has significant predictive power for real GDP growth after financial crisis. These findings provide further evidence of the potential usefulness of the yield curve spreads as indicators of the future economic activity. These findings might be beneficial for investors and provide further evidence of the potential usefulness of the yield curve spreads as indicators of the future economic activity.*

*Keywords: bonds, GDP prediction, slope, spread, yield curve*

*JEL codes: E43, E44, E47, G01*

## 1 Introduction

Many market observes carefully track the yield curve's shape, which is typically upward sloping and convex. However when the yield curve becomes flat or slopes downward (the spread between sovereign 10-year and 3-month bond is negative) it may signal GDP decrease (recession). The spread of 10-year and 3-month government bond is widely used and it is the most common measurement of the yield spread.

The yield curve simply plots the yield of the bond against its time to maturity. The yield curve – specifically the spread between long term and short term interest rates is a valuable forecasting tool. It is simple to use and significantly outperform other financial and macroeconomic indicators in predicting recessions four quarters ahead.

This paper builds on a wide range of previous researches, but differs in some ways. Bernard and Gerlach (1998) in their paper showed empirically on eight countries that the slope of the yield curve is a good predictor of the real economic activity. Berk and van Bergeijk (2001) examined 12 euro-area countries over the period of 1970-1998 and found that the term spread contains only limited information about future output growth. Their work is based on the previous theoretical researches of Estrella and Hardouvelis (1991), Estrella and Mishkin (1996). There was proven the evidence that the slope of the yield curve and the future GDP activity are related together. However it is necessary to say that this rule was true until the end of 20th century and it mostly disappeared at the beginning of 21st century and appeared again during the financial crisis (from 2008) and later on (De Pace, 2011; Giacomini and Rossi, 2006; Chinn and Kucko, 2010). Most of

the studies are focused on the relationship of the yield curve and GDP activity of the United States of America. All the authors used as a spread, which was analysed in their works, the spread of 10-year and 3-month government bonds. This relationship was proved to be the best in the past (Estrella and Hardouvelis, 1991; Estrella and Mishkin, 1996).

The aim of this paper is to show if the yield spread possesses the predictive power of future economic activity in France, Germany and United Kingdom between years 2000 and 2018 and to examine which time lag of the spread is the best for prediction of the future GDP.

Almost perfect tool containing the relevant future data provides the yield spread of government bonds. The simplest interpretation of the yield spread is through monetary policy of the country. Based on this criterion - relatively low spread reflects the restrictive and tight monetary policy and vice versa - high spread reflects loose monetary policy. We can find the theoretical justification for using of the spread in expectations hypothesis. It assumes that long term rate of return is the average of the current and expected future short term yields. The investor's decision to invest in short term or long term asset is completely irrelevant (Mishkin, 1990).

Dependence of the yield spread and GDP can be derived from their connection to the monetary policy of the state. As bond yields react to monetary policy as well as monetary policy is able to respond to the output of the economy, the yield curve assumes overlapping of policy measures and responses. The yield curve had the ability to reflect future production either directly or indirectly. Indirectly it comes to predicting of the future interest rate and the future monetary policy. It may also reflect the future production directly because the 10-year yields may depend on estimates of the output of the economy in 10-years.

A question arises – how many months, quarters, years of future economic activity can be predicted by the yield spread? Based on the study of Bonser-Neal and Morley (1997) as well as Chinn and Kucko (2010) spread has the greatest ability in predicting one-year horizon (four quarters ahead). These studies were carried out on USA data. As it was mentioned above, to prove if the spread has the best predictive power in one-year horizon is one of the aims of this paper.

## 2 Methodology and Data

There are many ways of using the yield curve to predict the future real activity. One common method uses inversions (when short term rates are higher than long term rates) as recession indicators. Obtaining predictions from the yield curve requires a lot of preliminary work. There is the principle which needs to be held: keep the process as simple as possible.

A yield curve may be flat, up-sloping, down-sloping or humped. The standard solution uses a spread (difference between two rates). The problem is to choose the spread between the right terms. The most used spread is between 10-year and 3-month bonds. The problem is that there are rarely bonds which mature exactly in 10 years (or 3 months). In that case the best solution is to use the yield curve, which shows the yield of each maturity. Creating and calculating of the yield curve is a rather difficult task because there are many ways how to do it and every country uses a different model of construction.

The yield curves are constructed by Bloomberg, therefore the data for spreads were gained from Bloomberg. For the spreads were chosen 10-year government bond rates minus 3-month sovereign bond rates, as in Estrella and Hardouvelis (1991) and Estrella and Mishkin (1996). Quarterly data were used for the spreads because the data for the economic activity are taken on quarterly basis as well. The data for real GDP can be found at Eurostat, OECD statistics or Bloomberg. The data of real GDP obtained and used in this paper are from OECD statistics.

The selected countries are France, Germany and Great Britain.

There is no previous research which would prove or reject the hypothesis of real GDP and bond spread dependence in European countries.

**Model Specification**

As a measure of real growth four-quarter percent change in real GDP was used (thus the percent change of the quarter against the last year's same quarter was calculated, e.g. the change from 1Q2004 and 1Q2003 real GDP was used). GDP is standard measure of aggregate economic activity and the four-quarter horizon answers the frequently asked question – what happens the next year?

The sample period starts from 1Q2000 and ends on 4Q2018. This time range covers the period before financial crisis, period of financial crisis and period after financial crisis. The basic model is designed to predict real GDP growth/decrease two to six quarters into the future based on the current yield spread Bonser-Neal and Morley (1997).

This was accomplished by running of a series of regressions using real GDP activity and the spread between 10-year and 3-month bond yields lagged two to six quarters (e.g. if the spread was lagged by 4 quarters, the interest rate spread used for 3Q2001 is actually from 3Q2000).

The last step is to find out which spread lag is the best for which country and to prove the hypothesis that the lag of four quarters is the best one for prediction of future GDP growth.

To generate the GDP predictions the regression using the whole sample was run, and later on two divided samples of real GDP and spreads of each selected country (the sample is divided in 4Q2007/1Q2008, because this period preceded financial crisis and should show some changes in prediction of the yield curve spread) were run. Time series data structure and ordinary least squares (OLS) method was used. All calculations were carried out in Gretl software.

The coefficients α and β were estimated for each country:

$$\text{Real GDP}_{t+n} = \propto + \beta * \text{spread}_t + \varepsilon_t \quad (1)$$

Where:

$\text{Real GDP}t + n$ is a prediction of the future real GDP in time $t + n$

$n$ is the lag of spread, value of the lag can be 2, 3, 4, 5 or 6

$\text{spread}_t$ is spread between 10-year and 3-month state bonds in time $t$

$\varepsilon_t$ is a white noise

## 3 Results and Discussion

The tests of normality were carried out. For the evaluation of the normality test is probably the easiest to observe the result from graph of the assumed normal distribution in comparison to the actual distribution of residues and analyse p-values of Chi-square test. We test the hypothesis H0: Residuals are normally distributed, against the hypothesis H1: Residuals are not normally distributed, the significance level of α was chosen as 0,01. If the p-value is greater than α then we cannot reject the H0, therefore the residuals are normally distributed. The test contributed that the data have normal distribution.

For the testing of heteroscedasticity we chose the White's test. We test the hypothesis H0: Constant variances of residuals – homoscedasticity, against H1: Heteroscedasticity. The significance level of α was chosen as 0.01. If the p-value is greater than α then we cannot reject H0, therefore it contributes homoscedasticity.

Does the yield curve accurately predict the future GDP?

To generate the GDP predictions a regression using the whole sample to generate each predicted data point was run.

**Results of Regression – Whole Sample**

The whole sample of dataset contains the real GDP from 1Q2000 to 1Q2018. A regression of the whole sample was run and we got the results as seen in Table 1.

For all the countries (France, Germany and United Kingdom) the best results were gained with lag of spreads by five quarters.

We can say that models for France and Germany are statistically significant, because the p-values are under 1%(***) or 5% (**). However the R2 are not very high. These models could be used as predictive models, but they would not explain very big proportion of the sample. The R2 coefficients (coefficients of determination) show us how many percent of the sample can be explained by these models.

The model for United Kingdom cannot be used as a predictive due to its high p-value (0.4875) and very low $R^2$ (0.8356%).

**Table 1** Results of All Countries and Whole Sample from OLS Regression

| 1Q00 – 1Q18 | Constant | Spread | P - value | $R^2$ |
|---|---|---|---|---|
| **France (n=5)** | 0.00312575 | 0.58956 | 0.0435 ** | 0.076529 |
| **Germany (n=5)** | -0.005489 | 1.29475 | 0.0047 *** | 0.147659 |
| **Great Britain (n=5)** | 0.0175859 | 0.36598 | 0.4875 | 0.08356 |

Source: author's own calculations

The $R^2$ coefficients (coefficients of determination) show us how many percent of the sample can be explained by these models.

For example we can say that future real GDP of Germany will be:

$$\text{Real GDP}_{\text{Germany t+5}} = -0.005489 + 1.29475 * \text{spread}_{\text{Germany t}}$$

By this model we can predict future real gross domestic product for Germany five quarters ahead.

We can test the hypothesis that the behavior of the spread and gross domestic product has changed during the financial crisis, therefore the sample was divided into two samples in order to prove this hypothesis.

**Results of Regression – Divided Samples**

The research continued as follows – the whole sample was divided into two samples. The first one is from 1Q2000 to 4Q2007, the second one is from 1Q2008 to 4Q2018 in order to show if there is any change of behavior and dependency between the variables before or after the financial crisis.

Regressions of the first sample and the second sample were run. The results for the time span of 1Q2000 – 4Q2007 (first sample) are possible to see in Table 2, the results for the period of 1Q2008 – 4Q2018 (second sample) are in Table 3.

**Table 2** Results of All Countries and Sample from 1Q2000 to 4Q2007

| 1Q00 – 4Q07 | Constant | Spread | P - value | $R^2$ |
|---|---|---|---|---|
| **France (n=3)** | 0.0132012 | 0.514563 | 0.0595 * | 0.113404 |
| **Germany (n=2)** | 0.0246873 | -0.599216 | 0.1611 | 0.064403 |
| **Great Britain (n=2)** | 0.0262708 | 0.309048 | 0.2575 | 0.042516 |

Source: author's own calculations

In the first period the best results for the France were gained with lag of spreads by three quarters, for Germany and United Kingdom by two quarters.

We can say that only model for France can be used as predictive, because its p-value is under 10% (*). Again the $R^2$ is not very high. Models for Germany and United Kingdom cannot be used as a predictive model because of their high p-values and very low $R^2$.

**Table 3** Results of All Countries and Sample from 1Q2008 to 4Q2018

| 1Q08 – 4Q18 | Constant | Spread | P - value | $R^2$ |
|---|---|---|---|---|
| **France (n=5)** | -0.0221453 | 1.17859 | 0.0002 *** | 0.485678 |
| **Germany (n=5)** | -0.0334598 | 2.34756 | 0.0001 *** | 0.473715 |
| **Great Britain (n=5)** | -0.0340596 | 1.69856 | 0.00247 *** | 0.269256 |

Source: author's own calculations

In the second period the best results for all countries were gained by lag of spreads by five quarters. All models can be used as predictive and we got the best results from all observations. $R^2$ of France and Germany are higher than 40% which is very good compared to the previous period. Even the result of United Kingdom shows the big difference against the previous period. This change in prediction possibility may be caused by different behavior of financial markets after the financial crisis (after year 2008).

The best predictive models are as follows:

$$\text{Real GDP}_{\text{France t+5}} = -0.0221453 + 1.17859 * \text{spread}_{\text{France t}}$$

$$\text{Real GDP}_{\text{Germany t+5}} = -0.0334598 + 2.34756 * \text{spread}_{\text{France t}}$$

$$\text{Real GDP}_{\text{United Kingdom t+5}} = -0.0340596 + 1.69856 * \text{spread}_{\text{United KIngdom t}}$$

For example if there would be a change of 1% up in the spread of the France then the GDP would increase about 1.2% ($-0.0221453 + 1.17859 * 1\%$).

At the end we can summarize the new theoretical finding according to which lag of spread is the best for predicting of the future GDP. We proved that in the selected countries it is lag of five quarters which shows the best results which are possible to use for predicting of future GDP.

At the end we can write down a short summary of the best results (n for whole sample, 1st period, 2nd period).

France – n=5, n=3, n=5

Germany – n=5, n=2, n=5

United Kingdom – n=5, n=2, n=5

The most common lag (and possibly the most suitable for predicting of the GDP) is lag of 5 quarters.

## 4 Conclusions

The 10-year and 3-month spread has substantial predictive power and should provide good forecast of real growth four quarters into the future (this was proved in USA). We showed that the best predictive lag of spreads is a lag of five quarters in order to get the best results for predictive models predictive power for real GDP growth and the behaviour of the models changed during and after the financial crisis. The results presented above confirm that 10-year and 3-month yield spread has a significant predictive power for real GDP growth and the behavior of the models changed during and after the financial crisis.

The simple yield curve growth forecast should not serve as a replacement for the predictions of companies, who deal with predicting of many economic indicators, it however does provide enough information to serve as a useful check on the more sophisticated forecasts.

Future research could be extended to a wider examination of the best lags of spreads in more countries, such as EU15 or EU28. It would be interesting to see if there is any rule which would prove the hypothesis that lag of five quarters is the best for predicting future GDP growth in the countries of European Union (in USA it was proved that the best lag of spread is a lag of 4 quarters).

## References


Berk, J., van Bergeijik, P. (2001). On the Information Content of the Yield Curve: Lessons for the Eurosystem? *Kredit und Kapital,* vol. 34.2001, pp. 28–47.

Bernard, H. J., Gerlach, S. (1998). Does the Term Structure Predict Recessions? The International Evidence. *CEPR Discussion Papers,* vol. 1892.

Bloomberg (2016). *30-year, 15-year, 10-year, 5-year, 1-year, 3-month Government Bond Yields.* Retrieved from: Terminal Bloomberg.

Bonser-Neal, C., Morley, T. R. (1997). Does the Yield Spread Predict Real Economic Activity? A Multicountry Analysis. *Economic Review: Federal Reserve Bank of Kansas City,* vol. 5(3), pp. 37-53.

Chinn, M., Kucko, K. (2010). The predictive power of the yield curve across countries and time. *NBER Working Paper Series.*

De Pace, P. (2011). *G*DP Growth Predictions through the Yield Spread: Time – Variation and Structural Break. *Euro Area Business Cycle Network*. Retrieved from: http://ssrn.com/abstract=1401752. (Accessed on 01. 05. 2016)

Estrella, A., Hardouvelis G. A. (1991). The Term Structure as a Predictor of Real Economic Activity. *Journal of Finance*, vol. 46(2), pp. 555-576.

Estrella, A., Mishkin, F. S. (1996). The Yield Curve as a Predictor of U.S. Recessions. *Current Issues in Economics and Finance*, vol. 2(7), pp. 1-6.

Giacomini, R., Rossi, B. (2005). How stable is the Forecasting Performance of the Yield Curve for Output Growth. *Oxford Bulletin of Economics and Statistics*, vol. 68(1), pp. 783-795.

Mishkin, F. (1990). Yield curve. *NBER Working Papers Series*, vol. 3550.

OECD statistics (2016). *Quarterly National Accounts: Quarterly Growth Rates of Real GDP, Growth rate compared to the same quarter of previous year*. Retrieved from: http://stats.oecd.org/index.aspx?queryid=350. (Accessed on 01. 05. 2016)

# Investing in Emerging Markets: Contrasted Mean and Median Models in Egyptian Stock Markets

**Mai A. Ibrahim[1], Mohammed El-Beltagy[2], Motaz Khorshid[3]**

[1] Cairo University
Faculty of Computers and Information
Dr. Ahmed Zewail Street, Postal Code: 12613, Orman, Giza, Egypt
m.adel@fci-cu.edu.eg

[2] Optomatica
Optomatica, Cairo, Egypt
Flat 102, 1st Floor Building 11, The 6th Touristic Area, 6th of October, Giza - 12582, Egypt
mohammed@computer.org

[3] Cairo University
Faculty of Computers and Information
Dr. Ahmed Zewail Street, Postal Code: 12613, Orman, Giza, Egypt
motaz.khorshid@fci-cu.edu.eg

***Abstract:*** *Emerging Markets return distributions have shown significance departure from normality were they are characterized by fatter tails relative to the normal distribution and exhibit levels of skewness and kurtosis that constitute a significant departure from normality. Therefore the classical Markowitz Mean-Variance is not the most suitable portfolio optimization model to apply for emerging markets since it assumes normally-distributed returns and a quadratic utility function. Alternative models were suggested in the literature, higher moments models have been introduced to account for the insufficiency of the description of a portfolio by only its first two moments while the median model has been introduced as a robust statistic which is less affected by outliers than the mean. Alternative risk measures have been introduced instead of variance to capture the effect of risk. The purpose of this paper is to investigate the performance of different portfolio models in an emerging market such as the Egyptian Market to decide which can suit better the characteristics of this market. Higher moment models including Mean-Variance-Skewness and Mean-Variance-Skewness-Kurtosis and median models including Median Value-at-Risk and Median Mean-Absolute-Deviation are compared to the Markowitz model. The formulation of the models varied between single-objective non-linear programming problems (NLP), single-objective mixed-integer linear programming (MILP) problems and single-objective quadratic programming problems. All the models are tested on real financial data in the Egyptian main Index EGX30. In general, median models have shown better performance than higher moments models and specifically the MedianVaR model. The MedianVaR model has provided the higher final wealth for the investor over the entire period of study. These findings can guide the decision making process for portfolio optimization in the Egyptian market were one can barely find any study on the portfolio optimization problem for the Egyptian Market in specific and the MENA region in general.*

*Keywords: Emerging markets, higher moment models, median models, mixed-Integer linear programming, non-Linear programming*

*JEL codes: C61; G11*

## 1 Introduction

The mean-variance model was introduced by Markowitz (Markowitz, 1952) and was a milestone in finance theory. The mean-variance model assumed that the probability distribution of the asset returns is the multivariate normal distribution; hence the distribution of asset returns can be described by the expected return and the variance. However empirical finance has shown that there are many examples that don't follow the normal distribution were the data include fat tails, skewness and abnormal jumps. In specific, the emerging markets return distributions were shown not to display normal

patterns were they have fatter tails (Fifield et al., 2011) and exhibit levels of skewness and kurtosis that constitute a significant departure from normality. Under significant levels of kurtosis and skewness, considering only the mean and variance may underestimate the risk leading to inefficient portfolios (Lai et al., 2006).

While in the original Markowitz model, the risk is measured by the variance. Some authors suggested discarding the variance which has been criticized for its symmetric nature. Later, some authors suggested discarding also the mean as it can be a poor estimator were it is so prone to errors (Jagannathan and Ma, 2003), and using robust statistics as alternative estimators in the mean-variance model.

To account for all the problems mentioned earlier, several models have been introduced in literature. Higher moments models have been introduced to solve the problem of the insufficiency of the description of a portfolio by only its first two moments. Recent work by many authors including (Li et al., 2010), all confirm the importance of higher moments of returns in portfolio construction. The median model has been introduced as a robust statistic which is less affected by outliers than the mean. Several other risk measures have been later considered, creating a family of mean-risk models (Mansini et al., 2003). Risk measures are classified into two categories. The first category measures the magnitude of deviations from a specific target and can be classified into symmetric measures and asymmetric risk measures. The symmetric risk measures include the mean absolute deviation (MAD) (Sharpe, 1971) and the Gini's mean absolute difference (GMD) (Yitzhaki, 1982) while the asymmetric risk measures include the semi-variance risk measure (Markowitz, 1959), central semi-deviations (Ogryczak and Ruszczynski, 2001) and lower partial moments risk measures. The second category is concerned with the left tail of a distribution and measures the overall significance of possible losses. The commonly used ones in this category are Value-at-Risk (VaR) and its updated version the Conditional Value-at-Risk (CVaR).

The paper is organized as follows, Section 2 contains the formulation of all the models were the Mean-Variance-Skewness (MVS) and Mean-Variance-Skewness-Kurtosis (MVSK) are formulated as single-objective non-linear programming problems (NLP) and median models including the Median-Value at Risk (Median-VaR) and Median-Mean Absolute Deviation (Median-MAD) are formulated as a single-objective mixed-integer linear programming (MILP) problems. Section 3 shows the application and comparison of the higher moment models and median models and the results are tested on real financial data in the Egyptian main Index EGX30. Finally, some concluding remarks are given and some directions for future research are pointed out.

## 2 Model Formulation

$N$ available assets are traded and the investor calculates an optimal portfolio through one of the following models the Equal-Weights benchmark model, two median models which are included are the Median-MAD and the Median-VaR models, the Markowitz Mean-Variance model and the two higher moments models which are Mean-Variance-Skewness and the Mean-Variance-Skweness-Kurtosis models. Let $Z$ be a random variable representing portfolio returns, were $r_{ti}$ be the return of asset $i$ in time period $t$ and the weights are $x_i$ which is the proportion of capital to be invested in asset $i$.

### The Equal Weights Benchmark Model

The Equal Weights model keeps uniform portfolio weights in every period. DeMiguel et al. (DeMiguel et al., 2009) has proved that this strategy is the best among many other strategies and therefore it is considered as an important benchmark. The model is subject to the budget/unity $\sum_{i=1}^{N} x_i = 1$ constraint and non-negativity constraints $x_i \geq 0, i = 1,2, \dots \dots .. N.$

$$x_i = \frac{1}{T} \; t = 1,2, \dots \dots \dots T \qquad (1)$$

**The Median Models**

The median function is an NP-hard, to be able to solve it using an exact method it can be re-formulated as a mixed integer linear programming (MILP) model (Benati, 2015). Let $z^{med}$ be the median of portfolio returns $z_t$, were $z_t = \sum_{i=1}^{N} r_{ti}x_i,\ \ t = 1,2,\dots..T$ and $i = 1,2,\dots\dots N$. Let $M$ be a sufficiently large number. The MILP is:

$$\max \text{median} = z^{med} \tag{2}$$

$$s.t.\ z^{med} \le \sum_{i=1}^{N} r_{ti}x_i + M(1 - y_t) \quad t = 1,2 \dots\dots T \tag{3}$$

$$\sum_{t=1}^{T} y_t = \left\lceil \frac{T+1}{2} \right\rceil \tag{4}$$

$$y_t \in \{0,1\} \quad t = 1,2,\dots\dots\dots T \tag{5}$$

The binary variables $y_t$ are used to determine the inequalities defining $z^{med}$. The equations (3) are active if and only if $y_t = 1$ and that will happen $\left\lceil \frac{T+1}{2} \right\rceil$ times according to equation (4). The three risk measures can be reformulated using binary or continuous variables and linear constraints.

**Median-MAD Model**

The mean absolute deviation (MAD) was early considered by (Konno and Yamazaki, 1991) in portfolio optimization as an attempt to linearize the portfolio optimization procedure. Although solving quadratic programming is no longer difficult than in the seventies and early eighties, MAD remains an alternative to the mean-variance model (Roman and Mitra, 2009). The MAD is considered as symmetric risk measure. The problem is a bi-objective problem, maximizing median (6) and minimizing MAD (7) as in (Trzpiot et al., 2008) subject to the budget/unity and non-negativity constraints.

$$\max \text{median} = z^{med} \tag{6}$$

$$\min \text{MAD}(z) = \frac{1}{T} \sum_{t=1}^{T} \left| (z_t - z^{med}) \right| \tag{7}$$

The median is optimized while the MAD is kept below a target $v^*$, so the problem can be reformulated as in (Benati, 2015) by adding the continuous variables $v_t$ and $z_t$ and establishing a threshold $v^* \in R$ (Benati, 2015) . The following inequalities are added to the Median model equations (2), (3), (4), (5):

$$z_t = \sum_{i=1}^{N} r_{ti}x_i \quad t = 1,2 \dots\dots T \tag{8}$$

$$v_t \ge z_t - z^{med} \quad t = 1,2 \dots\dots T \tag{9}$$

$$v_t \ge z^{med} - z_t \quad t = 1,2 \dots\dots T \tag{10}$$

$$\frac{1}{T} \sum_{t=1}^{T} v_t \le v^* \tag{11}$$

The constraints (8) are defining the return vectors, while constraints (9) and (10) are used to describe the non-linear continuous variable $v_t$ . While (11) is a constraint on the maximum MAD.

**MedianVaR**

Value-at-Risk (VaR) is a risk measure that has received greater acceptance in practice. $VaR_\alpha$ is defined as the maximum loss of portfolio during a certain period under certain confidential level (1-α), which was firstly proposed by (Morgan et al., 1996), were α is the probability of potential loss in the future exceeding VaR, and is usually between zero and one. The VaR has become the most widely used risk measure for years then many researches on new risk measures have been proposed to overcome the VAR drawbacks. The drawbacks are that VaR is a non-convex function which is difficult to optimize and fails to satisfy the sub-additivity property (Roman and Mitra, 2009), which is the property that imposes diversification. The Value-at-Risk (VaR) is considered a tail risk measure.

The problem is a bi-objective problem, maximizing median (6) and minimizing VaR (13) subject to the budget and non-negativity constraints.

$$\max \text{median} = z^{\text{med}} \tag{12}$$

$$\min \text{VaR}_{\alpha}(Z) = -\min\{u|P(Z \leq u) \geq \alpha\} \tag{13}$$

The reformulation to linearize the MedianVaR as in (Benati, 2015) is obtained by adding the following constraints and variables to the median model equations (2), (3), (4), (5):

$$-z^{\text{VaR}} \leq \sum_{i=1}^{N} r_{ti} x_i + M(1 - w_t) \quad t = 1,2 \dots \dots T \tag{14}$$

$$z^{\text{VaR}} \leq z^* \tag{15}$$

$$\sum_{t=1}^{T} w_t = \lceil (1 - \alpha)T \rceil \tag{16}$$

$$w_t \geq y^t \quad t = 1,2 \dots \dots T \tag{17}$$

$$w_t \in \{0,1\} \quad t = 1,2 \dots \dots T \tag{18}$$

The new variables $z^{\text{VaR}}$ and $z^*$ are introduced were $z^{\text{VaR}}$ represents the VaR while $z^*$ is the greatest value of VaR that is accepted. The equations (14) and (16) are similar to equations (3) and (4) that define $z^{\text{med}}$, and they define $z^{\text{VaR}}$. The constraint (17) connects the binary variables $w_t$ (18) with the binary variables of the median, while (15) is a constraint on the maximum VaR.

**The Markowitz Mean-Variance Model (MV)**

Let $z^{\text{mean}}$ be the mean of portfolio return were the portfolio return is calculated as $\sum_{i=1}^{N} r_{ti} x_i$. Let $\sigma_{ij}$ be the variance-covariance matrix which represents the covariance between returns of asset $i$ and asset $j$. The mean is maximized (19) while the variance is kept below a "calculated" threshold $v^*$ (20) subject to the budget/unity and non-negativity constraints.

$$\max \text{mean} = z^{\text{mean}} \tag{19}$$

$$\text{s.t.} \sum_{i=1}^{N} x_i^2 \sigma_i^2 + \sum_{i=1}^{N} \sum_{j=1}^{N} x_i x_j \sigma_{ij} (i \neq j) \leq v^* \tag{20}$$

**The Higher Moment Models**

**Mean-Variance-Skewness Model (MVS)**

While the two dimensional matrix $\sigma_{ij}$ represents the variance-covariance, the $s_{iij}$, are the skewness-coskewness matrices of the joint distribution returns of asset $i$ and $j$ and can be visualized as a three dimensional space. The problem maximizes the mean of returns (19), subject to the variance being less than a "calculated" threshold $v^*$ (20) and the skewness being greater than a "calculated" threshold $s^*$ (21) subject to the budget and non-negativity constraints. The thresholds are being calculated by solving each sub-problem.

$$\sum_{i=1}^{N} x_i^3 s_i^3 + 3 \sum_{i=1}^{N} \left( \sum_{j=1}^{N} x_i^2 x_j s_{iij} + \sum_{j=1}^{N} x_i x_j^2 s_{iij} \right), (i \neq j) \geq s^* \tag{21}$$

**Mean-Variance-Skewness-Kurtosis Model (MVSK)**

The four dimensional kurtosis-cokurtosis matrices of the joint distribution returns of asset $i$ and $j$ are represented by $k_{iiij}$,$k_{ijjj}$, $k_{iijj}$. The problem maximizes mean (19), keeping the variance (20) and kurtosis below the calculated thresholds $v^*$and $k^*$, while the skewness must exceed $s^*$ (21) subject to the budget and non-negativity constraints.

$$\sum_{i=1}^{N} x_i^4 k_i^4 + 4 \sum_{i=1}^{N} \left( \sum_{j=1}^{N} x_i^3 x_j k_{iiij} + \sum_{j=1}^{N} x_i x_j^3 k_{ijjj} \right) + 6 \sum_{i=1}^{N} \sum_{j=1}^{N} x_i^2 x_j^2 k_{iijj}, (i \neq j) \leq k^* \tag{22}$$

## 3 Results and Discussion

All the portfolio optimization models formulated above, are used for portfolio optimization using real financial data from the Egyptian stock market, in order to determine which

model has the best performance. The data is made up of returns calculated from the real weekly "Adjusted closing price" for 19 main companies in EGX30- the main index of the Egyptian Stock Exchange traded from July 2008 to November 2014, for a whole of 335 trading weeks.

A number of data sets were constructed in order to compare the different models and their sizes vary between 100, 235 to 335 weeks. The "Large" dataset spans the whole 335 trading weeks (July 2008 to November 2014), the medium dataset includes a total of 235 trading weeks (June 2010 to November 2014) while the fresh "Small" dataset includes a total of 100 trading weeks (January 2013 to November 2014).

An investor calculates an optimal portfolio through one of the following models using the past returns of the last $T = 31$ periods. The portfolio weights are then kept fixed for a period of $W = 30$ trading days (the rolling window), after which a new portfolio is calculated. The results are compared to the benchmark strategy "Equal-Weights" strategy that keeps uniform portfolio weights (DeMiguel et al., 2009). The risk is being constrained below what has been observed in the last period by the benchmark portfolio "Equal-Weights". More precisely, the threshold of maximum risk is calculated using the past performance of the uniform portfolio "Equal-Weights".

The MedianVaR uses $\alpha = 0.2$ and $\alpha = 0.3$. Usually $\alpha$ is a number close to 0, and for $\alpha = 0.5$ the VaR is the median, so that the VaR is (correctly) a value below the median, assume $\alpha \leq 0.5$. A number of estimation window lengths were tested and the best results were for the $W = 30$.

The outcomes analyzed to be able to compare the different models are the realized returns and the portfolio weights. The differences between portfolio weights are measured according to their diversification while the portfolio returns are measured through their quartile distributions. All tests were carried out in R, for the LP and MILP problems, the lpSolve and lpSolveAPI packages were used while for the NLP problems, the Nloptr package was used.

**Trading with real Egyptian data**

This section presents the trading experiments we performed with real data from the Egyptian stock market. Using these experiments, we evaluated the mean and median portfolio optimization models comparing their performance together using their accumulated return, the quartile distributions of portfolio and the differences between portfolio weights. The accumulated return is a standard performance measure for comparing investments. It relates the wealth at time t, $W_t$, with the initial $W_0$. As $W_t = W_0 \times \mathrm{AccumulatedReturn}_t$. The accumulated return is defined as $\prod_{i=0}^{t}(1 + r_i)$. All trading experiments used an initial wealth $W_0 = 1$.

The "Median-VaR (0.2)" had the highest return by achieving a weekly accumulated return of 5.134 which is 66.5 % above the 3.057 achieved by the next performing model "Mean-Variance" model, and is the highest accumulated return achieved over the three datasets. The "Median-VaR (0.2)" had also had the lowest Accumulated Return in the 235 weeks dataset and that represents its "risk-seeking" nature. This model outperforms all other models in terms of weekly accumulated return and is also among the most dispersed in terms of the maximum and minimum returns, and thus can be classified as appropriate for risk takers.

Otherwise, mean models are better in general than median models regarding the final accumulated return achieved. The Median-VaR models regardless of the (α) give the best results considering the final accumulated return when both the whole data set "335 weeks dataset" and the fresh dataset "100 weeks dataset" are considered. While the "235 weeks dataset" is less reliable as it includes the most unstable period of the Egyptian economic (revolution and post-revolution period).

**Table 1:** Weekly Accumulated Return for the three dataset 335, 235, 100 weeks

| | | Small | Medium | Large |
|---|---|---|---|---|
| **Benchmark Model** | **EqualWeights** | 1.689 | 1.487 | 2.789 |
| **Median Models** | **MedianMAD** | 1.397 | 1.152 | 1.975 |
| | **MedianVaR(0.2)** | 1.867 | 0.283 | 5.134 |
| | **MedianVaR(0.3)** | 2.333 | 0.927 | 1.740 |
| **Mean Models** | **MeanVariance** | 1.643 | 1.434 | 3.057 |
| | **MeanVarSkew** | 1.855 | 0.975 | 2.586 |
| | **MeanVarSkewKurt** | 1.572 | 1.728 | 1.997 |

Source: own calculation

**Realized Returns Analysis**

To compare the different models, several performance criteria were used. The minimum (min), first quartile (1st quart), median, third quartile (3rd quart), mean and maximum (max) portfolio returns and the dispersion measures as the standard deviation (std) are shown in Table 2. The maximum loss for MedianVaR(0.3) is 30.3% while the MedianMAD is approximately 13.8% with the rest of models varying between those two figures. Concerning the profit, the maximum profit achieved by MedianVaR(0.2), MedianVaR(0.3) is 52.8%.

**Table 2:** Descriptive Statistics for the 335 weeks dataset

| | | Min | 1st quart | Median | 3rd quart | Max | Mean | STD |
|---|---|---|---|---|---|---|---|---|
| **Benchmark** | **EqualWeights** | -0.1729 | -0.0124 | 0.0055 | 0.0273 | 0.1873 | 0.0044 | 0.0446 |
| **Median** | **MedianMAD** | -0.1379 | -0.0145 | 0.0029 | 0.0223 | 0.1939 | 0.0029 | 0.0362 |
| | **MedVaR(0.2)** | -0.2468 | -0.0280 | 0.0016 | 0.0399 | 0.5276 | 0.0084 | 0.0812 |
| | **MedVaR(0.3)** | -0.3030 | -0.0320 | 0.0005 | 0.0388 | 0.5276 | 0.0057 | 0.0799 |
| **Mean** | **MeanVariance** | -0.1742 | -0.0134 | 0.0059 | 0.0297 | 0.1912 | 0.0047 | 0.0454 |
| | **MeanVarSkew** | -0.1801 | -0.0144 | 0.0047 | 0.0290 | 0.1892 | 0.0042 | 0.0454 |
| | **MVarSkewKurt** | -0.1676 | -0.0160 | 0.0032 | 0.0256 | 0.1978 | 0.0032 | 0.0438 |

Source: own calculation

The maximum profit achieved over the whole time period is maximized for MedianVaR models, making them the models with maximum variation/dispersion for weekly returns and that's also clear in the dispersion measures, were the MedianVaR have the highest standard deviation. So one can conclude that the MedianVaR(0.2) and MedianVaR(0.3) models, generate the portfolios with the largest returns but also entailing the largest risk of underachievement. On the other hand, the Markwoitz Mean-Variance and Mean-Variance-Skewness demonstrate quite good average returns with relatively low risk of underachievement. This suggests further detailed research on a proper parameter selection for the MedianVaR models.

**Portfolio Weights Analysis**

The diversification is measured to show the differences between the portfolio weights. Two concentration indexes HH index (Herfindahl-Hirschman) (Hirschman, 1964) and Max index are considered to measure the diversification of the portfolio weights. The HH index is $\sum_{i=1}^{N} x_i^2$ and the Max index is $\{x_i | i = 1, \dots\dots, N\}$. The maximum value for both indexes is 1 which indicates that the portfolio is composed of a single asset. The time series of the two concentration indexes are compared between the different models using their mean value and are reported in Table 3.

**Table 3:** Egyptian Market Stock Data: HH and Max index

| | | Small | | Medium | | Large | |
|---|---|---|---|---|---|---|---|
| | | **HH** | **Max** | **HH** | **Max** | **HH** | **Max** |
| **Benchmark** | **Equal Weights** | 0.333 | 0.333 | 0.143 | 0.143 | 0.091 | 0.091 |
| **Median** | **MedianMAD** | 0.358 | 0.499 | 0.326 | 0.453 | 0.395 | 0.532 |
| | **MedianVaR(0.2)** | 0.706 | 0.800 | 0.843 | 0.888 | 0.605 | 0.685 |
| | **MedianVaR(0.3)** | 0.835 | 0.868 | 0.731 | 0.795 | 0.569 | 0.677 |
| **Mean** | **MeanVariance** | 0.074 | 0.107 | 0.068 | 0.099 | 0.071 | 0.102 |
| | **MeanVarianceSkew** | 0.070 | 0.098 | 0.073 | 0.110 | 0.073 | 0.107 |
| | **MeanVarSkewKurt** | 0.504 | 0.526 | 0.396 | 0.447 | 0.356 | 0.391 |

Source: own calculation

To understand why the mean models provide less risky portfolios than median models, one can observe that the diversification indexes of the median portfolios are higher than those of the mean models. Portfolios selected by the Markowitz model usually contain a large number of assets with small shares; such securities often cause marginal contributions to the portfolio return. Some models show a more aggressive behavior, by providing largest cumulative returns and lower diversification. While MedianVaR is classified as the most 'risk seeking' model while the Markowitz Mean-Variance and Mean-Variance-Skewness model are the most 'risk averse' providing portfolios with a stable diversification and lower returns.

## 4 Conclusions

The two median models MedianMAD and MedianVaR and the three mean models Mean-Variance, Mean-Variance-Skewness and Mean-Variance-Skewness-Kurtosis are applied and compared for asset allocation using real weekly prices for 19 main companies in EGX30. In general, median models have shown better performance than higher moments models and specifically the MedianVaR(0.2) model. In the future, some attempts should be done to choose the best value of α for MedianVaR as it was the model that yielded the highest weekly accumulated return over all the other models in the large dataset.

The MedianVaR model has turned out to be among the most dispersed in terms of the maximum and minimum returns, and thus can be appropriate for risk takers investors. This is very clear were in the large dataset it was the best performing model while in the medium dataset it was the worst performing one. Other models such as the Markwoitz Mean-Variance and Mean-Variance-Skewness demonstrate quite good average returns but not the highest with relatively low risk of underachievement which make them suitable for risk averse investors.

Although risk measures such as Conditional Value-at-Risk (CVaR) are very suitable to be applied when the distribution of returns is not normal, we did not apply it here since the CVaR model is designed to minimize the average extreme loss, a small window size will not help assess to true risk. Therefore, the window size of CVaR model must be set to around "300" weeks and in our case we don't have enough data. In addition to being a non-linear function CVaR which is hard in general to optimize.

## References

Benati, S. (2015). Using medians in portfolio optimization. *Journal of the Operational Research Society*, vol. 66(5), pp. 720–731.

DeMiguel, V., Garlappi, L., Uppal, R. (2009). Optimal versus naive diversification: How inefficient is the 1/N portfolio strategy? *Review of Financial Studies*, vol. 22(5), pp. 1915–1953.

Fifield, S. G. M., Power, D. M., Tolikas, K. (2011). The rare event risk in African emerging

stock markets. *Managerial Finance*, vol. 37(3), pp. 275–294.

Hirschman, A. O. (1964). The paternity of an index. *The American Economic Review*, vol. 54(5), pp. 761–762.

Jagannathan, R., Ma, T. (2003). Risk reduction in large portfolios: Why imposing the wrong constraints helps. *The Journal of Finance*, vol. 58(4), pp. 1651–1684.

Konno, H., Yamazaki, H. (1991). Mean-absolute deviation portfolio optimization model and its applications to Tokyo stock market. *Management Science*, vol. 37(5), pp. 519–531.

Lai, K. K., Yu, L., Wang, S. (2006). Mean-variance-skewness-kurtosis-based portfolio optimization. *Computer and Computational Sciences, 2006. IMSCCS'06. First International Multi-Symposiums On*, vol. *2*, pp. 292–297.

Li, X., Qin, Z., Kar, S. (2010). Mean-variance-skewness model for portfolio selection with fuzzy returns. *European Journal of Operational Research*, vol. 202(1), pp. 239–247.

Mansini, R., Ogryczak, W., Grazia Speranza, M. (2003). LP solvable models for portfolio optimization: A classification and computational comparison. *IMA Journal of Management Mathematics*, vol. 14(3), pp. 187–220.

Markowitz, H. (1952). Portfolio selection. *The Journal of Finance*, vol. 7(1), pp. 77–91.

Markowitz, H. (1959). *Portfolio Selection, Efficent Diversification of Investments*. John Wiley & Sons, New York.

Morgan, J. P. (1996). *Riskmetrics technical document*. 4th Edition. J. P. Morgan/Reuters, New York.

Ogryczak, W., Ruszczynski, A. (2001). On consistency of stochastic dominance and mean--semideviation models. *Mathematical Programming*, vol. 89(2), pp. 217–232.

Roman, D., Mitra, G. (2009). Portfolio selection models: A review and new directions. *Wilmott Journal*, vol. 1(2), pp. 69–85.

Sharpe, W. F. (1971). Mean absolute deviation characteristic lines for securities and portfolios. *Management Science*, vol. 18(2).

Trzpiot, G., Majewska, J. (2008). Investment decisions and portfolios classification based on robust methods of estimation. *Operations Research and Decisions*, vol. 1, pp. 83–96.

Yitzhaki, S. (1982). Stochastic dominance, mean variance, and Gini's mean difference. *The American Economic Review*, vol. 72(1), pp. 178–185.

# Key Performance Indicators System for Small and Medium-sized Enterprises in Non-productive Automotive in the Czech Republic: A Research Design

**Nikola Janíčková[1], Ondřej Žižlavský[2]**

[1] Brno University of Technology
Faculty of Business and Management, Department of Finance
Kolejní 2906/4, 61200 Brno, Czech Republic
E-mail: xpjanic07@vutbr.cz

[2] Brno University of Technology
Faculty of Business and Management, Department of Finance
Kolejní 2906/4, 61200 Brno, Czech Republic
E-mail: zizlavsky@fbm.vutbr.cz

***Abstract:*** *The aim of this article is to outline the research process that will be driven by small and medium-sized enterprises (SMEs) operating in the automotive industry as a car dealers or as other nonproductive works. The research will lead to the creation of key performance indicators system based not only on the Balanced Scorecard approach, but also on the other methodologies like as critical success factors that can improve and streamline financial management not only for firms in non-productive Automotive, but also for other companies. The research methodology consists of two parts. First part is literature review of scientific knowledge and finding a gap in knowledge in this area and second is schedule and planning of individual parts of the research, including to define the main research questions. The scientific aim of upcoming research is to define a system of key performance indicators based on the Balanced Scorecard approach, which will be applicable to all SMEs in the Czech Republic operating in the selected sector. The results of literature review show that it is necessary to define a system of financial performance management for nonproductive SMEs, because there is a lower level of knowledge and understanding in the financial performance and key indicators. But even this research cannot be without certain limitations. The limitation is that SMEs often lacking the necessary finances or knowledge of how implement this approach.*

*Keywords: key indicators, performance measurement, Balanced Scorecard, small and medium-sized enterprises, company performance*

*JEL codes: C51, C58, G32, M21, P47*

## 1 Introduction

Money makes the world go around. Verdict so despised, but true. Financial management is an integral part of the economic environment and creating financial systems that can streamline and improve business performance is now a tool that cannot be forgotten in any enterprise. Finance and corporate governance are one of the most discussed topics of the present, but there are still blanks, gaps in the knowledge that need to be fulfilled. Due to the increasing competitive fight, shortening product life cycles and turbulent economy, the pressure on businesses is growing. Enterprises are forced to improve their performance, reduce costs and eliminated bottlenecks to stay competitive. And for these reasons, the need to measure and track performance becomes necessary. That is why managers need to find tools to achieve this.

Key performance indicators (KPIs) are one of the possible approaches how we can manage, plan and improve our company performance. What key performance indicators are, how they are developed and define, and general framework for their implementation, is described by David Parmenter in his "Key performance indicators" (Parmenter, 2015). The second important tool which provides executives with a comprehensive framework that can translate company's vision and strategy into a coherent and linked set of performance measures is called the Balanced Scorecard and describe it as first Kaplan and Norton in their book "The Balanced Scorecard" (Kaplan and

Norton, 1996) or, for example, by Niven in "Balanced Scorecard Evolution" (Niven, 2014). These are two approaches to financial management of the company, which I will deal with not only in this article, but also in the entire upcoming research.

This article consists of two main parts. First part is focused on the literature research, which was done before (Janíčková and Žižlavský, 2019) and its aim is to map the level of scientific knowledge in the area of key performance indicators and the Balanced Scorecard approach. The scientific aim of this article is to map the upcoming research, which is focused on key performance indicators system, and the Balanced Scorecard approach in small and medium-sized enterprises operating in automotive industry as a nonproductive firm. The upcoming research will be a main part of my dissertation thesis. This section contains the definition of main scientific questions, detailed plan and the time schedule of how the research will be conducted and what I want to reach.

This paper is organized as follows, Section 2 presents methodology and data that will be used in the research and how it will be done. Section 3 presents results and discussion, deals with the theoretical background of the research, and thus contains a literature review and definition of the gap in knowledge, also describes the research itself, its course and time frame. Some concluding remarks follow in section 4.

## 2 Methodology and Data

In terms of methodology, it is necessary to divide it into two parts. First is methodology for literature review and second methodology is for upcoming research.

Methodology for literature research was backed by four books. First book is "Key performance indicators: Developing, Implementing and Using Winning KPIs" Parmenter (2015), second book is "The Balanced Scorecard" Kaplan and Norton (1996), third is "Balanced Scorecard evolution: a dynamic approach to strategy execution" Niven (2014) and the last one is "The scorecard solution: measure what matters and drive sustainable growth" King (2015). This literature review was limited to articles from peer-reviewed journals that publish most of the research related to economy and papers from conferences, which were published in proceedings. For example: "Procedia – Economics and Finance" or "Computing and Informatics Journal". The literature review was restricted to the period from the beginning of 2014 through the presence of 2019. The search was performed in the database Proquest Central, in the database Business Source Complete (EBSCO), and in the citation database Web of Science. The search was performed combining the following keywords either in the title or in the abstract: performance indicators, key performance indicators, performance measurement, small and medium-sized enterprises, nonproductive enterprises and the balanced scorecard approach. The relevance of the articles was ensured by reading all abstract and checking for a discussion related to the goals of future research. Finally, articles were chosen which seemed to be most relevant for the researched issue and future use in the upcoming research.

The methodology of the upcoming research will take place in several key steps. First, the basic research questions for upcoming research will be formulated. These questions help to refine the objectives of the entire research. This will be followed by pre-research, which is an integral part of any scientific work. Third, a secondary research will be carried out to select a sample of companies. This is followed by primary research, which will be carried out in the form of questionnaire survey.

All these steps will be described in detail in the following sections of this article.

## 3 Results and Discussion

Literary research divides articles into three basic groups. The first group of articles is focused on the Balanced Scorecard (BSC) approach, the second group of articles is focused on the key performance indicators and the last group is focused on combination both of them.

The main outputs of used articles are listed in the tables below.

**Table 1** Approaches of articles focused on the Balanced Scorecard approach or on the Key Performance Indicators

| Authors | The principles of articles focused on the BSC approach – an overview |
|---|---|
| **Shafiee et al. (2014)** | • They define supply chain performance as a one of the most complicated decision-making problems.<br>• Combine four perspectives of BSC approach with the Decision making trial and evaluation laboratory for obtain a network structure and this structure is use for Data Envelopment Analysis.<br>• This approach was successfully implemented to the companies operating in the Iranian food industry. |
| **Lesáková and Dubcová (2016)** | • They detected the current state of the knowledge and use of the BSC in businesses in the Slovak Republic.<br>• Their results showed very low level of knowledge BSC in the Slovak Republic. |
| **Authors** | **The principles of articles focused on the KPIs – an overview** |
| **Pavelková et al. (2018)** | • The study from macroeconomic point of view, which is based on the sample of original equipment manufacturers and suppliers in Czech automotive sector.<br>• They used sensitivity analysis and the Stochastic Frontier Analysis.<br>• The study shows how the value-based measure represented by Economic Value Added and its pyramidal breakdown could act as facilitators in revealing value drivers.<br>• They identify how business react and how they are affected by the pre-crisis, crisis and post-crisis period. |
| **Kaganski et al. (2018)** | • The follow study used the KPIs selection model with utilization SMARTER approach and fuzzy analytical hierarchy process and successfully implemented it to SMEs from different industries. |

Source: A literature review – own summarization, 2019

**Table 2** Approaches of articles focused on KPIs by the Balanced Scorecard approach

| Authors | Approaches of articles – an overview |
|---|---|
| **Wu (2016)** | • The study implements the KPIs into a strategy map of the BSC for banking institutions and define relationships between KPIs with using DEMATEL method. |
| **Chaharsooghi et al. (2016)** | • They create direct and indirect correlation matrix of the KPIs for each perspective of BSC.<br>• They combine key performance indicators with the Balanced Scorecard approach and implemented it into the e-commerce in Iran. |
| **Hsu et al. (2017)** | • They identify the key performance indicators utilizes quality function deployment approach with combination fuzzy Delphi method, modified fuzzy extent analytic hierarchy process and technique for order preference by similarity to an ideal solutions method to prioritize them.<br>• They combine compilation of sustainable development criteria and compilation of KPIs based on the perspectives of BSC.<br>• The study is focused on the small and medium-sized enterprises. |

Source: A literature review – own summarization, 2019

As you can see from the tables above that view at performance metrics can be very different and there is a lot of space to combine different ways and angles of view to solve this problem. The state of scientific knowledge in this topic illustrates the very frequent use of key performance indicators. A gap in this theme are in non-production enterprises. However, a single study has not been focused in recent years to aim on the performance measurement and the setting of key performance indicators in non-production sphere and processes. Performance measurement in non-manufacturing enterprises is just as important as in the manufacturing sphere. In a better case, non-production SMEs are themselves looking for performance management capabilities and apply already-used methods in manufacturing processes to non-manufacturing processes, but in the worst case, and these are overwhelming majority, these companies do not consider it important to measure, standardize or even improve their processes (Janíčková and Žižlavský, 2019).

As the goal of upcoming research is to design a key performance indicators scheme for small and medium-sized nonproductive enterprises, operating in the automotive industry. The upcoming research will take place in period of 2019 – 2022. The exact timetable will be specified after the pre-research, which will take place in the second half of the year 2019. For upcoming research were defined the following research questions:

- What are the critical factors for the success of the selected companies?
- In which areas of management is it necessary to formulate KPIs?
- How will be selected KPIs monitored and measured?
- Is it possible to implement certain parts of BSC into the defined KPIs system?

After mapping a level of scientific knowledge of the topic to which the dissertation thesis will be devoted and the formulation of the basic research questions that will be answered during the research, the basic co-conceptual framework of upcoming research will be defined.

- Pre-research

This section provides an overview of the pre-research, which will take place as the first part of the upcoming research. The aim of the entire pre-research is to create the most appropriate questionnaire, which will be later sent to a sample of companies within the research itself. The questionnaire, data collection and method of their evaluation will be consulted with the several practitioners. The basic goal of the questionnaire is to find the critical success factors of companies which help to define a KPIs scheme.

As already mentioned, the pre-research will take place in the second half of 2019, specifically at 5-10 selected friendly companies that will participate in the overall research. Selected companies will meet the same requirements as the subsequent sample on which the entire investigation will be conducted. These companies will test the questionnaire, whether all the items are understandable and clear. Their task will help me with finding the most appropriate questionnaire questions so that they are understandable and as conclusive as possible. That will be done by filling the questionnaires and providing interviews. After several iterations of item editing and refinement, the questionnaire will be administered to the full research sample.

- Secondary research

This section provides an overview of the data used for the upcoming research and the main characteristic of the research sample. Secondary research will take place after completion the pre-research. This phase of upcoming research is expected to begin in early 2020. Three types of data will be collected for this upcoming research: a questionnaire and interviews, company data and public information (data from the Amadeus database). Amadeus contains comprehensive information on around 21 million companies across Europe. Amadeus contains, for example, information about company, financial strength indicators, directors, detailed corporate structure or market research (Amadeus, 2019). The Amadeus database will generate all the companies, which will be object of the research.

The first step will be to define the research sample. Companies will be selected according to the following requirements.

- Company must be *"registered in the Czech Republic".*

The upcoming research is focused on non-productive SMEs operating in Automotive in the Czech Republic. For this reason, it would not be relevant to consider companies that do not operating in the Czech Republic. The results of upcoming research would be affected by irrelevant variables and could not be considered conclusive.

- Company have to operate in *"NACE category, section G, Code 4511"* (trade in cars and other light vehicles).

The choice of category is related to two facts. The first fact is the founded gap in knowledge that was revealed in the literature research. As already mentioned, non-productive small and medium-sized enterprises are very neglected in terms of performance measurement and their knowledge level of performance management is very low. The second fact is that the Automotive in the Czech Republic is a very attractive industry. According to CzechInvest, one of the largest concentrations of automotive production, design, research and development is located in the Czech Republic. According to the AutoSAP Automotive Industry Association, the Czech Republic is the fifth largest car manufacturer in Europe and the largest producer of passenger cars in Central and Eastern Europe. The automotive industry in the Czech Republic accounts for more than 20% of industrial production and also more than 20% of exports (CzechInvest, 2017). Taking this information into account, the attractiveness of this sector in the Czech Republic cannot be questioned. If I combine both of the above-mentioned facts, focusing the upcoming research on performance management of non-productive small and medium-sized enterprises in the Automotive in the Czech Republic is a completely desirable topic. The selected NACE category also ensures that each of the selected enterprises is non-productive, because definition of this category is only "trade".

- Company must be *"active".*

The status of an active company means that the company is currently still operating on the market. In other words, the company is not insolvent or canceled. Monitoring the management of such companies would not be relevant for the upcoming research.

- The legal form of the company is *"limited liability company".*

For reasons of simplicity and greater conclusiveness of the proposed system, other legal forms of companies are excluded from the sample. Joint-stock companies have, for example, a different management system or different system of reporting public information. Only 63 companies have the status of a joint stock company and approximately half of them is small or medium-sized enterprise. However, the differences in the management of these companies are so different that it is not possible to include this type of companies to research sample. Self-employed persons are excluded because of the lack of an information obligation and the consequent impossibility of obtaining a public data. However, the system which will be created in the upcoming research will be fully usable for self-employment persons too. Other forms of companies (such as a public commercial company or a limited partnership) do not occur at all in the research sample or their number is negligible (less than 5 companies). The last reason for using only the one legal form is that limited liability companies represent approximately 85.98% of all active companies in the sought-after NACE category operating in the Czech Republic.

- Company must be *"small or medium-sized enterprise".*

Focusing only on small and medium-sized enterprises again follows from the founded gap in the literary research. It is not appropriate to include large companies because their level of knowledge and management can be diametrically different.

A selective sample of these companies was obtained from the database Amadeus. Searching for the basic sample was done in five steps. Each step further refining the previous step thereby narrowing the selection. By the first step was searched 506,278 companies registered in the Czech Republic. 932 companies operate in the selected NACE category in the second step. By the third step was detected that only 920 companies are active. The fourth step was found that 791 companies from the generated 920 have the legal form of limited liability company. 685 companies from found 791 are small or medium-sized enterprises, which was found in the last, fifth step. The basic sample so contains 685 companies.

One basic question must be answered at the beginning of upcoming research: "What sized sample do I need?". There are several approaches to determining a sample size. It is often assumed that the samples in surveys are often large enough that an estimate made from them is approximately normally distributed. The total sample size required for this upcoming research is calculated using Cochran's formula,

$$n_o = \frac{Z^2 pq}{e^2} \quad (1)$$

where $n_o$ is the required sample size, $Z^2$ is the abscissa of the normal curve that cuts off an area α at the tails (1-α equals the desired confidence level), e is the desired level of precision, p is the estimated proportion of an attribute that is present in the population, and q is (1-p) (Cochran, 1963).

The value of Z is found in statistical tables, which contain the area under the normal curve and estimated percentage prevalence of the population of interest is 5%. Therefore, the required return sample size ($n_o$) for this upcoming research was computed as follows:

$$n_o = \frac{Z^2 pq}{e^2} = \frac{0{,}51^2 * 0{,}3 * 0{,}03}{0{,}05^2} = 94\ respondents \quad (2)$$

The final representative sample for upcoming research contains 94 companies. This sample will be used in the primary research, which is the next phase of the upcoming research.

- Primary research

Primary research will follow the secondary research, which was mentioned above. The primary research will probably take place from the middle of 2020. 94 respondents, whose form the final sample will receive a questionnaire, which was created and completed in the pre-research. These respondents will be selected using the random method.

The questionnaire will be structured into two parts. The first part consists of main information about the company and the second part will focused on way, how these companies measure their performance, which factors they are measure and monitor, and on the level of their performance management knowledge. The structured questionnaire also enables additional comments. The respondents will be able to describe in detail the performance management system in their enterprise. At the same time, they will be able to express their opinion on whether they would like to see some change in performance system. The questionnaire will be sent to each company by e-mail. The e-mail will provide a brief introduction clarifying the purpose of the upcoming research. It will be sent exclusively to CEOs or top managers. The questionnaire will be anonymous and take 5 to 10 minutes to complete. Appendix 1 in this paper shows the prepared questionnaire for the pre-research.

The results of the questionnaire survey will be compared according to the SMART principle and key performance indicators scheme will be created.

## 4 Conclusions

The first half of the upcoming research was planned in this study. This part will be provided and followed by the second part of the upcoming research, where the final goals will be answered and create the second part of my dissertation thesis.

After conducting the upcoming research, business-economics field will be enriched in expanding the use of KPIs that have not yet been implemented in this area, allowing many businesses to improve their performance and management. In the scientific field, key performance indicators, the Balanced Scorecard approach and the SMART principle will be linked to this type of businesses. This interconnection will expand, simplify and improve the performance assessment capabilities of small and medium-sized non-manufacturing companies in the automotive industry and provide a more comprehensive overview of not only key indicators but also the entire organization. This will bring several methods together to make it easier for many companies of this type to give them the opportunity to be better and more competitive. Assuming that the research and its objectives are successfully met, we can expect that this system will be used not only by Czech, but also foreign entrepreneurs, whom it can significantly help them in their activities.

But even this research cannot do without certain limitations. First and foremost, it must be borne in mind that each company is unique and therefore, the methods of measuring and understanding performance management will always be a little different for each of them. The second limitation is the difficulty to guarantee the return on completed questionnaires and ensuring fair and long-term collaboration with the companies from the sample and from the pre-research too. Nevertheless, the upcoming research will increase companies' awareness of the need to measure the key performance indicators, so cooperation for future research could be significantly improved.

## Acknowledgments

The authors are thankful to the Internal Grant Agency of University No.: FP-S-18-5234 "Prediction models in finance: analysis of factors and predictions of bankruptcy, company performance and value" for financial support to carry out this research.

## References


Amadeus, (2019). *Bureau Van Dijk: Amadeus overview.* Retrieved from: https://www.bvdinfo.com/en-gb/our-products/data/international/amadeus.

Cochran, W. G. (1963). *Sampling Techniques*, 2nd Ed. New York: John Wiley & Sons.

CzechInvest, (2017). *Agentura pro podporu podnikání a investic: Automobilový průmysl*. Retrieved from: https://www.czechinvest.org/cz/Sluzby-pro-investory/Klicove-sektory/Automobilovy-prumysl.

Hsu, Ch., Chang, A., Luo, W. (2017). Identifying key performance factors for sustainability development of SMEs – integrating QFD and fuzzy MADM methods. *Journal of Cleaner Production*, vol. 161, pp. 629-645.

Chaharsooghi, S. K., Beigzadeh, N., Sajedinejad, A. (2016). Analyzing key performance indicators of e-commerce using balanced scorecard. *Management Science Letters,* vol. 6, pp. 127-140.

Janíčková, N., Žižlavský, O. (2019). Key performance indicators and the Balanced Scorecard approach in small and medium-sized enterprises: A literature review. In: *Selected Papers: Perspectives of Business and Entrepreneurship Development in Digital Transformation of Corporate Business: Economic, Management, Finance and System Engineering form the Academic and Practioners views.* Brno: Thomson Reuters Conference Proceedings Citation Index, pp. 55-64.

Kaganski, S., Majak, J., Karjust, K. (2018). Fuzzy AHP as a tool for prioritization of key performance indicators. *Procedia CIRP*, vol. 72, pp. 1227-1232.

Kaplan, R.S., Norton, D. (1996). *The Balanced Scorecard*, 1st ed. Boston: Harvard Business Review Press.

King, D.E. (2015). *The scorecard solution: measure what matters and drive sustainable growth,* 1st ed. New York: AMACON.

Křivková, K. (2011). *Podpora malých a středních podniků*. Sofispol. Černošice, 2011. Retrieved from: https://sophispol.webnode.cz/male-a-stredni-podniky-pateri-ekonomiky/.

Lesáková, L., Dubcová, K. (2016). Knowledge and Use of the Balanced Scorecard Method in the Businesses in the Slovak Republic. *Procedia – Social and Behavioral Sciences,* vol. 230, pp. 39-48.

Niven, P. R. (2014). *Balanced Scorecard evolution: a dynamic approach to strategy execution*, 1st ed. New Jersey: John Wiley & Sons.

Parmenter, D. (2015). *Key performance indicators: Developing, Implementing and Using Winning KPIs,* 3rd ed. New Jersey: John Wiley & Sons.

Pavelková, D., Homolka, L., Knápková, A., Kolman, K., Pham, H. (2018). EVA and key performance indicators: the case of automotive sector in pre-crisis, crisis and post-crisis periods. *Economics & Sociology,* vol. 11 (3), pp. 78-95.

Shafiee, M., Lotfi, F. H., Saleh, H. (2014). Supply chain performance evaluation with data envelopment analysis and balanced scorecard approach. *Applied Mathematical Modelling,* vol. 38, pp. 5092-5112.

Wu, H.-Y., (2016). Constructing a strategy map for banking institutions with key performance indicators of the balanced scorecard. *Evaluation and Program Planning*, vol. 35, pp. 303-320.

## Appendix 1

**Prepared questionnaire could include the following questions.**

1. What is the number of employees in your company?
    - 10 – 49
    - 50 – 249
2. How long is your company operating on the market (in years)?
    - 0 – 4
    - 5 – 9
    - 10 – 14
    - 15 – 19
    - 20 and more
3. Do you measure the performance of your company?
    - Yes
    - No
4. How often do you measure the performance?
    - Weekly
    - Monthly
    - Quarterly
    - Semi – annually
    - Annually
5. Which factors do you use to measure your performance?
    - Sales
    - Costs
    - Margin
    - Liquidity
    - Annual turnover
    - Cash at the cash desk and at the account
    - Stocks
    - Profits
    - Cash Flow
    - Others: ……
6. Do you know what the key performance indicators are?
    - Yes
    - No
7. Do you use the key performance indicators in your company?
    - Yes
    - No (If no, please describe why: ……..)
8. Please describe your performance management system in more details:

……

9. Please express your opinion:

Do you think that your performance management system is sufficient? ……..
Describe improvement suggestions:
……
……

# Analysis of Financial Market Using Soft Computing Techniques

**Zuzana Janková[1], Petr Dostál[2]**

[1] Brno University of Technology
Faculty of Business and Management, Institute of Informatics
Kolejní 2906/4, Královo Pole, 612 00 Brno, Czech Republic
E-mail: Zuzana.Jankova@vutbr.cz

[2] Brno University of Technology
Faculty of Business and Management, Institute of Informatics
Kolejní 2906/4, Královo Pole, 612 00 Brno, Czech Republic
E-mail: dostal@fbm.vutbr.cz

***Abstract:*** *Soft computing is part of artificial intelligence containing fuzzy logic and artificial neural networks. Soft computing based systems are able to extract relevant information from large data sets by discovering hidden patterns in the data. The combination of these two techniques can provide an intelligent system with more ability and flexibility. Financial markets are becoming increasingly complex and demanding to predict stock price movements due to their non-linear and dynamic nature. The present study combines fuzzy c-means clustering and a neural network to support investment decisions in the ETF in the US stock market. The proposed model is designed to help investors identify profitable opportunities in stock markets.*

*Keywords: artificial intelligence, financial market, fuzzy logic, soft computing techniques*

*JEL codes: G11, G12, C45*

## 1 Introduction

Many recent research into financial market analysis uses software techniques to address the challenges of complexity, uncertainty and market non-linearity. A recent growing trend is the use of complex hybrid approaches combining various soft computing techniques. These techniques have become a necessity because financial markets are complex systems involving a vast number of participants influenced by many interconnected economic, political and psychological factors (Ballings et al., 2015, Lan et al., 2011). These factors cause many uncertainties in financial markets and have a positive or negative impact on stock values. Furthermore, Chourmouziadis and Chatzoglou (2016) add that it is difficult to invest in financial markets as a result of the globalization of national economies, distinctive emergencies, bubbles, increasing debts and costs, etc. For investors, these imbalances are both threats and great opportunities. Understanding the business sectors and the ability to predict are key competences that every successful investor must have. (Venkat and Reddy, 2017) In addition, Chen et al. (2016) draw attention to the problems associated with the use of time series models in financial market forecasts. These problems include the fact that input parameter selection may depend on personal experience or opinion, and most conventional time series models consider only one variable. Last but not least, most models rely on restrictive assumptions such as linear separability or data file normality. Wei (2016) continues and adds that time series prognosis is an important and widely popular topic in system modeling and stock indexing research. Accurate forecasting of stock prices is a challenging task. There are disadvantages of using time series methods for the financial market. These limits include, in particular, the use of data sets that do not follow statistical assumptions, and most time series models contain significant amounts of noise.

Fuzzy logic is one of the methods of soft computing and provides a way to draw definitive conclusions from vague, ambiguous or inaccurate information. Fuzzy models are tolerant of inaccuracy, uncertainty and approximation. As a result, they have become popular among the academic community. Fuzzy logic allows you to cover inaccuracies and work with the meanings of natural language words in a relatively simple way. The reason why

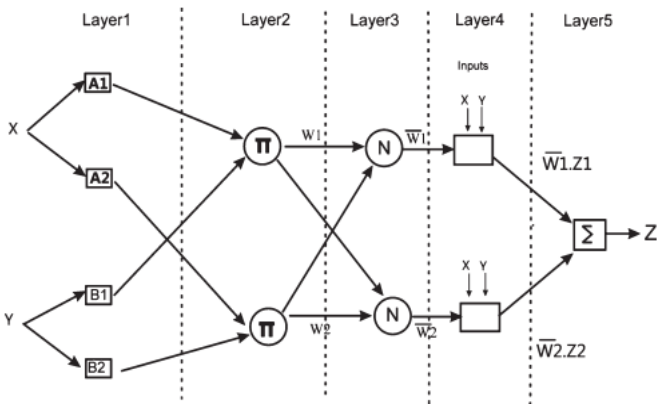
fuzzy logic works is quite surprising because it uses vaguely characterized expert knowledge. It is the relationship between relevance and accuracy of information, the principle that the main representative of fuzzy logic Lotfi A. Zadeh (1978) called the principle of incompatibility. The potential of fuzzy logic to improve forecasting models can be found in various applications due to its known ability to bridge the gap between numerical data (quantitative information) and language expression (qualitative information). An artificial neural network is one of the methods of retrieving data that is widely accepted in an enterprise area because of its ability to learn and discover relationships between nonlinear variables. The artificial neural network overcomes statistical regression models and also allows deeper analysis of large data sets, especially those that tend to fluctuate in the short term, as reported by Tung and Le (2017).

Cheng and Yang (2018) add that, unlike traditional time series, fuzzy time series can solve the problem of forecasting using historical data files. The authors tested the created model on the prices of TAIEX, Nikkei and HSI. Ruiz-Cruz and Diaz-Gonzalez (2018) propose a business strategy for a stock exchange portfolio. The proposed strategy uses k-means clustering algorithm to learn and familiarize with internal hidden patterns in the time series of stock market prices. Subsequently, the authors use the fuzzy inference system to take trading decisions. The fuzzy inference system consists of rules provided by a professional trader. The performance of the business algorithm is verified by simulation using real prices of the Mexican stock exchange. To improve the management of insecurity, as reported by Muñoz and Miranda (2016), the use of fuzzy logic makes it possible to better capture the reality of the derivatives market in an uncertain environment. The authors used the fuzzy inference system based on Mamdani as a support tool for implementing strategies to manage financial risk by minimizing exchange rate risk. According to Su and Cheng (2016), the stock price forecast is a hot issue for investors, traders and brokers. It is difficult to determine the best point in time to buy or sell shares, because many variables affect the stock market. The authors use the Adaptive Neuro Fuzzy Inference System (ANFIS) based on an integrated nonlinear feature selection method to predict stock prices. Their results show that the proposed methods outperform conventional models in accuracy, gain evaluation and statistical test.

## 2 Methodology and Data

Models based on mathematical and statistical tools are not suitable for solving non-linear, badly structured, and unclear systems. In such a case it is advisable to use the fuzzy inference systems that are able to transform human knowledge and expert experience into the form of rules and membership function. Hammer et al. (2012) adds that the fuzzy-neural network is represented by a general Fuzzy Inference System (FIS) consisting of four main components: knowledge base, the fuzzy inference system, fuzzification and defuzzification block. The fuzzy system uses IF–THEN rules that mediate available knowledge from a given domain.

**Figure 1** ANFIS Architecture




Source: Gunasekaran and Ramaswami (2014)

If a given FIS system is to be stable and work effectively, the parameters and structure must be selected correctly. This is set or derived by the learning process. As mentioned by Keles et al. (2008), the Adaptive Neuro-Fuzzy Inference System is one of the most often used learning systems for determination of linear and non-linear FIS parameters and it also allows for their adaptive changes. The Neuro-Fuzzy Inference System architecture, as described by Hammer et al. (2012), consists of five basic layers:

**Layer 1: Input layer**

The layer includes solely adaptive nodes, while each node transforms the input variable to a linguistic form by fuzzification and determines their membership function. The Gaussian curve is one of the most frequently used membership function shapes. For this reason, this fuzzy function type is used, same as in the survey by Esfahanipour and Aghamiri (2010).

$$O_i^1 = \mu A_i(X) \tag{1}$$

**Layer 2: Rule layer**

This layer consists of non-adaptive nodes, with each node corresponding to one T-S fuzzy rule. The node inputs are signals from the previous layer and at input they give weight or strength of the rules whose antecedent is given by a combination of the linguistic values of the respective variables.

$$w_i = \mu A_i(X) \times \mu B_i(Y), i = 1,2 \tag{2}$$

**Layer 3: Normalization layer**

The nodes in this layer are fixed. The aim of this layer is to normalize the strength of a given rule, which is a ratio of the respective rule weight and the sum of the weights of all rules.

$$\overline{w_l} = \frac{w_i}{\sum_{i=1}^{2} w_i}, i = 1,2 \tag{3}$$

**Layer 4: Defuzzification layer**

It is a layer consisting of adaptive nodes connected to normalisation nodes, while the transfer function is given by the required consequent shape.

$$\overline{w_l} f_i = \overline{w_l}(m_i X + n_i Y + q_i), i = 1,2 \tag{4}$$

**Layer 5: Summation layer**

The last layer contains a single non-adaptive node that determines the overall ANFIS output based on the sum of all input signals from previous layers.

$$\sum_i \overline{w_l} f_i = \frac{\sum_i w_i f_i}{\sum_i w_i}, i = 1,2 \tag{5}$$

To evaluate the performance of the model it is appropriate to select a suitable metric. Accuracy is the most popular metric for descriptor data. Displays percent of samples truly described as the result. The calculation of this metric is possible according to the following mathematical notation Hamidzadeh and Namaei (2019):

$$Accuracy = \frac{TP+TN}{(TP+FN)+(FP+TN)} \tag{6}$$

Table 1 shows the confusion matrix. In the confusion matrix, samples are divided into interested and unwanted samples. The created model will try to close the samples and reject the unwanted ones.

**Table 1** Confusion Matrix

| | **Actual Positive** | **Actual Negative** |
|---|---|---|
| **Positive Prediction** | True Positive (TP) | False Positive (FP) |
| **Negative Prediction** | False Negative (FN) | True Negative (TN) |
| | Total Positive | Total Negative |

Source: Bernardo et al. (2013)

Due to matrix results and two classes (positive and negative), there are four possible outcomes: The result is positive and is classified as positive (TP). The result is negative and counts as positive (False Positive, FP). The result is negative and is classified as negative (False Negative, FN). The result is negative and assumed to be negative (True Negative, TN).True Positive (TP) is the number of correct predictions in positive cases. False Positive (FP) is the number of incorrect predictions that were classified as positive, with the instance being negative. False Negative (FN) is the number of false predictions that have been classified as negative, with the instance positive. While True Negative (TN) is the number of correct negative predictions.

## 3 Results and Discussion

In the following section, not only the selected data sample but also the required inputs are listed. Subsequently, a model based on a Neuro-Fuzzy Inference System (ANFIS) is created. The neural network generates fuzzy rules based on the selected membership function. Model output is a signal to buy or sell Exchange-Traded Funds (ETF).

### Examined Set

To create a neuro-fuzzy model, 20 ETFs are selected with passive management tracking stock indices from two sectors: American and European. ETFs are a suitable and cost-effective tool for investors seeking large-scale market indices, certain sectors or geographic regions, etc. The largest ETF organizer in the world is the US, which according to ICI Factbook (2018) offers 1832 ETFs and $ 3.4 trillion managed assets. Table 2 shows the selected ETFs entering the model.

**Table 2** Asset values of selected ETF´s

| Sector | ETF | Ticker | AUM (mld. USD) |
|---|---|---|---|
| **American** | SPDR S&P 500 ETF | SPY | 212 |
| | PowerShares QQQ ETF | QQQ | 47 |
| | SPDR Dow Jones Industrial Average | DJA | 16 |
| | iShares Russell 1000 Value | IWD | 36 |
| | iShares Core S&P 500 | IVV | 101 |
| **Europe** | SPDR EURO STOXX 50 ETF | FEZ | 2.6 |
| | SPDR STOXX Europe 50 ETF | FEU | 0.177 |
| | iShares Europe | IEV | 2.4 |
| | iShares MSCI EMU | EZU | 9 |
| | Vanguard FTSE Europe ETF | VGK | 11 |

Source: Finance Yahoo (2017)

### Financial Indicators

When deciding about investing in investment instruments, the investors can consider several financial indicators. However, the return and risk of a given investment are the most important indicators. These two key indicators were investigated and recommended in many studies in the context of soft computing, such as in Fang et al. (2006), Gupta et al. (2008).

- **Return** provided by a given investment is a key stock investment indicator. Return can be understood as investor's reward for the risk taken.

**1** $$r = \frac{market\ price_t - market\ price_{t-1}}{market\ price_{t-1}} \quad (7)$$

- **Risk** may be characterized as the possibility of the expected return deviating from the real return. It is a certain degree of uncertainty related to the expected return.

**2** $$\sigma = \sqrt{\frac{(\sum_{t=1}^{T} r_{it} - \bar{r}_{it})^2}{T-1}} \quad (8)$$

- **Tracking error** that measures variations in fund portfolio and benchmark performance. The indicator quantifies the over-profit volatility, i.e. the difference

between the fund's portfolio return and the benchmark, around the average value, i.e. the average over-profit.

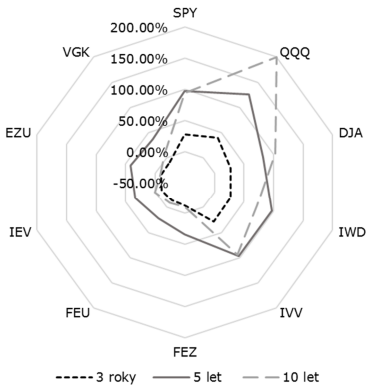
$$Tracking\ error = \sqrt{\frac{\sum_{i=1}^{i=n}(r_i - \bar{r})^2}{n}} \quad (9)$$

- **Sharpe ratio** examines the return adjusted for the risk component. The higher value indicates Shape ratio, the investor has reached a higher return in excess of the risk-free return per unit of total risk.

**3** $$Sharpe\ ratio = \frac{r - r_f}{\sigma} \quad (10)$$

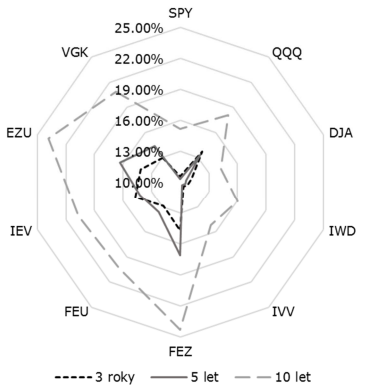
Figures 2-4 show graphically selected indicators over a period of 3, 5 and 10 years. It can be noted that the US ETF has higher returns than the European ETFs in all time horizons under review. In addition, although the US ETFs earn higher returns, they are less risky than European ETFs. In terms of the Tracking error, it can also be seen that the US ETFs show a very low deviation from the benchmark. This indicates a passive investment strategy that all selected ETFs hold. However, European ETFs are also able to replicate the underlying index well. Only a ETF with a ticker of EZU and FEZ shows a higher deviation. The last monitored indicator is the Sharpe ratio. Here again, the US ETFs excel, which show higher return than the risk-free rate compared to the European ETFs, given the overall risk exposure.

**Figure 2** Return ETF´s



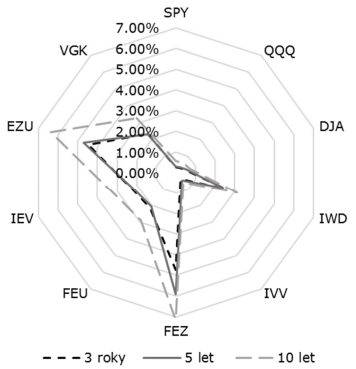

Source: own elaboration

**Figure 3** Risk ETF´s



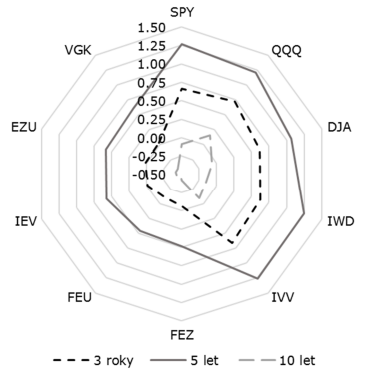

Source: own elaboration

**Figure 4** Tracking Error ETF´s




Source: own elaboration

**Figure 5** Sharpe Ratio ETF´s

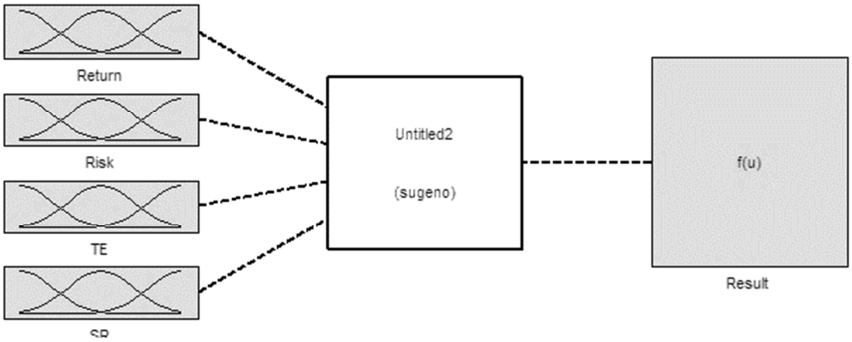



Source: own elaboration

**Results**

Based on the above description, a fuzzy inference system is created consisting of four input variables: return, risk, tracking error and Sharpe ratio, and one output variable indicating the investor's decision to invest or not to invest in the ETF. There is used Sugeno FIS, which can work with ANFIS.

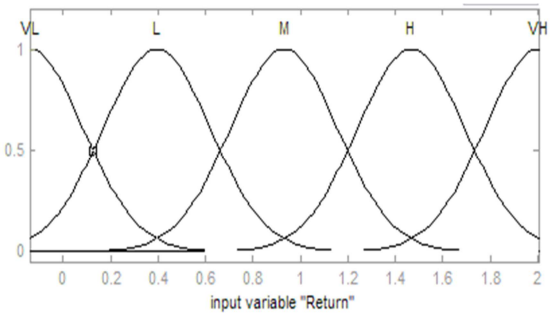
**Figure 6** FIS Architecture




Source: own elaboration

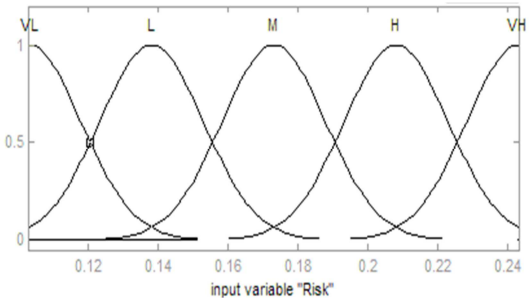
For each input variable it is necessary to determine the appropriate membership function. According to the selected dataset coming from the financial market, Gauss's membership function is best suited to its character. Figure 7-10 shows the individual membership functions for input variables. Five attributes are defined for each input variable, namely: VL - very low, L - low, M - medium, H - high, VH - very high. The model output is encoded as follows: 0 - sell, 0.25 - rather sales, 0.5 - hold, 0.75 - rather buy and 1 - buy.

**Figure 7** Gaussian Function for Return



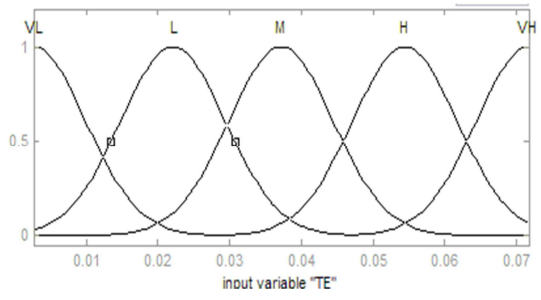

Source: own elaboration

**Figure 8** Gaussian Function for Risk



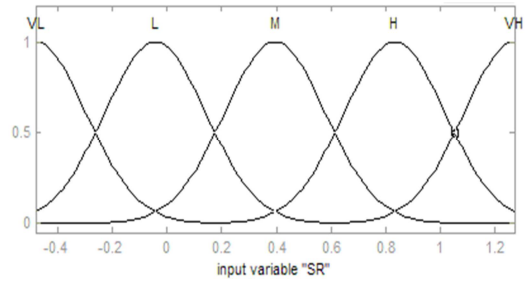

Source: own elaboration

**Figure 9** Gaussian Function for Trac. Error




Source: own elaboration

**Figure 10** Gaussian Function for Sharpe Ratio

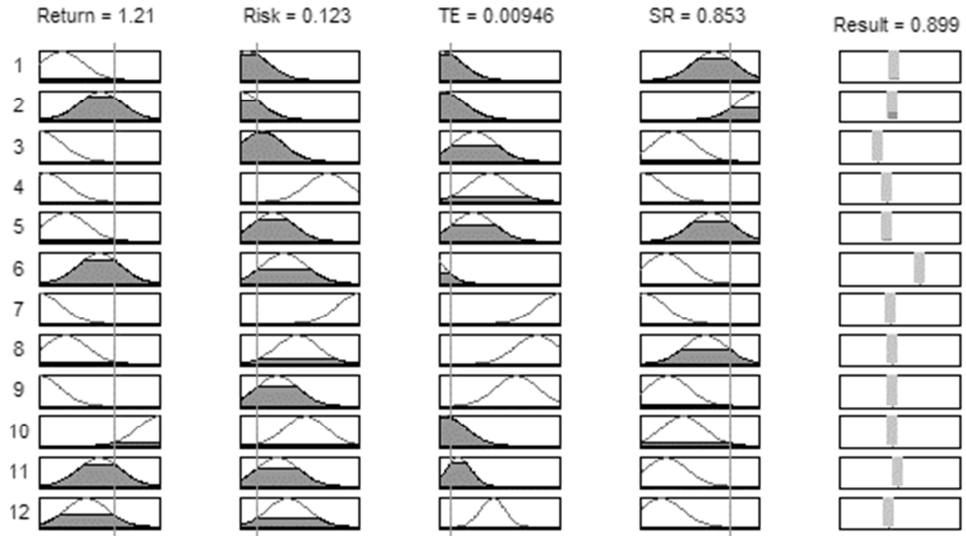



Source: own elaboration

The rules necessary for the functioning of the fuzzy system are either determined by experts or set by artificial neural networks. In our case, the ANFIS is used. To generate the FIS method, the grid partition is selected and the created FIS is trained using hybrid learning. The number of rules created is equal to 5x5x5x5 = 625. However, many rules created usually reduce the performance of the model. Hence, the number of fuzzy rules created is reduced by fuzzy clustering. In the case of fuzzy clustering, each element is assigned a membership level, and in the case of soft clustering, the element can belong to not only one cluster. The membership level indicates the strength of the assignment between the element and the corresponding cluster. Fuzzy clustering is thus a process of

assigning these membership levels. One of the most common fuzzy clustering algorithms is Fuzzy C-Means (FCM). In our case, 12 fuzzy clusters are created.

**Figure 11** Rule Block after Fuzzy Clustering




Source: own elaboration

The resulting rule block is shown in Figure 11. The resulting rule block can be used to make ETF investment decisions. According to the set parameters in Figure 11, the decision process can be interpreted. If the return of 121%, the risk of 12.3%, the tracking error 0.946% and the Sharpe ratio of 0.853, then the ANFIS result is 0.899, which is very close to 1 and therefore it is recommended to invest in the ETF. Finally, the accuracy indicator of Formula 6 is calculated. The accuracy is 93.46%, indicating that the system is able to generate correct results from the specified number of language rules. However, it is important to note that artificial neural network based models, although providing good predictive capabilities, are considered black boxes that do not provide easy-to-understand and understandable reasoning decisions or summaries of the resulting model.

## 4 Conclusions

The presented paper deals with the use of soft computing methods on financial markets. Specifically, fuzzy logic and artificial neural networks are used to support decision making about investing in Exchange Traded Funds on the American and European continents. Four input parameters representing return, risk, tracking error and Sharpe ratio are selected. The output of the model is the decision whether to invest in the ETF or not. Created is an Adaptive Neuro-Fuzzy Inference System providing rules for fuzzy model. Because of the large number of fuzzy rules caused by the number of selected member function attributes, the fuzzy c-means clustering method is used to reduce the number of fuzzy rules and improve model performance.

## Acknowledgments

This paper was supported by project No. FP-J-19-5814 'The Use of Artificial Intelligence in Business III' and No. FP-S-18-5524 'Project Information and Knowledge Management in the Era of Industry 4.0' from the Internal Grant Agency at Brno University of Technology.

## References


Ballings, M., Poel, D. V. D., Hespeels, N., Gryp, R. (2015). Evaluating multiple classifiers for stock price direction prediction. *Expert Systems with Applications*, vol. 42, pp. 7046-7056.

Bernardo, D., Hagras, H., Tsang, E. (2013). A genetic type-2 fuzzy logic based system for the generation of summarised linguistic predictive models for financial applications. *Soft Computing*, vol. 17(12), pp. 2185-2201.

Chen, Y. S., Cheng, C. H., Chiu, C. L., Huang, S. T. (2016). A study of ANFIS-based multi-factor time series models for forecasting stock index. *Applied Intelligence*, vol. 45(2), pp. 277-292.

Cheng, C. H., Yang, J. H. (2018). Fuzzy time-series model based on rough set rule induction for forecasting stock price. *Neurocomputing*, vol. 302, pp. 33-45.

Chourmouziadis, K., Chatzoglou, P. D. (2016). An intelligent short term stock trading fuzzy system for assisting investors in portfolio management. *Expert Systems with Applications*, vol. 43, pp. 298-311.

Fang, Y., Lai, K. K., Wang, S. Y. (2006). Portfolio rebalancing model with transaction costs based on fuzzy decision theory. *European Journal of Operational Research*, vol. 175(2), pp. 879-893.

Finance Yahoo. (2017). Retrieved from: https://www.financeyahoo.com/.

Gunasekaran, M., Ramaswami, S. (2014). A hybrid intelligent system of ANFIS and CAPM for stock portfolio optimization*. Journal of Intelligent and Fuzzy Systems,* vol. 26(1), pp. 277-286.

Gupta, P., Mehlawat, M. K., Saxena, A. (2008). Asset portfolio optimization using fuzzy mathematical programming*. Information Sciences*, vol. 178(6), pp. 1734-1755.

Hamidzadeh, J., Namaei, N. (2019). Belief-based chaotic algorithm for support vector data description. *Soft Computing*, vol. 23(12), pp. 4289-4314.

Hammer, M., Janda, O., Ertl, J. (2012), Využití vybraných soft-computingových metod v diagnostice výkonových olejových transformátorů - 1. Část. *Elektrorevue*, vol. 14(3).

ICI Factbook (2018). Investment Company Institute Factbook 2016. Invesment Company Institute.

Keles, A., Kolcak, M., Keles, A. (2008), 'The adaptive neuro-fuzzy model for forecasting the domestic debt. *Knowledge-Based Systems*, vol. 21(8), pp. 951-957.

Lan, Q., Zhang, D., Xiong, L. (2011). Reversal pattern discovery in financial time series based on fuzzy candlestick lines. *Systems Engineering Procedia*, vol. 2, pp. 182-190.

Munoz, M., Miranda, E. (2016). A fuzzy system for estimating Premium Cost of option exchange using Mamdani Inference: Derivates Market of Mexico. In: *2016 IEEE International Conference on Fuzzy Systems (FUZZ-IEEE)*. IEEE, pp. 888-895.

Ruiz-Cruz, R., Diaz-Gonzalez, A. D. (2018). Investment Portfolio Trading based on Markov Chain and Fuzzy Logic. In: *2018 IEEE Latin American Conference on Computational Intelligence (LA-CCI)*. IEEE, pp. 1-6.

Su, C. H., Cheng, C. H. (2016). A hybrid fuzzy time series model based on ANFIS and integrated nonlinear feature selection method for forecasting stock. *Neurocomputing*, vol. 205, pp. 264-273.

Tung, K. T., Le, M. H. (2017). An Application of Artificial Neural Networks and Fuzzy Logic on the Stock Price Prediction Problem. *JOIV: International Journal on Informatics Visualization*, vol. 1(2), pp. 40-49.

Venkat, N. R., Reddy, K. (2017). Application of fuzzy logic in financial markets for decision making. *International Journal of Advanced Research in Computer Science,* vol. 8(3), pp. 382-386.

Wei, L. Y. (2016). A hybrid ANFIS model based on empirical mode decomposition for stock time series forecasting. *Applied Soft Computing*, vol. 42, pp 368-376.

Zadeh, L. A. (1978). Fuzzy sets as a basis for a theory of possibility. *Fuzzy Sets and Systems*, vol. 1, pp. 3–28.

# Stock Price and Investment Decisions – Case of Warsaw Stock Exchange

**Magdalena Jasiniak**

University of Lodz
Faculty of Economics and Sociology, Corporate Finance Department
Rewolucji 1905 r. No 39, 90-214 Lodz, Poland
E-mail: magdalena.jasiniak@gmail.com

***Abstract:*** *The main aim of the paper is to verify whether the price is one of the determinants of the investment decisions. According to theory of market efficiency, stock price should not influence rate of investment return and investment decisions. However, investors who are influenced by behavioural biases show a greater tendency to invest in the low – priced stocks. This phenomenon occurs in particular among investors with less experience who are under the illusory impression that low – priced stocks will grow faster and will bring above – average profits. This has an impact on managerial decisions and the desire to keep the company's stock prices at optimal price range (f.e. by dividing the shares) to ensure effective capital allocation and liquidity of the company's stocks. Article presents the results of questionnaire study conducted among individual investors in Poland. The analysis is based on the logit model. The results of the proved that price does matter in investment decision process and influence the future profits.*

*Keywords: financial markets, behavioural finance, low price anomaly, investment decisions*

*JEL codes: G02, G11*

## 1 Introduction

Making an investment decisions on capital market is a very complex process, determining the effectiveness of taken decisions.

Assuming rationality of decision – making processes it is stated that investor made the proper decision as a result of evaluation all possible choices. Before choosing the best option, investors are expected to collect all available information, to analyze all available possibilities, then prioritize them and finally choose the best one. Such procedure leads to maximization of marginal utility.

However, the real investment process seem to be much less complicated, faster and based on many simplifications. Investors cannot avoid emotions related with previous experience, their intuition, fears and hopes. Finally, to make the process of decision – making simpler and faster, investors use simplified heuristics and therefore reasoning on the basis of unconscious evaluations.

Following paper analyzes one of heuristics when the decision of stock purchase is made in the light of their prices. Assuming that investment decisions are rational and capital market is effective, price should not affect the decision and influence future profits. However, investors perceived the investment attractiveness of stocks also by their price.

Following study is based on qualitative analysis what has a complementary character to quantitative studies conducted in the literature. There are many studies indicating that investors are affected by stock prices, however, based only on stock quotations and data from capital market. Information gathered from survey conducted among individual investors provide additional knowledge that is not possible to verified on data collected from the market.

The main aim of the paper is to verify whether the price is one of the determinants of the investment decisions. Following hypotheses were verified.

H1: Price is one of the dominant factor in investment decisions.

H2: Investors affected by price illusion are more willing to buy low – priced stocks that stocks with high – prices.

H3: There is a price range below which investors perceive stock as too cheap to buy.

The verification of hypotheses formulated above is based on survey conducted on the sample of 600 individual investors in Poland in II-III quarter of 2018.

Research results confirm that price is one of important factor determining investment decisions. Stocks with low price are perceived as attractive to buy, however, there is a price range below which investors perceive stocks as too cheap to buy.

**The role of price in perceiving stock investment attractiveness**

There is a number of studies describing how prices influence investment decisions on the capital market (i.a. Goodhart and Currio (1990), Harris (1991), Grossman et al. (1997), Christie and Schultz (1994), Kandel and Marx (1997), Kandel et al. (1999), Fernando et al. (2004)). Capital market investors perceived stocks also by their price. They are affected by the numbers that constitute a certain point that is a barrier to the price increase or decrease. There is also a clear tendency to group share prices around round nominal values (Woodhouse et al. (2016); Sonnemans (2006); Brown and Mitchell (2008); Hu et al. (2017)).

There is a strong evidenced proofed by Green and Hwang (2009) that stocks are categorized by investors based on price. This phenomena is often used by some companies that proactively managed share prices to keep them relatively stable at certain nominal range (Weld et al. (2009); Baker et al. (2009)). However, it is also noticed that investors' preferences for stocks of different nominal prices are time – varying.

According to Hwang and Lu (2008), investors that are affected by numbers more often invest in low – price stocks. This is because of price illusion in which the share price seems to be too high for investors to allow shares to become more expensive and bring the expected rates of return. From this perspective, low – priced stocks are more attractive to buy as they have more space to grow. Chan et al. (2017) concluded that high stock prices make stock exchange transactions more difficult. This is due to budget constraints and lower availability of expensive share packages for a wider group of investors. This means that the market is not able to fully estimate these values, because the demand for them is limited. However, there are companies that keep stock prices at a relatively high level and will not divide them. On the other hand, as indicated by Weld et al. (2009), high stock prices are the specifics of large companies. The companies are upgrading to the next price range of the stock through the development and accompanying increase in the market price of the shares.

This phenomena occurs in split strategies. Too high stock prices may discourage investors from buying them due to limited portfolio diversification possibilities, which in particular affects small investors. On the other hand, maintaining a high share price is prestigious, because only a small group of investors, with more rich portfolios, can afford to buy them. In this context, an increase in the subjective value of stocks with behavioral factors.

However, some companies, wanting to avoid perception as prestigious, share their stocks, reducing their price to the optimal level, available to ordinary investors (Fernando et al., 1999).

## 2 Research method

Paper presents results of the survey conducted among Polish individual investors of capital market. The scope of the research had a nationwide character and was conducted on the sample of 600 respondents (0,02% of the general population). Sample was chosen deliberately – only those responders who are active on capital market

participated in the study. Survey was conducted in II-III quarter of 2018 with the participation of trained interviewers in this field. The interviewers were present during the research. Survey was financed from National Science Centre - DEC-2017/01/X/HS4/00089.

The research sample is representative with regards to individual investors structure in Poland, defined on the basis of previous analyses and implemented i.e. by Individual Investors Association [Association of Individual investors in Poland].

Author presented the frequency of responses that illustrates the basic information about price perception and logit models that describe qualitative variables in the context of probability of phenomenon occurring and formulated in a binary variable.

The linear probability model in the theoretical form can be written as:

$$y_i = \beta_0 + \beta_1 x_{1i} + \beta_2 x_{2i} + \cdots + \beta_k x_{ki} + \varepsilon_i \quad (1)$$

Where:

y (i) is a zero-one variable,

x (1, 2…) is an explanatory variable,

β (1, 2…) is a regression parameter,

i – number of observations,

It should be noted that:

$$\hat{Y}_i = E(Y_i) = P\{Y_i = 1\} \times 1 + P\{Y_i = 0\} \times 0 = P\{Y_i = 1\} = p_i \quad (2)$$

However, from the functional form of the model it follows that:

$$\hat{Y}_i = E(Y_i) = \beta_0 + \beta_1 x_{1i} + \beta_2 x_{2i} + \cdots + \beta_k x_{ki} \quad (3)$$

From the above it follows that:

$$p_i = \beta_0 + \beta_1 x_{1i} + \beta_2 x_{2i} + \cdots + \beta_k x_{ki} \quad (4)$$

Where:

p (i) is a probability of certain phenomena occurance.

This means that the theoretical value of the explanatory variable can be interpreted as the probability that the variable y (i) will be 1. In the logistic probability model, the function has the form:

$$p_i = \frac{e^{z_i}}{1 + e^{z_i}} \quad (5)$$

Where:

$$z_i = \beta_0 + \beta_1 x_{1i} + \beta_2 x_{2i} + \cdots + \beta_k x_{ki} + \varepsilon_i \quad (6)$$

## 3 Results and Discussion

In following tables, responses for chosen questions reflecting to price perception are presented.

To evaluate whether price is one of key factors in investment decision, responders were asked which stocks they are willing to buy, assuming that both companies have the same fundamental characteristics.

**Table 1** Assuming that stocks of both companies have the same fundamental value and only one factor that differentiate them is price – which stock you would like to buy

| Characteristics | % of responses |
|---|---|
| **low - price stocks** | 77,7 |
| **high - price stocks** | 21,2 |

Source: own elaboration

Definitely majority of investors prefer stocks at lower prices – almost 80% of responses. Next responders were asked to define the price range that they understand as low in reference to previous question.

**Table 2** Stock price you are willing to buy

| | below 0,50 PLN | from 0,51 PLN to 1 PLN | from 1,01 PLN to 5 PLN | from 5,01 to 10 PLN | from 10,01 to 50 PLN | from 50,01 PLN to 100 PLN | from 100,01 PLN to 200 PLN | from 200,01 PLN to 500 PLN | above 500,01 PLN |
|---|---|---|---|---|---|---|---|---|---|
| **low price stocks** | 2,4% | 12,4% | 12,7% | 24,2% | 35,2% | 12,0% | 0,6% | 0,4% | 0,0% |
| **high priced stocks** | 0,0% | 0,8% | 0,0% | 0,8% | 6,3% | 14,2% | 29,9% | 47,2% | 0,8% |

Source: own elaboration, V-Cramera: 0,505, p – value: 0,000

According to the responses presented above some price ranges that are preferred by investors may be indicated. At first, investors who are willing to buy low – price stocks, prefer stocks from 5 PLN to 50 PLN. What is interesting, stocks priced below 0,50 PLN, that definitely may be defined as cheap, are not attractive to buy for the investors. Those, who focus on high – priced stocks, prefer stocks from 100 PLN up to 500 PLN. Stocks above 500 PLN seem to be too expensive to buy.

Responders were directly asked how price and other factors are important in investment – decision making process. They could evaluate each factor on the scale from 1 – as most important to 5 – not important at all. Results presented in table below reflect only to answers "most important" and "rather important".

**Table 3** The role of chosen factors in investment-decision making process (%)

| Characteristics | most important | rather important | total |
|---|---|---|---|
| **stock price** | 28,2 | 21,8 | 50,0 |
| **price change in last period** | 21,8 | 19,3 | 41,2 |
| **trading liquidity** | 20,7 | 17,5 | 38,2 |
| **brokerage recommendation of the company** | 19,3 | 21,5 | 40,8 |
| **company sector** | 17,0 | 27,0 | 44,0 |
| **Information from market** | 11,7 | 14,7 | 26,3 |
| **book to market value** | 10,7 | 23,3 | 34,0 |
| **relation stock price to earnings** | 9,0 | 38,2 | 47,2 |
| **market value of the company** | 8,3 | 20,8 | 29,2 |
| **book value of the company** | 7,5 | 22,8 | 30,3 |
| **company stocks already present in the portfolio** | 1,0 | 17,2 | 18,2 |

Source: own elaboration

Surprisingly stock price seem to be the most important factor in investment decision – making process, even more than typical indicators for fundamental analysis like relation of stock price to earnings, market and book value of the company, book to market value. Every second respondent evaluate price as most or rather important factor in investment decision.

Finally, responders evaluate the influence of stock price on future price changes (variability), investment attractiveness and rate of return. Results are presented in table below.

**Table 4** The relation between price and chosen stock characteristics (%)

| Relation | yes - very strong | yes - strong | no – without any influence |
|---|---|---|---|
| **price and future variability** | 16,9 | 44,5 | 38,6 |
| **price and investment attractiveness** | 43,2 | 42,0 | 14,8 |
| **price and rate of return** | 25,3 | 48,7 | 26,0 |

Source: own elaboration

The strong relationship between stock price and investment attractiveness is confirmed. However, investors also find strong relationship between stock prices and rate of return what stays in contrast with effective market theory. The lowest relation is observed between stock prices and future price changes, however, every second respondent perceived is as at least "strong".

According to presented result, stock price definitely has an important role in decision process what may be a reason of observed price anomalies on capital market.

In order to verify what factors determine probability of choosing low – priced stocks, logit models are proposed. In the first model the dependent variable Y1 describes the probability of purchase stock of companies with low – priced stocks than stock with high prices (assuming that all other fundamental characteristics for two companies are the same and stock price is the only one difference). Y1 has a binary character: 1 – low – priced stocks, 2 – high – priced stocks. In the second model, considering price as the most important factor in investment decision making process was taken into consideration. The dependent variable Y2 has also binary character, 1 – price is definitely important, 0 – price is not important.

Following explanatory variables were taken into consideration:

- X1 - price range for stocks that are considered as too cheap to buy (values: 1 – stocks up to 0,30 PLN, 2 – up to 0,50 PLN, 3 – up to 0,75 PLN, 4 – up to 1,0 PLN, 5 – up to 3,0 PLN, 6 – up to 5 PLN, 7 – up to 10 PLN, 8 – up to 10 PLN, 9 – up to 100 PLN)
- X2 - price range for stocks that are considered as cheap but acceptable to buy (values: 1 – stocks from 0,10 PLN, 2 – from 0,30 PLN, 3 – from 0,50 PLN, 4 – from 0,75 PLN, 5 – from 1,0 PLN, 6 – from 3,0 PLN, 7 – from 5,0 PLN, 8 – from 10 PLN, 9 – from 100 PLN)
- X3 - price range for stocks that are considered as too expensive to buy (values: 1 – stocks up to 10 PLN, 2 – from 10,01 PLN, 3 – from 50 PLN, 4 – from 75 PLN, 5 – from 100 PLN, 6 – from 200 PLN, 7 – from 500 PLN, 8 – from 1000 PLN).
- X4 - the relation between stock price and variability of price in the future (1 – price influence the variability, 0 – there is no influence);
- X5 - the relation between stock price and investment attractiveness of stocks (1 – price influence the attractiveness, 0 – no influence);
- X6 - the evaluation of investment risk for stocks at price below 0,50 PLN (scale from 1 to 9 where 1 is the lowest and 9 the highest level of risk);

- X7 - the evaluation of investment risk for stocks at price between 5 and 10 PLN (scale from 1 to 9 where 1 is the lowest and 9 the highest level of risk);
- X8 - the evaluation of chance for over average returns for stocks at price below 0,50 PLN (scale from 1 to 9 where 1 is the lowest and 9 the highest);
- X9 - the evaluation of chance for over average returns for stocks at price from 0,51 PLN up to 1 PLN (scale from 1 to 9 where 1 is the lowest and 9 the highest);
- X10 - the evaluation of chance for over average returns for stocks at price from 200,01 PLN up to 500 PLN (scale from 1 to 9 where 1 is the lowest and 9 the highest);
- X11 - the belief that low – price stocks grow faster than high – priced stocks (scale from 1 to 5 where 1 – I do not completely agree and 5 – I totally agree);
- X12 - the belief that low – price stocks are characterized by higher variability than high – priced stocks (scale from 1 to 5 where 1 – I do not completely agree and 5 – I totally agree);
- X13 - the belief that there is higher probability of price increase in case of low – price stocks than high – priced stocks (scale from 1 to 5 where 1 – I do not completely agree and 5 – I totally agree).

**Table 5** Logit Model: Y1 **-** the probability of purchase stocks of companies with low – priced stocks than stock with high prices, No of observations: 587.

| | **Coefficient** | **Stnd.error** | **z** | **p-value** | |
|---|---|---|---|---|---|
| **const** | -1,545 | 0,84784 | -1,8223 | 0,06841 | * |
| **X1** | -0,9531 | 0,22703 | -4,1981 | 0,00003 | *** |
| **X2** | 0,62381 | 0,17745 | 3,5154 | 0,00044 | *** |
| **X3** | -0,2528 | 0,12877 | -1,963 | 0,04964 | ** |
| **X4** | -1,6202 | 0,76742 | -2,1113 | 0,03475 | ** |
| **X5** | -1,3277 | 0,41352 | -3,2107 | 0,00132 | *** |
| **X7** | -0,2275 | 0,10175 | -2,2362 | 0,02534 | ** |
| **X11** | 0,47871 | 0,18417 | 2,5993 | 0,00934 | *** |

Source: own elaboration, Note: Number of cases of "correct prediction" = 548 (93,4%)

Assuming that all characteristics of two companies are the same, despite price, the probability of purchase low – priced stocks is higher for those investors who consider that stock price determines future price changes and perceived the investment attractiveness of stocks by their price. These investors are also affected by price illusion and low – price anomaly effect and convinced that low – priced stocks will grow faster than high – priced stocks. Still the probability of choosing low – priced stocks is for those investors who indicate that penny stocks are too cheap to buy and prefer stocks at relatively higher prices but still characterized by "low".

Second model is evaluating the probability of considering prices as the most important factor in investment decision making process.

**Table 6** Logit Model: Y2 **-** price as the most important factor in investment decision making process, No of observations: 587.

| | **Coefficient** | **Stnd.error** | **z** | **p-value** | |
|---|---|---|---|---|---|
| **const** | -1,1002 | 1,08378 | -1,0151 | 0,31004 | |
| **X2** | -0,4487 | 0,08619 | -5,2052 | <0,00001 | *** |
| **X3** | 0,55878 | 0,1025 | 5,4513 | <0,00001 | *** |
| **X4** | 1,37852 | 0,28252 | 4,8794 | <0,00001 | *** |
| **X5** | 3,03245 | 0,65531 | 4,6275 | <0,00001 | *** |
| **X6** | -0,2188 | 0,04518 | -4,8436 | <0,00001 | *** |
| **X8** | -0,4665 | 0,14527 | -3,2114 | 0,00132 | *** |
| **X9** | 0,42411 | 0,15933 | 2,6619 | 0,00777 | *** |

| | | | | | |
|---|---|---|---|---|---|
| **X10** | -0,2996 | 0,06245 | -4,7976 | <0,00001 | *** |
| **X11** | -0,5761 | 0,17091 | -3,3707 | 0,00075 | *** |
| **X12** | -0,4709 | 0,1782 | -2,6426 | 0,00823 | *** |
| **X13** | 0,42127 | 0,22431 | 1,8781 | 0,06037 | * |

Source: own elaboration, Note: Number of cases of "correct prediction" = 472 (80,4%)

The probability of perceiving price as important factor in evaluating investment attractiveness of stocks is higher for those investors who are affected by price illusion and believe that there is a higher probability of price increase in case of low – priced stocks than high – priced stocks. On the other hand, those who do not agree that low – priced stocks grow faster than high – priced stocks and are characterized by higher variability will also consider stock price as important factor in decision making process. The probability of considering price as important is higher also for those who evaluate investment risk, attractiveness and chance for over average returns also by stock price perspective.

## 4 Conclusions

Summarizing the survey results it might be proved that investors are affected by price perception and this factors has a dominant role in decision making process. Investors are definitely more likely to buy stocks with lower prices but there is a bottom line below which stocks are too cheap to buy. The price range that seem to be most preferred by the investors is between 5 PLN and 50 PLN, however, the particular price barriers were proposed by Author and might need some verification in future studies.

For future analysis it would be interesting to verify the price ranges on the capital market and find the crucial price points. This could be useful not only from analyzing the heuristics but also for company managers in order to maintain the prices (by split or re-split) at level that is most preferred by the investors.

## References


Baker, M., Greenwood, R., Wurgler, J. (2009). Catering through nominal share prices. *Journal of Finance*, vol. 64, pp. 2559–2590.

Brown, P., Mitchell, J. (2008). Culture and stock price clustering: Evidence from The Peoples' Republic of China. *Pacific-Basin Finance Journal*, vol. 16(1-2), pp. 95–120.

Chan, K., Li, F., Lin, J. C., Lin, T. C. (2017). What do stock price levels tell us about the firms? *Journal of Corporate Finance*, No. 46, pp. 34–50.

Christie, W. G., Schultz, P. H. (1994). Why do NASDAQ Market Makers Avoid Odd-Eighth Quotes? *The Journal of Finance*, vol. 49(5), pp. 1813–1840.

Fernando, C. S., Krishnamurthy, S., Spindt, P. A. (1999). Is share price related to marketability? Evidence from mutual fund share splits. *Financial Management*, pp. 54–67.

Goodhart, C., Currio, R. (1990). Asset price discovery and price clustering in the foreign exchange market. *Working paper, London School of Economics.*

Green, T., Hwang, B. (2009). Price-based return comovement. *Journal of Financial Economics*, vol. 93, pp. 37–50.

Grossman, S., Miller, M., Fishel, D., Cone, K., Ross, D. (1997). Clustering and competition in asset markets. *Lexecon Inc. Report*, April.

Harris, L. (1991). Stock price clustering and discreteness. *The Review of Financial Studies*, No. 4, pp. 389–415.

Hu, B., Jiang, C., McInish, T., Zhou, H. (2017). Price clustering on the Shanghai Stock Exchange. *Applied Economics*, vol. 49(28), pp. 2766–2778.

Hwang, S., Lu, C. (2008). *Is Share Price Relevant?* (September 25, 2008). Pp. 1-39. Available at SSRN: https://ssrn.com/abstract=1341790 or http://dx.doi.org/10.2139/ssrn.1341790.

Kandel, E., Marx, L. M. (1997). Nasdaq market structure and spread patterns. *Journal of Financial Economics*, vol. 45(1), pp. 61–89.

Kandel, S., Sarig, O., Wohl, A. (1999). The demand for stocks: An analysis of IPO auctions. *Review of Financial Studies*, vol. 12(2), pp. 227–247.

Sonnemans, J. (2006). Price clustering and natural resistance points in the Dutch stock market: A natural experiment. *European Economic Review*, vol. 50(8), pp. 1937–1950.

Weld, W. C., Michaely, R., Thaler, R. H., Benartzi, S. (2009). The nominal share price puzzle. *Journal of Economic Perspectives*, vol. 23(2), pp. 121–142.

Woodhouse, S. A., Singh, H., Bhattacharya, S., Kumar, K. (2016). Invisible walls: Do psychological barriers really exist in stock index levels? *The North American Journal of Economics and Finance*, vol. 36, pp. 267–278.

# Financial Position of the Slovak Spa Companies

**Sylvia Jenčová[1], Petra Vašaničová[2], Igor Petruška[3]**

[1] University of Presov
Faculty of Management, Department of Finance
Konštantínova 16, 080 01 Prešov, Slovakia
E-mail: sylvia.jencova@unipo.sk

[2] University of Presov
Faculty of Management, Department of Mathematical Methods and Managerial Informatics
Konštantínova 16, 080 01 Prešov, Slovakia
E-mail: petra.vasanicova@unipo.sk

[3] University of Presov
Faculty of Management, Department of Mathematical Methods and Managerial Informatics
Konštantínova 16, 080 01 Prešov, Slovakia
E-mail: igor.petruska@unipo.sk

***Abstract:*** *In recent years, the Slovak spa companies, through increasing in spa guests (self-payers, or clients of insurance companies), has been significantly contributing to the support of tourism, especially health tourism. The aim of the paper is to evaluate the financial position of non-financial business entities divided by SK NACE 869 - Other human health activities. In the analysis, we use financial data about 21 spa companies for the period 2013-2017 that are obtained from the Register of Financial Statements of the Ministry of Finance of the Slovak Republic. The research sample is considered according its revenues in a given period. In terms of legal form, research sample consists of 16 joint stock companies (a.s.), 3 limited liability companies (s.r.o.), and 2 state-owned companies (s.o.). Financial and economic analysis of spa companies in space is determined using four methods of Multi-Criteria Evaluation. Within this methodology, we use productivity and intensity indicators, namely basic earning power of the decision making unit, return on sales, personal costs-to-net turnover ratio, value added-to-sales ratio. Results have shown that the best position in the period 2013-2017 have had these Slovak spa companies: Spa Bojnice, Spa Lúčky, Spa Dudince, Bardejov Spa, and Slovak Health Spa Piešťany.*

*Keywords: competitiveness, spa companies, indicators, model, Slovak Republic*

*JEL codes: Z33*

## 1 Introduction

In Slovakia, tourism shows positive growth in economic indicators, but as an industry, it needs to ensure greater competitiveness. Tourism, taking into account finance indicators, shows its potential for the Slovak economy. At the same time, it is an important sector in terms of its significant contributions to the export of services, the gross domestic product, the employment as well as the development of the region and rural development. Data from the Statistical Office of the Slovak Republic shows that in 2018, there were 4,007 accommodation establishments in Slovakia with the number of bed places equal 170,735. The number of visitors increased from 3,770,062 in 2012 to 5,596,407 in 2018. The nights spent by the visitor in total were 15,515,083 in 2018, and for comparison in 2012, it was 10,908,200.

One of the important segments of tourism is spa tourism. We can associate it with the concept of health tourism. As defined by the UNWTO and European Travel Commission, "health tourism covers those types of tourism which have as a primary motivation the contribution to physical, mental and/or spiritual health through medical and wellness-based activities which increase the capacity of individuals to satisfy their own needs and function better as individuals in their environment and society. Health tourism is the umbrella term for the subtypes: wellness tourism and medical tourism (UNWTO and ETC,

2019)". On the other hand, Aluculesei (2015) stated that spa tourism is at the border between wellness tourism and medical tourism.

Increasing number of spa guests in the Slovak spa resorts has been significantly contributing to the support of tourism, especially health tourism. Motivated by this fact, the aim of this paper is to evaluate the financial position of 21 non-financial spa companies operating in Slovakia. Based on the methods of Multi-Criteria Evaluation, we want to determine their competitive position.

## 2 Spa Companies in Slovakia

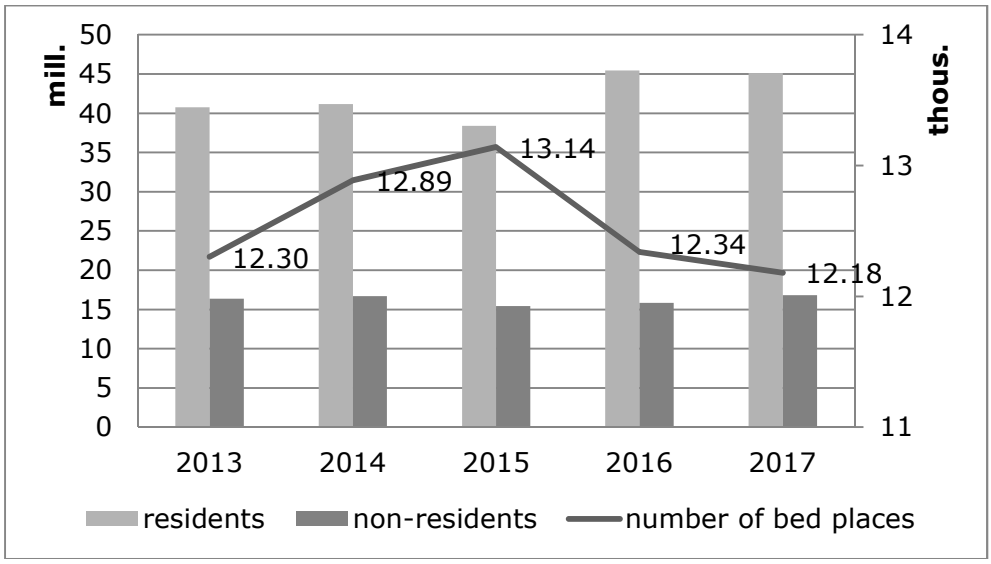
The issue of tourism in Slovakia was studied by several authors, for example, in terms of spa tourism (Jenčová et al., 2018; Litavcová et al., 2018), medical tourism (Košíková, 2018; Košíková and Vašaničová, 2018; Mitríková et al., 2018; Košíková et al., 2017), marketing and propagation (Štefko et al., 2015; Štefko, Kiráľová, Mudrík, 2015), performance analysis (Onuferová and Čabinová, 2018). Tourism competitiveness was analyzed by Kiseľáková et al. (2017); Lagrosen and Lagrosen (2015); Divisekera and Nguyen (2018); Djeri et al. (2018); Li et al. (2018), and others.

Slovakia is an ideal place for spa care and health tourism offering up to 94 thermal and healing springs. Thanks to 21 spa resorts with unique conditions, Slovakia is one of the most advanced European countries in the spa industry.

The beginning of spa tourism can be dated back to the last centuries. According to Kerekeš (2018), spa tourism applies natural quality water and suitable climatic conditions. The contribution for its development is to increase the knowledge of healthy natural mineral water, alternative medicine, and to build spa towns. New technology enabling the construction of spa wellness facilities, thermal pools, aqua parks, natural and built swimming pools also contributes significantly to the development of spa tourism. The development of new types of facilities and their equipment ensures and makes faster the regeneration and relaxation of the tourist.

Kasagranda and Gurňák (2017) categorized Slovak spa resorts according to their importance for spa tourism on international, national, regional, and local. Vystoupil et al. (2011) performed a similar dividing for the Czech spa resorts. Figure 1 shows information about accommodation revenues from residents and non-residents in the Slovak spa resorts (in EUR), and about number of bed places in the Slovak spa resorts (in total).

**Figure 1** Accommodation revenue (in EUR) and number of bed places in the Slovak spa resorts




Source: Statistical Office of the Slovak Republic

In addition, in Table 1, we present a comparison of average number of overnight stays in spa resorts between the Slovak Republic and the Czech Republic in the period 2013-2017. In Table 2, we compare arrivals at the spa resorts of these countries.

**Table 1** Average number of overnight stays at the spa resorts in 2013-2017

| Country | Visitors | 2013 | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|---|---|
| Slovak Republic | Residents | 9.4 | 9.0 | 8.7 | 9.0 | 9.1 |
| | Non-residents | 8.4 | 8.0 | 8.0 | 7.5 | 7.7 |
| Czech Republic | Residents | 7.9 | 8.9 | 9.9 | 10.2 | 7.5 |
| | Non-residents | 8.3 | 8.4 | 8.0 | 9.9 | 7.5 |

Source: Statistical Office of the Slovak Republic, Czech Statistical Office

**Table 2** Arrivals at the spa resorts in 2013-2017

| Country | Visitors | 2013 | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|---|---|
| Slovak Republic | Residents | 210,311 | 230,343 | 241,704 | 250,756 | 248,262 |
| | Non-residents | 68,118 | 68,689 | 63,271 | 65,290 | 62,876 |
| Czech Republic | Residents | 371,191 | 391,793 | 414,141 | 438,701 | 453,778 |
| | Non-residents | 374,744 | 350,488 | 318,135 | 341,421 | 385,349 |

Source: Statistical Office of the Slovak Republic, Czech Statistical Office

The volume of revenues is one of the main outputs of non-financial corporations. Jenčová et al. (2018) modeled the volume of sales from the personal costs and the number of assets among Slovak spa companies. Results of their analysis showed that the most competitive are Slovak Health Spa Rajecké Teplice, a.s. (1.0); Spa Nimnica, a.s. (0.942); Slovak Health Spa Turčianske Teplice, a.s. (0.911); Spa Nový Smokovec, a.s. (0.886); Bardejov Spa, a.s. (0.848); Spa Bojnice, a.s. (0.749); Spa Lúčky, a.s. (0.723). The least competitive are Natural Iodine Spa Číž, a.s. (0.275); Spa Sliač, a.s. (0.243); Spa Brusno, a.s. (0.074). The figures in brackets represent the achieved coefficient of competitiveness for the spa company.

## 3 Data and Methodology

The aim of the paper is to evaluate the financial position of non-financial business entities divided by SK NACE 869 - Other human health activities. We use data of 21 spa companies, which are connected with its revenues, obtained from the Register of Financial Statements of the Ministry of Finance of the Slovak Republic. We cover the period 2013-2017. In terms of legal form, research sample consists of 16 joint stock companies (a.s.), 3 limited liability companies (s.r.o.), and 2 state-owned companies (s.o.). In Table 3, we present selected absolute indicators of the Slovak spa companies.

**Table 3** Absolute indicators of the Slovak spa companies in 2017 (in EUR)

| Spa company | Revenue | Value Added | EAT |
|---|---|---|---|
| Slovak Health Spa Piešťany, a.s. | 37,491,880 | 23,765,937 | 1,499,595 |
| Slovak Health Spa Turčianske Teplice, a.s. | 12,928,241 | 6,055,653 | 115,080 |
| Slovak Health Spa Rajecké Teplice, a.s. | 12,764,446 | 5,244,639 | 503,524 |
| Bardejov Spa, a.s. | 12,675,602 | 6,727,552 | 628,696 |
| Spa Trenčianske Teplice, a.s. | 12,307,137 | 5,836,352 | 161,326 |
| Spa Bojnice, a.s. | 10,775,006 | 7,668,663 | 2,410,191 |
| Spa Dudince, a.s. | 9,411,193 | 6,481,969 | 1,260,235 |
| Spa Lúčky, a.s. | 6,022,758 | 3,955,728 | 535,199 |
| Spa Nimnica, a.s. | 5,978,252 | 3,306,077 | 618,662 |
| Specialized Medical Institute Marína, s.o. | 3,804,057 | 3,804,057 | 184,191 |
| Spa Vyšné Ružbachy, a.s. | 3,632,430 | 2,155,847 | 129,628 |
| Spa Brusno, a.s. | 3,208,944 | 1,560,035 | -621,275 |
| Slovthermae Spa Diamant, Dudince, s.o. | 3,197,353 | 2,097,788 | 24,572 |
| Spa Lučivná, a.s. | 3,193,247 | 1,941,481 | 96,600 |

| | | | |
|---|---|---|---|
| Spa Sliač, a.s. | 3,081,044 | 1,549,111 | -556,390 |
| Spa Nový Smokovec, a.s. | 2,695,434 | 1,463,701 | 15,307 |
| Natural Iodine Spa Číž, a.s. | 1,776,120 | 983,027 | -224,557 |
| Spa Štós, a.s. | 1,461,875 | 864,612 | -269,146 |
| Spa Kováčová, s.r.o. | 931,555 | 596,534 | -196,474 |
| Spa Horný Smokovec, s.r.o. | 822,403 | 471,492 | 46,613 |
| Spa Červený Kláštor Smerdžonka, PIENINY RESORT, s.r.o. | 570,464 | 208,722 | -45,577 |

Source: own calculations using data from the Register of the Financial Statements of the Slovak Republic

We determine financial and economic position of spa companies in space by using methods of Multi-Criteria Evaluation. The multi-criteria evaluation of business entities in the space applied, for example, Jenčová et al. (2017). Within selected methods, we use productivity and intensity indicators, namely basic earning power of the decision making unit, return on sales, personal costs-to-net turnover ratio, value added-to-sales ratio. These methods allow us to determine and evaluate competitiveness of the spa companies in the Slovak market. We have determined the orders of selected companies by formulas according to Jenčová (2018), Zmeškal et al. (2013). Following formulas correspond to ranking method (1), scoring method (2), method of normed shape (3), and method of distance from fictitious object (4). Integral indicator $d_{1i}$ - $d_{4i}$ for $i$-th company is given (in the case of unit weights) by formula (1)-(4).

$$d_{1i} = \frac{1}{m}\sum_{j=1}^{m} s_{ij} \tag{1}$$

$$d_{2i} = \frac{1}{m}\sum_{j=1}^{m} b_{ij} \tag{2}$$

$$d_{3i} = \frac{1}{m}\sum_{j=1}^{m} u_{ij} \tag{3}$$

$$d_{4i} = \frac{1}{m}\sqrt{\sum_{j=1}^{m}\left(u_{ij} - u_{0j}\right)^2} \tag{4}$$

We have evaluated the consensus of the calculated rankings using the selected methods through the Spearman's rank correlation coefficient $r_s$ (5).

$$r_s = 1 - \frac{6\sum\left(i_x - i_y\right)^2}{n\left(n^2 - 1\right)} \tag{5}$$

## 4 Results and Discussion

The classification of spa companies according to mentioned methods of multi-criteria evaluation is given in Table 4 (ranking method and scoring method) and Table 5 (method of normed shape and method of distance from fictitious object).

**Table 4** Ranking of spa companies based on ranking method (RM) and scoring method (SM)

| Spa company | RM | | | | | SM | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 2013 | 2014 | 2015 | 2016 | 2017 | 2013 | 2014 | 2015 | 2016 | 2017 |
| Slovak Health Spa Piešťany, a.s. | 7 | 5 | 4 | 10 | 7 | 9 | 7 | 6 | 11 | 8 |
| Slovak Health Spa Rajecké Teplice, a.s. | 15 | 10 | 10 | 12 | 8 | 10 | 9 | 9 | 10 | 7 |
| Slovak Health Spa Turčianske Teplice, a.s. | 9 | 12 | 5 | 4 | 11 | 6 | 10 | 4 | 3 | 11 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Bardejov Spa, a.s. | 3 | 9 | 3 | 8 | 5 | 3 | 8 | 3 | 6 | 6 |
| Spa Trenčianske Teplice, a.s. | 12 | 16 | 13 | 16 | 14 | 12 | 15 | 14 | 14 | 14 |
| Spa Bojnice, a.s. | 2 | 1 | 1 | 1 | 1 | 4 | 1 | 1 | 1 | 1 |
| Spa Dudince, a.s. | 6 | 4 | 6 | 3 | 4 | 8 | 6 | 7 | 4 | 4 |
| Spa Lúčky, a.s. | 10 | 2 | 2 | 2 | 3 | 11 | 3 | 2 | 2 | 3 |
| Spa Nimnica, a.s. | 11 | 15 | 16 | 9 | 2 | 13 | 14 | 16 | 9 | 2 |
| Specialized Medical Institute Marína, s.o. | 8 | 7 | 7 | 5 | 9 | 7 | 5 | 5 | 5 | 9 |
| Spa Vyšné Ružbachy, a.s. | 19 | 18 | 17 | 15 | 12 | 19 | 18 | 17 | 15 | 13 |
| Slovthermae Spa Diamant, Dudince, s.o. | 17 | 19 | 19 | 18 | 15 | 17 | 19 | 21 | 21 | 15 |
| Spa Brusno, a.s. - in restructuring | 16 | 11 | 15 | 17 | 20 | 15 | 12 | 15 | 17 | 18 |
| Spa Lučivná, a.s. | 4 | 8 | 9 | 14 | 10 | 1 | 11 | 10 | 16 | 10 |
| Spa Sliač, a.s. - in liquidation | 21 | 20 | 21 | 21 | 17 | 21 | 21 | 20 | 19 | 20 |
| Spa Nový Smokovec, a.s. | 13 | 13 | 11 | 11 | 13 | 14 | 13 | 12 | 12 | 12 |
| Natural Iodine Spa Číž, a.s. | 18 | 17 | 18 | 20 | 19 | 18 | 16 | 18 | 20 | 19 |
| Spa Štós, a.s. | 1 | 3 | 12 | 6 | 21 | 2 | 2 | 11 | 7 | 21 |
| Spa Kováčová, s.r.o. - in liquidation | 5 | 6 | 8 | 7 | 16 | 5 | 4 | 8 | 8 | 17 |
| Spa Horný Smokovec, s.r.o. | 14 | 14 | 14 | 13 | 6 | 16 | 17 | 13 | 13 | 5 |
| Spa Červený Kláštor Smerdžonka, PIENINY RESORT, s.r.o. | 20 | 21 | 20 | 19 | 18 | 20 | 20 | 19 | 18 | 16 |

Source: own calculation

**Table 5** Ranking of spa companies based on method of normed shape (NS), and method of distance from fictitious object (DFO)

| Spa company | NS | | | | | DFO | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 2013 | 2014 | 2015 | 2016 | 2017 | 2013 | 2014 | 2015 | 2016 | 2017 |
| Slovak Health Spa Piešťany, a.s. | 7 | 5 | 4 | 5 | 8 | 7 | 5 | 4 | 4 | 5 |
| Slovak Health Spa Rajecké Teplice, a.s. | 12 | 9 | 12 | 13 | 6 | 16 | 9 | 14 | 15 | 10 |
| Slovak Health Spa Turčianske Teplice, a.s. | 8 | 8 | 6 | 4 | 9 | 9 | 11 | 11 | 12 | 12 |
| Bardejov Spa, a.s. | 4 | 7 | 3 | 6 | 5 | 3 | 6 | 3 | 8 | 6 |
| Spa Trenčianske Teplice, a.s. | 10 | 13 | 14 | 15 | 12 | 10 | 13 | 12 | 16 | 13 |
| Spa Bojnice, a.s. | 3 | 1 | 1 | 1 | 1 | 4 | 1 | 1 | 1 | 1 |
| Spa Dudince, a.s. | 6 | 4 | 5 | 3 | 4 | 6 | 4 | 5 | 3 | 3 |
| Spa Lúčky, a.s. | 9 | 2 | 2 | 2 | 3 | 8 | 2 | 2 | 2 | 4 |
| Spa Nimnica, a.s. | 11 | 15 | 16 | 12 | 2 | 11 | 14 | 18 | 13 | 2 |
| Specialized Medical Institute Marína, s.o. | 13 | 11 | 8 | 11 | 15 | 17 | 16 | 16 | 17 | 15 |
| Spa Vyšné Ružbachy, a.s. | 19 | 18 | 17 | 14 | 13 | 19 | 17 | 15 | 10 | 9 |
| Slovthermae Spa Diamant, Dudince, s.o. | 17 | 19 | 21 | 21 | 14 | 15 | 19 | 21 | 21 | 14 |
| Spa Brusno, a.s. - in restructuring | 14 | 12 | 13 | 16 | 19 | 13 | 12 | 10 | 11 | 20 |
| Spa Lučivná, a.s. | 1 | 10 | 7 | 8 | 10 | 1 | 7 | 6 | 5 | 8 |
| Spa Sliač, a.s. - in liquidation | 21 | 21 | 20 | 20 | 16 | 21 | 21 | 20 | 19 | 16 |
| Spa Nový Smokovec, a.s. | 15 | 14 | 10 | 10 | 11 | 14 | 10 | 7 | 7 | 11 |
| Natural Iodine Spa Číž, a.s. | 18 | 16 | 18 | 18 | 20 | 18 | 15 | 17 | 18 | 19 |
| Spa Štós, a.s. | 2 | 3 | 11 | 7 | 21 | 2 | 3 | 8 | 6 | 21 |
| Spa Kováčová, s.r.o. - in liquidation | 5 | 6 | 9 | 9 | 18 | 5 | 8 | 9 | 9 | 17 |
| Spa Horný Smokovec, s.r.o. | 16 | 17 | 15 | 17 | 7 | 12 | 18 | 13 | 14 | 7 |
| Spa Červený Kláštor Smerdžonka, PIENINY RESORT, s.r.o. | 20 | 20 | 19 | 19 | 17 | 20 | 20 | 19 | 20 | 18 |

Source: own calculation

Revenues of business entities represent the base on which business entities operate. Revenues are determined by numerous factors. Revenues, as a practical feature in the industry, quantify the additive relationship between state indicators. According to the

Financial Statement, we are talking about following: Revenue from the sale of merchandise, Revenue from the sale of own products and services, Revenue from the sale of non-current assets and raw materials. Higher volume of revenues signals the higher competitiveness and vice versa. The revenue generation factor is the asset turnover ratio. Specifically, greater asset turnover ratio stands the potential for generating more revenues and vice versa. Personal costs are one of the other factors in generating revenues because the volume of revenues is directly dependent on the volume of work that is quantified by the average number of employees in the company. Higher volume of labor consumed, respectively, a higher volume of personal cost indicates a higher volume of revenues.

We have calculated some financial indicators to analyze financial situation of the best and the worst Slovak spa resort. Despite the fact that Bardejov Spa, a.s. has ranked sixth among all analyzed spa companies, it has occupied the first place in terms of economic success. According to its profit, Bardejov Spa is among the top 100 non-financial corporations in Slovakia. One euro of total assets generates almost ten cents of operating earnings before interest and taxation. Profit margin is 33.8%. There are 28 cents of personal costs per euro of sales. One euro of revenues generated almost 73 cents of value added in 2017. During the examined period, there is an increase in all productivity indicators and a slight decrease in the intensity indicators.

The negative difference between revenues and costs is recorded in these spa companies: Spa Brusno, a.s.; Spa Sliač, a.s.; Natural Iodine Spa Číž, a.s.; Spa Štós, a.s.; Spa Kováčová, s.r.o.; Spa Červený Kláštor Smerdžonka, PIENINY RESORT, s.r.o. The highest change occurred within the Spa Štós, a.s., where the positive profit in 2013-2016 has decreased. The year-on-year change in profit fell by almost 500%, and this was determined mainly by a decrease in the volume of generated revenues. Equity-to-Debt Ratio categorized the Spa Štós, a.s. among the companies at risk of crisis. We do not analyze the financial situation of other companies because of the limited length of the paper.

We use Spearman's correlation coefficient to determine whether individual methods of multi-criteria evaluation provide consistent results. Table 6 presents results of mentioned correlation analysis calculated according to formula (5).

**Table 6** Spearman's rank correlation coefficients

| | | | **2014** | | | | **2015** | |
|---|---|---|---|---|---|---|---|---|
| **Metod** | **RM** | **SM** | **NS** | **DFO** | **RM** | **SM** | **NS** | **DFO** |
| **RM** | 1.00 | 0.97 | 0.96 | 0.91 | 1.00 | 0.99 | 0.98 | 0.86 |
| **SM** | | 1.00 | 0.96 | 0.88 | | 1.00 | 0.97 | 0.81 |
| **NS** | | | 1.00 | 0.96 | | | 1.00 | 0.91 |
| **DFO** | | | | 1.00 | | | | 1.00 |
| | | | **2016** | | | | **2017** | |
| **Metod** | **RM** | **SM** | **NS** | **DFO** | **RM** | **SM** | **NS** | **DFO** |
| **RM** | 1.00 | 0.98 | 0.90 | 0.71 | 1.00 | 0.98 | 0.96 | 0.95 |
| **SM** | | 1.00 | 0.88 | 0.65 | | 1.00 | 0.95 | 0.93 |
| **NS** | | | 1.00 | 0.88 | | | 1.00 | 0.96 |
| **DFO** | | | | 1.00 | | | | 1.00 |

Source: own calculation

All correlation coefficients were statistically significant at significance level of 0.05. It means that the four methods of multi-criteria evaluation provide the same results. The highest compliance is between results of the ranking method and the scoring method. On the other hand, the lowest compliance is between the scoring method and the method of distance from fictitious object.

## 5 Conclusions

The importance of spa tourism is growing because of people's increasing interest in their own health and a healthy lifestyle. Slovakia is considered to be a traditional spa destination in Europe with an ancient history that is associated with the emergence of the first settlements in thermal and mineral springs. However, the Slovak spa industry needs to ensure greater competitiveness. In this paper, we implemented multidimensional statistical methods within the financial and economic analysis of 21 spa companies. Their ranking (in Table 3) was determined according to the volume of generated revenues in 2017. Using the exact data of these companies from the financial statements of the Register of Financial Statements, financial ratios were calculated. Within the multi-criteria evaluation, we used productivity and intensity indicators, namely basic earning power of the decision making unit, return on sales, personal costs-to-net turnover ratio, value added-to-sales ratio. Evaluation of analyzed spa companies were performed by implementing four methods, namely ranking method, scoring method, method of normed shape, and method of distance from fictitious object. We have ranked the selected spa companies in the market space. Results have shown that the best position has had Spa Bojnice, a.s., and Spa Lúčky, a.s. In 2017, the least competitive was Spa Štós, a.s.; Spa Červený Kláštor Smerdžonka, PIENINY RESORT, s.r.o.; Natural Iodine Spa Číž, a.s.; Spa Brusno, a.s.; Spa Sliač, a.s. The follow-up research will cover the implementation of multidimensional scaling for spa decision-making units.

## Acknowledgments

This work was supported by research grant VEGA No. 1/0470/18 "Economic activity of tourism in the European area", and GAPU 43/2019 "Kultúrne rozdiely a ich vplyv na cestovný ruch (Cultural differences and their impact on tourism)".

## References

Aluculesei A. C. (2015). Spa Tourism-A Comparative Analysis on Spain and Romania. *Balneo research journal*, vol. 6(3), pp. 199-207.

Divisekera, S., Nguyen, V. K. (2018). Determinants of innovation in tourism evidence from Australia. Tourism Management, vol. 67, pp. 157-167.

Djeri, L., Stamenkovic, P., Blesic, I., Milicevic, S., Ivkov, M. (2018). An importance-performance analysis of destination competitiveness factors: case of Jablanica district in Serbia. Economic Research-ekonomska Istrazivanja, vol. 31(1), pp. 811-826.

Jenčová, S., Litavcová, E., Petruška, I., Vašaničová, P. (2018). Competitiveness of Spa Companies. In: Frankovský, M., Dobrovič, J., Fedorko, R. ed., Management and the World in Motion, Challenges, Opportunities and Threats. VII. International Scientific Conference. Nový Smokovec. Prešov: Bookman, pp. 521-526.

Jenčová, S., Litavcová, E., Vašaničová, P., Košíková, M. (2017). Implementation of multidimensional analytic methods to compare performance between corporationsed. In: Němec, R., Chytilová, L., ed., Strategic management and its support by information systems. Proceedings of the 12th International Conference, SMSIS. Ostrava. Ostrava: VŠB - Technical university of Ostrava, pp. 21–29.

Kasagranda, A., Gurňák, D. (2017). Spa and Wellness Tourism in Slovakia (A Geographical Analysis). Czech Journal of Tourism, vol. 6(1), pp. 27-53.

Kerekeš, J. (2018). Kúpeľníctvo a jeho význam v turizme. Bratislava: Weltprint.

Kiseľálová, D., Šofranková, B., Čabinová, V., Onuferová, E. (2018). Competitiveness and sustainable growth analysis of the eu countries with the use of global indexes' methodology. Entrepreneurship and Sustainability Issues, vol. 5(3), pp. 581-599.

Košíková, M. (2018). Index medicínskeho cestovného ruchu. In: Jenčová, S., Litavcová, E. ed., Ekonomická aktivita turizmu. Konferenčný zborník príspevkov. Prešov. Prešov: Bookman, pp. 59-67.

Košíková, M., Šenková, A., Litavcová, E., Bielik, R. (2017). Spa tourism in Slovakia - analysis of defined aspects. In: Mathematical methods in economics 2017. 35th international conference : conference proceedings. Hradec Králové. Hradec Králové: University of Hradec Králové. pp. 348-353.

Košíková, M., Vašaničová, P. (2018). Zdravotné výkony medicínskeho cestovného ruchu. In: Jenčová, S., Litavcová, E. ed., Ekonomická aktivita turizmu. Konferenčný zborník príspevkov. Prešov. Prešov: Bookman, pp. 80-90.

Lagrosen, Y., Lagrosen, S. (2015). Entrepreneurial Learning for Quality and Competitiveness: A Study in the Spa-Industry. In: Proceedings of the European Conference on Entrepreneurship and Innovation (ECIE). Genoa: University Genoa, pp. 392-399.

Li, K. X., Jin, M., Shi, W. (2018). Tourism as an important impetus to promoting economic growth: A critical review. Tourism Management Perspectives, vol. 26, pp. 135-142.

Litavcová, E., Jenčová, S., Košíková, M., Šenková, A. (2018). Implementation of Multidimensional Analytical Methods to Compare Performance between Spa Facilities. In: Loster, T., Pavelka, T. ed. The 12th International Days of Statistics and Economics. Prague. Slaný: Melandrium. pp. 1070-1079.

Mitríková, J., Sobeková Voľanská, M., Šenková, A., Parová, V., Kaščáková, Z. (2018). Bardejov Spa: the analysis of the visit rate in the context of historical periods of its development from 1814 to 2016. Economic Annals-XXI, vol. 167(10), pp. 57-62.

Onuferová, E., Čabinová, V. (2018). Enterprise Performance Analysis of the Selected Service Sector by Applying Modern Methods with an Emphasis on the Creation and Application of the Modified Creditworthy Model (MCWM). Journal of Tourism and Services, vol. 9(17), pp. 1-26.

Register of the Financial Statements of the Slovak Republic (2019). Retrived from: http://www.registeruz.sk

Štefko, R., Fedorko, I., Bačík, R., Fedorko, R. (2015). An analysis of Perceived Topicality of Website Content influence in Terms of Reputation Management. Polish Journal of Management Studies, vol. 12(1), pp. 177-185.

Štefko, R., Kiráľová, A., Mudrík, M. (2015). Strategic Marketing Communication in Pilgrimage Tourism. Procedia: social & behavioral sciences, vol. 175, pp. 423-430.

UNWTO and ETC. (2018). Exploring Health Tourism – Executive Summary. Retrived from: https://www.e-unwto.org/doi/book/10.18111/9789284420308

Vystoupil, J., Šauer, M. et al. (2011). Geografie cestovního ruchu České republiky. Plzeň: Aleš Čeněk.

Zmeškal, Z., Dluhošová, D., Tichý, T. (2013). Finanční modely. Koncepty, metody, aplikace. Praha: Ekopress.

# Cultural Diversity in Working Teams

**Yvona Kaňovská, Klára Strašáková, Lenka Janošová**

Masaryk University
Department of Corporate Economy,
the Faculty of Economics and Administration,
Lipova 41a, 602 00 Brno, Czech Republic
E-mail: lenkajanosova@mail.muni.cz

***Abstract:*** *With ever-increasing globalization and new trends in the labor market, we are increasingly confronted with teams that are not homogeneous, whether this heterogeneity is based on a different gender, age, nationality or race. This paper focuses on cultural diversity, as due to the openness of the Czech economy and the high share of foreign capital, Czech managers must face culturally diverse teams more often at the workplace. It is also necessary to adapt the style of leadership and communication to exploit the potential of cultural diversity. Although some authors deny the existence of a relationship between diversity and team performance, most authors agree that diversity enhances the competitiveness of a company and assists in increasing the firm's value. On the other hand, however, authors admit that diverse teams face several problems, which if not solved, can end up harming the business. The aim of this article is to present studies on cultural diversity using a systematic literary review and to help answer the question of whether cultural diversity affects the effectiveness and performance of teams and, if so, whether it is a positive or negative influence, and what factors have an impact on it.*

*Keywords: cultural diversity, team effectiveness, team performance, team influence*

*JEL codes: M10, M12, M14, M15, M16*

## 1 Introduction

Cultural diversity is increasingly common in the workplace, especially in the Czech Republic, where the model of a Czech subsidiary of a foreign parent company is strongly represented. Foreign managers come into contact with Czech employees or they rotate workers among the group's branches around the world. It is, therefore, necessary to take into account the issue of cultural diversity and how it can affect the functioning of work teams. If executives are aware of the potential benefits and disadvantages of cultural diversity, they can employ its potential to increase a company's competitiveness and market value.

Over the past few decades, the relationship between cultural diversity and team effectiveness has been explored by different authors (Wright and Drewery, 2006; Gupta, 2008; Brunow and Nijkamp, 2018). Some authors state that no relationship exists, others say that this relationship is positive, while others claim it is negative. Therefore, we considered it important to use a systematic literature review to compile an overview of the literature so far to find out under what conditions the relationship between the cultural diversity of the team and effectiveness is positive, negative or impossible to prove. We would also like to specify the different benefits of diversified (multicultural) teams, and which critical factors the success of these positive impacts depends on, as well as the issue of diversified (multicultural) teams and the factors that shape the magnitude of these impacts. We will thus try to find out if cultural diversity is beneficial for the team, and what conditions are needed to support the positive impact of cultural diversity on the effectiveness and performance of multicultural teams.

According to McGrath et al. (1995), diversity is a characteristic of a group of two or more people, and mostly refers to the demographic differences of one or more types among the members of the group. Jackson (1992), Triandis et al. (1994) and Williams and O'Reilly (1998) state that diversity refers to differences between individuals in any attribute that may lead to the perception that another person is different from the

individual. Knippenberg et al. (2004) add that diversity essentially covers an almost infinite number of dimensions, from age to nationality, from religious background to functional background, from task to relationship, from political to sexual preference. Based on the observability of the characters of diversity, we can distinguish between surface-level and deep-level diversity.

Surface-level diversity is defined as differences between team members in apparent demographic characteristics, such as age or gender. As far as cultural diversity is concerned, ethnicity and nationality are most often studied (Ely and Thomas, 2001; Mannix and Neale, 2005). Deep-level diversity addresses the differences between the team members from a psychological point of view, thus focusing on personality, values and attitudes (Harrison et al., 1998). In cultural differences, we focus on values or attitudes that are associated with culture. (Hofstede, 1980; House et al., 2004; Kirkman and Shapiro, 2001). Deep-level can also lead to negative impacts in teams due to conflicts in the values of individuals who are not then in the group to create a background for communication and cooperation (Sitkin and Roth, 1993). On the other hand, it can also lead to positive results, since heterogeneity in teams is associated with better informed groups which focus on the problem from different perspectives (Mannix and Neale, 2005). The heterogeneous team is thus more creative and has new, more effective ideas (Adler, 2002; Cox and Blake, 1991; O'Reilly et al., 1998).

**Cultural diversity**

According to Cox (1994), cultural diversity means the representation of people with significantly different group relationships of cultural significance in one social system. Mannix and Neale (2005) state that cultural diversity, as well as other types of differences, affects teams in three potentially contradictory ways. First, according to the theory of similarity and attractiveness, people find it more comfortable to work with people who have similar values, beliefs and attitudes (Williams and O'Reilly, 1998). Secondly, according to social identity (Tajfel, 1982), people tend to divide into specific groups, then positively accept the members of their group, while on the other hand, judge those who do not belong to them and stereotypically condemn people according to their type of group. These opinions lead to the idea that group differences lead to negative results, mainly because of the fact that individual processes become more difficult for a group. However, in a third case, based on process-information theory, diversity brings a variety of benefits (Mannix and Neale, 2005), mainly due to the fact that team differences cover a wider area of knowledge, a wider network of cooperation, improve problem solving, and increase creativity and adaptability (Blau, 1977; Cox and Blake, 1991; Jackson, 1992).

Several variables have been identified as being critical factors for behavior in teams (Cohen and Bailey, 1997, Jackson et al., 2003, Smith et al., 1994, Williams and O'Reilly, 1998). We can categorize whether they are associated with divergence or convergence (Earley and Gibson, 2002), and if they lead to procedural losses or profits (Steiner, 1972), and in so doing, we will attempt to clarify the consequences of cultural diversity.

**Divergence**

Cultural differences tend to increase processes that bring different values and ideas to one another (Davison and Ekelund, 2004). They can lead to positive results as they enable the team to achieve better results together than one single person, for example, by brainstorming (Adler, 2002; Cox, 1994). In the case of a negative result, the cause is determined by a conflict that arises from differences and misconceptions.

**Convergence**

Cultural differences, therefore, tend to reduce convergent processes that are associated with the same goals, commitments, and conclusions. Sometimes convergent processes positively contribute to team behaviour and help achieve a consistent outcome through communication, social integration, cohesiveness, determination and identity. Other convergent processes contribute more negatively as they lead to disagreement within the

team or regarding new information from outside, even if the information would lead to a better decision, for example group thinking (Janis, 1972).

## 2 Methodology and Data

The aim of our work, therefore, will be to determine whether cultural diversity affects the performance and effectiveness of teams, either positively or negatively, and what factors can determine this influence and in what manner.

On the basis of these theoretical foundations, we have identified two research questions:

RQ1: What is the impact of cultural diversity on the effectiveness and performance of teams?

RQ2: What factors does this (positive or negative) influence depend on?

Our research method will be a systematic literary research, through which we will explore various authors and publications and look for links between them. To search for articles, we use the Google Scholar and Web of Science databases, using the following keywords: cultural diversity, team effectiveness, team performance, and team influence. We did not focus on any specific industry or country.

## 3 Results and Discussion

### Cultural diversity and team effectiveness

Bliss (2004) describes the team as a group of people dedicated to a common goal, who, through regular and frequent interaction, work together to carry out the activities necessary to achieve that goal. Friedemann et al. (2008) describe multicultural teams as teams of different cultures and ethnicities. Staples and Zhao (2006) then state that teams offer companies potentially effective ways to combine different skills, talents and perspectives of a group of individuals to achieve the company's goals. Watson et al. (1998) note that unless the views and actions of individuals are consistent with the team's objectives, the integrity of the team is at stake. They describe the need for a balance between the team and the individual's orientation. It further states that the potential for imbalance is greatest when individuals of different cultural or work performance are to cooperate. Friedemann et al. (2008) evaluate the effectiveness of the team as the interaction between the three components: the team as a whole in terms of structure and process, team members in terms of work performance, communication and cultural understanding, and teamwork. Friedemann et al. (2008) also look for the ideal level of diversity to maximize creativity and team innovation. Here, Austin (1997) suggests that optimal diversity depends on factors such as the level of individual tolerance of innovations and the different context of the cultural environment. On the other hand, according to Daye et al. (1995), the impact of cultural differences on group interaction and performance was not confirmed.

### Benefits of multicultural teams

The positive benefits of culturally diverse teams can be found in several aspects, which we will gradually describe according to the approaches of individual authors and case studies. For example, culturally diverse teams are recognized for providing more accurate information, greater creativity and innovativeness, and greater understanding of the issues (Shaw and Barrett-Power, 1998; Williams and O'Reilley, 1998), different views, better information exchange and maximization of human talent - expertise of members (Elron, 1997). Processes contribute positively to team performance, generate process gains, and achieve better results overall, which can be supported, for example, by brainstorming or creativity (Cox, 1994).

### Creativity – innovativeness

We take creativity in team processes to mean the evaluation of a wide range of alternatives and criteria, and building on new and useful ideas. Creativity is also a very important part of innovation (O'Reilly et al., 1998), and can improve performance. This is

supported, for example, by a study by Mannix and Neale (2005), which confirms that cultural diversity has a positive impact on team processes through greater creativity. Several studies have confirmed that creativity increases with team heterogeneity, which is mostly associated with sensitivity and different approaches to problems.

**More accurate information and data, more effective transfer between members and better understanding of the issue**

Cultural diversity has been demonstrated to contribute greatly in data collection and interpretation, as reported by Sauquet and Jacobs (1998). They also state that an added benefit is ensuring greater objectivity, because research teams composed of ethnically diverse members understand the cultural views of study participants and the context of the community from which the data originates. This statement is supported by Foldy (2004), who adds that multicultural teams are needed in research because people better identify with someone who is judging the world in the same way and has the same overall view of the world. Ely and Thomas (2001) also conducted research on this topic and demonstrated the creation of work groups based on the aforementioned shared values. The groups then led to better efficiency and results for the entire team. Heterogeneous groups have seen higher results (effectiveness) in two areas – identifying perspectives of the problem and creating alternative solutions. Improving the process and performance was also faster for culturally diverse groups (Watson et al., 1993). Watson et al. (2002) have shown that ethnically diversified teams demonstrate better performance in team project assignments. Pasik et al. (2001) even add that the multicultural team seems to be the best at collecting data, which accurately reflects the needs and perceptions of different ethnic communities and responds to complex research questions.

**Human Resources – skills of team members**

Friedemann et al. (2008) conducted research into the impact of cultural diversity on the performance of a multicultural research team. This influence was confirmed, with the specific results including: empowering research practices and tools, maximizing access to hard-to-reach populations, enhancing communication with participants and, as a "by-product", also training cultural awareness. It was created by a team that allowed intercultural learning and common problem solving. A well-functioning multicultural team could be one of the best ways to achieve culturally compatible results and interpretations. Ely and Thomas (2001) add that diversity creates alternative views of work, new ways of thinking and adapting work, and how best to achieve it. Based on this, employees' understanding, skills and experience are developed. Intercultural "learning" improved work in the group. In addition, due to diversity, it is also possible to enter into previously inaccessible market niches. Diversity has been found to be a source of learning and change, enabling an expansion of the knowledge base as well as the network of contacts. Mcleod et al. (1996) and Watson et al. (1993) also state that when performance is measured by the number of ideas created, the effects of different perspectives on culturally diverse group members are obvious.

On the basis of a relatively large number of studies, a positive effect on the effectiveness of culturally diverse teams has been demonstrated in some areas. It is now possible to mention the critical factors which the success of these positive impacts depends on. We distinguish the countries from which the individuals originate, the size of the team they work in, the duration of the teamwork, the overlapping of certain characteristics, leadership and the loyalty of the team, and credibility, communication, sensitivity and tolerance.

**Differences between countries**

Cultural diversity is easier to grasp in countries which are similar, for example, in education or in the style of state institutions. Such countries have similar beliefs, values, and often a language, resulting in smaller communication barriers where members are better able to solve problems together. As an example, Tung (1993) looked at English-speaking Canadians and Americans.

**Team Size**

According to some authors, the size of the heterogeneous team may affect performance positively (Yetton and Bottger, 1983). The hypotheses are mainly based on larger sources of human capital, time, energy, money, and experience the culturally diverse team has.

**Duration of team membership co-operation**

Based on Watson et al. (1993), duration of team membership cooperation limits the process and performance among members in newly created groups. The longer a team cooperates, the more the differences in the heterogeneous environment are eliminated, while the cooperation is smoother, more automatic and less conflictual. This is also supported by Watson et al. (1993) and Harrison et al. (1998). Furthermore, a study by Earey and Mosakowski (2000) confirms that efficiency in heterogeneous teams increases over time, especially when they develop interaction, communication and identity sharing. If shared identity fails to develop sufficiently, the effectiveness of heterogeneous teams will suffer from conflicts and communication problems (Jehn et al. 1997).

**An overlap within other characteristics**

Teams can build their shared identity on other characteristics which are no longer heterogeneous. These include age, hobbies, sex, beliefs, and many others that can create consistency within a heterogeneous group (Earey and Mosakowski, 2000), as we have mentioned above. Friedmanann, Pagan-Coss and Mayorga (2008) confirm their affirmation of having something common to do with others, encouraging cohesiveness and stimulating mutual interest in mutual differences. Of course, the characteristics vary according to the country which the individuals come from, and some variations, for example, in religion, cannot be overcome. Harstone and Augoustinos (1995) further found that a third subgroup can solve the problems of two subgroups, which consequently promotes team integrity.

**Leadership and commitment of teams**

Friedman et al. (2008) highlight successful team leadership, commitment to the team, such as ability and a deep commitment to life-long learning and learning from each other (Ely and Thomas, 2001) using regular group meetings. Companies will, therefore, have to make more effort and spend more time training their managers and creating the organizational infrastructure (McDonough et al., 2001). Higgs (1996) adds that the organization will have to think more clearly about intercultural issues, and be more open and systematic in its understanding and appreciation of the benefits of diversity in international teams. They need to integrate team-building theory and practice, understand the benefits of different personal styles and behavior, and integrate changes within the selection and development of its rewards and recognition policies and practices. In addition, this author provides a framework for the development of efficient and effective international management teams, which teams must address: team purpose/charter, goals, values, team-member roles, and team processes. Most authors, such as Borrelli et al. (1995), tend to agree, while Elron (1997), for example, still adds the need for conflict-management training.

**Trustworthiness, effective communication, sensitivity and tolerance**

Friedman et al. (2008) state as a prerequisite for the coherence and optimal functioning in multicultural teams, credible and effective (culturally sensitive) communication, as well as sensitivity towards and the toleration of cultural differences in order to build cultural awareness. Here, Appelbaum et al. (1998) have revealed three barriers to effective communication, which must be avoided: incorrect intercultural perceptions (perceptions of a person are selective and inaccurate due to cultural bias), incorrect intercultural interpretations (inclination to categorize situations from our own cultural point of view and use it for other ethnic groups) and misconceptions (we use our own cultural values as a benchmark for assessment, and are then erroneous in our estimation of others).

**Problems regarding diversified/multicultural teams**

Other studies claim otherwise, stating that culturally diverse teams exhibit less cohesion and more interpersonal conflicts (Shaw and Barrett-Power, 1998).

**Conflict**

Conflict means differences in opinions or priorities that arise due to the conflicting needs and requirements of team members (Tjosvold, 1986). Conflicts arise from a disparate environment that hinders communication and teamwork (Sitkin and Roth, 1993). The result may be a personal conflict that reduces performance and leads to loss (Jehn et al., 1997). In multinational societies it is very difficult to identify the source of the conflict, and it is even more difficult to resolve the conflict (Kirchmeyer and Cohen, 1992). Foldy (2004) and Shaw and Barrett-Power (1998) agree that culture not only determines the way a member of the team perceives and approaches problematic circumstances, but also the way they deal with them. That is why the team must learn creative ways to resolve conflicts. If conflicts within a group are successfully resolved, then, according to Amason (1996) and Jehna (1994), they can contribute to the overall functioning of the team. Baugh and Graen (1997) add to the view that members of multicultural teams have to overcome the strong differences in the cultural origin of members and have to work harder to create and maintain working relationships. A study by Elrona (1997) also highlights the fact that the heterogeneity of teams mostly brings conflicts, misunderstandings and causes the creation of a negative team identity. According to one theory which focuses on the attractiveness of similarities among team members, people are more satisfied if they work with people who have similar values, beliefs and attitudes (Williams and O'Reilly, 1998). We can also mention the fact that, according to social categorization (Tajfel, 1982), people divide themselves into groups according to similarities and take those belonging to another group as outsiders. The members of their group are then evaluated more positively.

**Language**

Individuals from different cultural backgrounds communicate and make decisions differently. Even their verbal and non-verbal communication styles vary widely (Shachaf, 2008). But a very important element of the process is effective communication, or the transfer of information from person to person. Effective team behavior is associated with successful communication, whereas heterogeneous teams may include different languages, leading to misunderstandings (Maznevski, 1994). In his study, Thomas (1999) examined the impact of cultural diversity on workgroups made up of college students, where one group task involved creating ideas and decision-making. He found that the group's cultural diversity is clearly linked to the performance of the group. Culturally homogeneous groups outperformed heterogeneous groups in all five instances of the analysis. The reasons were the difficulties in communication, differing perceptions of how the groups should work, and different views on the basic principles of creating ideas and the decision-making tasks.

**Satisfaction**

Another disadvantage of multicultural teams is satisfaction. Satisfaction is a feeling that has to be adequately fulfilled. In teams this is associated with the need for an efficient process and output, which can mean smoother operation without conflict. Diversity in teams is, therefore, mainly associated with lower satisfaction (Basadur and Head, 2001).

**Social integration**

The final problem associated with multicultural teams is social integration (O'Reilly et al., 1989). It is reported in the proper and smooth co-operation of individuals in the team (Katz and Kahn, 1978, Shaw, 1981). Therefore, diversity is again a negative link in social integration, as it reduces fluidity and credibility in the group (Jackson et al., 1991; Kirchmeyer, 1995). Diverse groups find it more difficult to agree on where it is important to cooperate, and often have members who try to exert too much control, which prevents other team members from contributing (Watson et al., 1993). After

demonstrating the negative effects of cultural diversity on the team, we will again mention the factors which demonstrate how significant these factors are.

**Differences between countries**

Teams whose members come from countries which differ greatly in terms of values, faith, behavior, and style of communication, often solve conflicts, misunderstandings and grievances (DiStefano and Maznevski, 2000).

**Complexity of task**

The more complex the task is, the greater the negative correlation between diversity and performance in a heterogeneous team (De Dreu and Weingart 2003). McDonough et al. (2001) found that global teams perform less efficiently as they pose greater behavioral challenges and project-management challenges to such teams, and businesses have limited experience with managing such teams. Watson et al. (1993) state that in complex tasks and in overall performance evaluation, homogeneous groups often show higher performance.

**Teams size**

The more heterogeneous a team, the more frequently there arise problems of communication (Indik, 1965), coordination (Gratton and Erickson, 2007), depression of team members (Mullen et al., 1987).

**Discussion**

Based on our research, we have come to the conclusion that there exists a relationship between cultural diversity and the effectiveness and performance of a team. This relationship can be positive, where cultural diversity has positive benefits for team performance in some areas. Some examples of these positive benefits include greater creativity and innovativeness and greater understanding of the issue, different perspectives, new ways of thinking, better identification of perspectives of the problem and creation of alternative solutions, faster process and performance improvements, more accurate information and better exchange, greater objectivity in collecting and interpreting data, maximizing access to hard-to-reach populations, but also maximizing the resources of human talent, i.e. the expertise of members.

However, we also found a negative relationship between cultural diversity and the effectiveness and performance of a team, and that cultural diversity is also a problem in the performance and efficiency of multicultural teams. Examples of these problems include more interpersonal conflicts, different communication and decision making, a different perception of how groups should work, different views on the bases of ideas creation, frequent misunderstandings, less satisfaction, less cohesion, and reduced fluidity and credibility within the group.

In our second research question, we asked: "What factors does this (positive or negative) influence depend on?

In our research, we also found that there are critical factors which determine the extent of these positive and negative impacts. The critical factors for positive impacts include the duration of teamwork, the size of the team in which they work, the diversity of the countries from which individuals come from, the overlapping of certain characteristics, trustworthiness, effective communication, sensitivity and tolerance, leadership and devotion to the team. The critical factors for negative impacts include the size of the team, the complexity of the tasks and the diversity of the countries which the team members come from.

Therefore, we have discovered that cultural diversity for the effectiveness and performance of teams can have positive and negatively effects, and this influence depends largely on the critical factors mentioned above.

It is, therefore, possible to understand why multicultural teams are becoming more and more frequent, not only because of the foreign affiliates of multinational companies, but

also because of numerous benefits for the team and consequently for the whole society which would not be possible without cultural diversity.

**Limits and future research**

The first limitation is the fact that there are countless numbers of resources, articles and publications from which to draw. This led to the topic only being covered by a relatively small sample of studies. Other limitations are the types of studies that deal with cultural diversity in different fields. Therefore, some differences were specific for certain areas, but due to the length of the article, an insufficient number of studies was examined to recommend the specifics for the individual fields. We consider this to be an area for further research. In our work, therefore, we refer mainly to structured views of the positive and negative aspects of cultural diversity in teams and the critical factors that are specific to them.

## 4 Conclusions

Due to the numerous contradictions between experts on the impact of cultural diversity on the efficiency and performance of the team, but also due to globalization and the increasingly common phenomenon of multicultural teams, this paper aimed to find out whether cultural diversity affects the effectiveness and performance of teams in a positive or negative manner, as well as the factors which influence this and in what way A systematic literary research method was used.

We came to the conclusion that there is a relationship between cultural diversity and the efficiency and performance of a team. This relationship can be positive - cultural diversity has benefits for the team and its performance, in some areas this can even be quite considerable, such as greater creativity and innovativeness and greater understanding of the issue, different views of the subject, new ways of thinking, providing more accurate information and improving their objectivity in collecting and interpreting data, maximizing access to hard-to-reach populations, better identification of the perspectives of the problem and creating alternative solutions, as well as faster improvements in process and performance, and maximizing human resources – the expertise of members. We also found that there are critical factors which determine the success of these positive impacts, namely the diversity of the countries which individuals come from, the size of the team in which they work, the duration of teamwork, the overlapping of certain characteristics, the leadership and the commitment of the team, and credibility, effective communication, sensitivity and tolerance.

We have discovered, however, that cultural diversity for the performance and efficiency of multicultural teams also poses problems such as less cohesion and more interpersonal conflicts, different communication and decision making, a different perception of how groups should function and different views on the bases of creating ideas, frequent misunderstandings, less satisfaction, and reducing the fluency and credibility of the group. Here, too, we have found that there are critical factors which determine the magnitude of these negative impacts: the diversity of the countries from which the team members come, the complexity of the tasks, and the size of the teams.

Therefore, we have discovered that cultural diversity for the effectiveness and performance of teams can have both positive and negative effects, and this influence depends largely on the critical factors mentioned above. We found that the reason for the increasingly frequent occurrence of multicultural teams was not only globalization linked to the growth of foreign affiliates of multinational companies, but also the numerous benefits of this diversity for the efficiency and effectiveness of the team and consequently for the whole society, which would not be possible without cultural diversity.

## Acknowledgments

The paper was supported by the Masaryk University research project [MUNI/A/0817/2017] Talent management and organizational diversity.

## References

Adler, N. J. (2002). Global companies, global society: There is a better way. *Journal of Management Inquiry*, vol. 11(3), pp. 255-260.

Amason, A. C. (1996). Distinguishing the effects of functional and dysfunctional conflict on strategic decision making: Resolving a paradox for top management teams. *Academy of management journal*, vol. 39(1), pp. 123-148.

Ancona, D. G., Caldwell, D. F. (1992). Demography and design: Predictors of new product team performance. *Organization science*, vol. 3(3), pp. 321-341.

Appelbaum, S. H., Shapiro, B., Elbaz, D. (1998). The management of multicultural group conflict. *Team Performance Management: An International Journal*, vol. 4(5), pp. 211-234.

Basadur, M., Head, M. (2001). Team performance and satisfaction: A link to cognitive style within a process framework. *The Journal of Creative Behavior*, vol. 35(4), pp. 227-248.

Baugh, S. G., Graen, G. B. (1997). Effects of team gender and racial composition on perceptions of team performance in cross-functional teams. *Group & Organization Management*, vol. 22(3), pp. 366-383.

Blau, P. M. (1977). *Inequality and heterogeneity*. New York: Free Press.

Bliss, J. (2004). Effective team management by district nurses. *British journal of community nursing*, vol. 9(12), pp. 524-526.

Borrelli, G., Cable, J., Higgs, M. (1995). What makes teams work better. *Team Performance Management: An International Journal*, vol. 1(3), pp. 28-34.

Brunow, S., Nijkamp, P. (2018). The Impact of a Culturally Diverse Workforce on Firms' Revenues and Productivity. *International Regional Science Review*, vol. 41(1), pp. 62-85

Cohen, S. G., Bailey, D. E. (1997). What makes teams work: Group effectiveness research from the shop floor to the executive suite. *Journal of management*, vol. 23(3), pp. 239-290.

Cox, T. H., Blake, S. (1991). Managing cultural diversity: Implications for organizational competitiveness. *The Executive*, vol. 5(3), pp. 45-56.

Cox, T. (1994). *Cultural diversity in organizations: Theory, research and practice*. Berrett- Koehler Publishers.

Davison, S. C., Ekelund, B. Z. (2009). Effective team processes for global teams. In: *The Blackwell handbook of global management: A guide to managing complexity*.

Day, D., Dosa, M., Jorgensen, C. (1995). The transfer of research information within and by multicultural teams. *Information processing & management*, vol. 31(1), pp. 89-100.

De Dreu, C. K., Weingart, L. R. (2003). Task versus relationship conflict, team performance, and team member satisfaction: a meta-analysis. *Journal of applied Psychology*, vol. 88(4), pp. 741.

Distefano, J. J., Maznevski, M. L. (2000). Creating value with diverse teams in global management. *Organizational Dynamics*, vol. 29(1), pp. 45-63.

Dorlette Paul, M. (2015). *An investigation of the efficiency of synergistic multicultural teams*.

All dissertations. Retrieved from: https://tigerprints.clemson.edu/cgi/viewcontent.cgi?article=2560&context=all_dissertations.

Earley, Ch. P., Mosakowski, E. (2000). Creating hybrid team cultures: An empirical test of transnational team functioning. *Academy of Management Journal*, vol. 43(1), pp. 26-49.

Earley, P. Ch., Gibson, C. B. (2002). *Multinational work teams: A new perspective*. Routledge.

Elron, E. (1997). Top management teams within multinational corporations: Effects of cultural heterogeneity. *The Leadership Quarterly*, vol. 8(4), pp. 393-412.

Ely, R. J., Thomas, D. A. (2001). Cultural diversity at work: The effects of diversity perspectives on work group processes and outcomes. *Administrative science quarterly*, vol. 46(2), pp. 229-273.

Foldy, E. G. (2004). Learning from diversity: A theoretical exploration. *Public Administration Review*, vol. 64(5), pp. 529-538.

Friedemann, M. L., Pagan-Coss, H., Mayorga, C. (2008). The Workings of a Multicultural Research Team. *Transcultural Nursing*. Sage Publications, vol. 19(3), pp. 266-273.

Goodman, P. S. (1986). Impact of task and technology on group performance. P. S. Goodman & Associates (Eds.), *Designing effective work groups.* San Francisco: Jossey-Bass, vol. 120, pp. 167.

Gratton, L., Erickson, T. J. (2007). Eight ways to build collaborative teams. *Harvard business review*, vol. 85(11), pp. 100.

Gupta, S. (2008). Mine the Potential of Multicultural Teams. *HR Magazine,* vol. 53(10), pp. 79-82.

Hackman, J. R., Morris, Ch. G. (1975). Group tasks, group interaction process, and group performance effectiveness: A review and proposed integration. *Advances in experimental social psychology*, vol. 8, pp. 45-99.

Harrison, D. A., Price, K. H., Bell, M. P. (1998). Beyond relational demography: Time and the effects of surface-and deep-level diversity on work group cohesion. *Academy of management journal*, vol. 41(1), pp. 96-107.

Hartstone, M., Augoustinos, M. (1995). The minimal group paradigm: Categorization into two versus three groups. *European Journal of Social Psychology*, vol. 25(2), pp. 179-193.

Higgs, M. (1996). Overcoming the problems of cultural differences to establish success for international management teams. *Team Performance Management: an international journal*, vol. 2(1), pp. 36-43.

Higgs, M., Rowland, D. (1992). All pigs are equal? *Management Education and Development*, vol. 23(4), pp. 349-362.

Hofstede, G. (1980). Motivation, leadership, and organization: do American theories apply abroad? *Organizational dynamics*, vol. 9(1), pp. 42-63.

Hofstede, G. (2007) *The 6-D model of national culture*. Retrieved from: http://geerthofstede.com/culture-geert-hofstede-gert-jan-hofstede/6d-model-of-national-culture/. (Accessed on 04. 04. 2017)

Indik, B. P. (1965). Organization size and member participation: Some empirical tests of alternative explanations. *Human Relations*, vol. 18(4), pp. 339-350.

Jackson, S. E. (1992). Team composition in organizational settings: Issues in managing an increasingly diverse workforce. In: S. Worchel, W. Wood, & J. A. Simpson (Eds.), *Group processes and productivity.* Newbury Park, CA: Sage.

Jackson, S. E., Brett, J. F., Sessa, V. I., Cooper, D. M., Julin, J. A., Peyronnin, K. (1991). Some differences make a difference: Individual dissimilarity and group heterogeneity as correlates of recruitment, promotions, and turnover. *Journal of applied psychology*, vol. 76(5), pp. 675.

Jackson, S. E., Joshi, A., Erhardt, N. L. (2003). Recent research on team and organizational diversity: SWOT analysis and implications. *Journal of management*, vol. 29(6), pp. 801-830.

Janis, I. L. (1972). *Victims of groupthink: a psychological study of foreign-policy decisions and fiascoes*. Oxford, England: Houghton Mifflin.

Jehn, K. A. (1994). Enhancing effectiveness: An investigation of advantages and disadvantages of value-based intragroup conflict. *International journal of conflict management*, vol. 5(3), pp. 223-238.

Jehn, K. A., CHadwick, C., Thatcher, S. MB. (1997). To agree or not to agree: The effects of value congruence, individual demographic dissimilarity, and conflict on workgroup outcomes. *International journal of conflict management*, vol. 8(4), pp. 287-305.

Katz, D., Kahn, R. (1978). *The Social Psychology of Organizations*. New York: Wiley.

Katz, R. (1982). The effects of group longevity on project communication and performance. *Administrative science quarterly*, vol. 27(1), pp. 81-104.

Kirchmeyer, C. (1995). Demographic similarity to the work group: A longitudinal study of managers at the early career stage. *Journal of Organizational Behavior*, vol. 16(1), pp. 67-83.

Kirchmeyer, C., Cohen, A. (1992). Multicultural groups their performance and reactions with constructive conflict. *Group & Organization Management*, vol. 17(2), pp. 153-170.

Kirkman, B. L., Shapiro, D. L. (2001). The impact of cultural values on job satisfaction and organizational commitment in self-managing work teams: The mediating role of employee resistance. *Academy of Management journal*, vol. 44(3), pp. 557-569.

Leung, K., Bhagat, R. S., Buchan, N. R., Erez, M., Gibson, C. B. (2005). Culture and international business: Recent advances and their implications for future research. *Journal of international business studies,* vol. 36(4), pp. 357-378.

Mannix, E., Neale, M. A. (2005). What differences make a difference? The promise and reality of diverse teams in organizations. *Psychological science in the public interest*, vol. 6(2), pp. 31-55.

Maznevski, M. L. (1994). Understanding our differences: Performance in decision-making groups with diverse members. *Human relations*, vol. 47(5), pp. 531-552.

Mcdonough, E. F., Kahn, K. B., Barczak, G. (2001). An investigation of the use of global, virtual, and colocated new product development teams. *Journal of product innovation management*, vol. 18(2), pp. 110-120.

Mcgrath, J. E., Berdahl, J. L., Arrow, H. (1995). *Traits, expectations, culture, and clout: The dynamics of diversity in work groups.* Washington, DC, US: American Psychological Association.

Mullen, B., Johnson, D. A., Drake, S. D. (1987). Organizational productivity as a function of group composition: A self-attention perspective. *The Journal of social psychology*, vol. 127(2), pp. 143-150.

O'reilly III, Ch. A., Caldwell, D. F., Barnett, W. P. (1989). Work group demography, social integration, and turnover. *Administrative science quarterly*, vol. 31(1), pp. 21-37.

O'reilly III, Ch. A., Williams, K. Y., Barsade, S. (1998). Group demography and innovation: Does diversity help? *US: Elsevier Science/JAI Press*.

Pfeffer, J. (1983). Organizational demography. In L. L. Cummings & B. M. Staw (Eds), *Research in organizational behaviour*, Greenwich, CT: JAI Press, pp. 229-357.

Shachaf, P. (2008). Cultural diversity and information and communication technology impacts on global virtual teams: An exploratory study. *Information & Management*, vol. 45(2), pp. 131-142.

Shaw, J. B., Barrett-power, E. (1998). The effects of diversity on small work group processes and performance. *Human Relations*, vol. 51(10), pp. 1307-1325.

Sitkin, S. B., Roth, N. L. (1993). Explaining the limited effectiveness of legalistic "remedies" for trust/distrust. *Organization science*, vol. 4(3), pp. 367-392.

Smith, K. G., Smith, K. A., Olian, J. D., Sims Jr, H. P., O'Bannon, D. P., Scully, J. A. (1994). Top management team demography and process: The role of social integration and communication. *Administrative science quarterly*, vol. 39(3), pp. 412-438.

Staples, D. S., Zhao, L. (2006). The effects of cultural diversity in virtual teams versus face-to-face teams. *Group Decision and Negotiation*, vol. 15(4), pp. 389-406.

Steers, R. M., Rhodes, S. R. (1978). Major influences on employee attendance: A process model. *Journal of Applied psychology*, vol. 63(4), pp. 391.

Tajfel, H. (1982). Social psychology of intergroup relations. *Annual review of psychology*, vol. 33(1), pp. 1-39.

Thomas, D. C. (1999). Cultural diversity and work group effectiveness an experimental study. *Journal of cross-cultural psychology*, vol. 30(2), pp. 242-263.

Thomas, D. C., Ravlin, E. C., Wallace, A. W. (1996). Effect of cultural diversity in work groups. *Research in the sociology of organizations*, vol. 14(1), pp. 1-33.

Tjosvold, D. (1986). *Working Together to Get Things Done.* Lexington. MA: Lexington Books.

Triandis, H. C., Kurowski, L. L., Gelfand, M. J. (1994). Workplace diversity. In H. C. Triandis, M. P. Dunnette, & L. M. Hough (Eds.), *Handbook of industrial and organizational psychology*. Palo Alto, CA: Consulting Psychologists Press, pp. 769–827.

Tung, R. L. (1993). Managing cross-national and intra-national diversity. *Human Resource Management*, vol. 32(4), pp. 461-477.

Van Knippenberg, D., De Dreu, C. K. W., Homan, A. C. (2004). Work group diversity and group performance: an integrative model and research agenda. *Journal of applied psychology*, vol. 89(6), pp. 1008.

Watson, W. E., Johnson, L., Merritt, D. (1998). Team orientation, self-orientation, and diversity in task groups: Their connection to team performance over time. *Group & organization management*, vol. 23(2), pp. 161-188.

Watson, W. E., Johnson, L., Zgourides, G. D. (2002). The influence of ethnic diversity on leadership, group process, and performance: An examination of learning teams. *International Journal of Intercultural Relations*, vol. 26(1), pp. 1-16.

Watson, W. E., Kumar, K., Michaelsen, L. K. (1993). Cultural diversity's impact on interaction process and performance: Comparing homogeneous and diverse task groups. *Academy of management journal*, vol. 36(3), pp. 590-602.

Williams, K. Y., O'reilly III, Ch. A. (1998). Demography and diversity in organizations: A review of 40 years of research. *Research in Organizational Behavior*, vol. 20, pp. 77-140.

Wright, N. S., Drewery, G. P. (2006). Forming cohesion in culturally heterogeneous teams: Differences in Japanese, Pacific Islander and Anglo experiences. *Cross Cultural Management: An International Journal*, vol. 13(1), pp. 43-53.

Yetton, P., Bottger, P. (1983). The relationships among group size, member ability, social decision schemes, and performance. *Organizational Behavior and Human Performance*, vol. 32(2), pp. 145-159.

# Foreign Capital Inflows and Domestic Savings in Turkey

**Özcan Karahan**

Bandırma Onyedi Eylul University
Faculty of Economics and Administration, Department of Economics
Merkez Yerleşkesi, Bandırma-Balıkesir / Turkey
E-mail: okarahan@bandirma.edu.tr

***Abstract**: Since a high level of financial funding is needed to stimulate investment and thus enhance economic growth, most of the developing countries have sought to attract foreign capital to their financial system. Accordingly, after the implementation of different policies aiming the country to be attractive for foreign funds, Turkey have attracted huge financial capital to the own economy over the last decades. This study aims to determine the impact of capital inflows on total saving in Turkey by using ARDL Bound Testing Approach for quarterly data between 2002 and 2018. Empirical findings indicated that capital inflows to Turkey could not create the positive effect on total saving as much as expected from them. This is because foreign funds provided by capital inflows to Turkey had a substitution effect rather than completing domestic savings in the Turkish Economy. This result also shows that external dependence and thus fragility of financial markets in Turkey have significantly increased. Therefore, it is necessary to give priority to policies related to the management of capital inflows in order to ensure financial stability and achieve sustainable growth in Turkey.*

*Keywords: Capital Inflows, savings, ARDL Model*

*JEL codes: E21, F43, F62*

## 1 Introduction

Saving means the fund that economic agents generate by not spending some of their income. The economic units try to increase their earnings by investing these funds in various instruments of the financial markets. In this way, the savings invested in financial instruments constitute the main source used to finance reel investments and production capacity. Thus, from a macro-economic perspective, savings are considered to be a significant source of economic growth since providing the fund required to finance increasing investment. Therefore, savings have a central role in the economic growth process. Because of this reason, it is generally asserted in the literature that developing countries that suffer from the scarcity of domestic savings rate cannot reach permanent economic growth since they do not have enough fund to finance their investment.

With the financial liberalization policies implemented over the past decades, it had been expected that increasing international capital movements provided additional resources for the developing countries suffering from shortage of domestic savings to finance their investment effectively. As a matter of fact, with the increasing financial liberalization process, foreign savings have flowed to the financial markets of developing countries through various capital inflow channels. Accordingly, it is expected that capital flows to developing countries will contribute to the domestic savings of these countries and thus increase the total fund supply required to finance real investment. However, the financial capital entering the developing countries could not increase the total savings as much as expected. In other words, although the capital movements towards the developing countries have been highly realized, the total amount of savings in these countries has not increased as much as expected. Because increasing capital inflows to developing countries have mostly reduced domestic savings. Thus, foreign savings provided by the way of capital inflows to developing countries had created a substitution effect rather than completing domestic savings in these economies. This process has caused to developing countries to become more dependent on foreign resources. Hence, these countries have become more fragile against to external shock.

Turkey was intensively integrated with the world financial markets since 1989. Therefore, as in all developing countries, capital inflows to Turkey have also increased rapidly. From this point of view, Turkey's economy provides significant experience to observe the impact of capital inflows on domestic savings. So much so that increasing capital inflows 1990s has created many substantial effects on Turkish economy. Unfortunately, in this process Turkey has experienced two significant economic crises in 1994 and 2001, arising from the adverse effects of capital inflows. However, Turkey, attaining economic stability by adopting the inflation targeting regime after the crisis in 2001, has continued to attract large amounts of foreign capital. The aim of this study is to examine the experience with the capital inflows in the period when Turkey adopted inflation targeting regime. It seems that the literature focusing on investigating the effects of capital inflows on domestic savings in Turkey is to be quite limited. To complete this lack, our study has focused on examining the impact of capital inflows on domestic savings in the period of 2002-2018. Accordingly, second part of this study reviews related literature. In the third part of study explains data and methodology. Fourth part of study presents and discusses the empirical results. Final section concludes and makes some policy implications.

## 2 Literature Review

Looking at the literature focusing on the cases of developing countries, it is seen that most of the researchers argue that there is a substitution relationship between foreign capital inflows and domestic savings, because the foreign capital entering the country causes a reduction in domestic savings. Thus, it has been mostly asserted that there is a substitution relationship between foreign capital inflows and domestic savings rather than complementary connection. In the literature, Haavelmo (1963) has first suggested that capital movements to developing countries would decrease instead of increasing the domestic savings of these countries. With the increase in the volume of foreign capital inflows and thus providing easy financing facilities, public and private savings have reduced because of increasing total expenditures based on expanding credit volume. At the same time, the fact that the volume of the enlarging credit is channeled into securities and real estate investments instead of productive investments may also reduce private savings. In addition, the increase in the current account deficit as a result of the appreciation of the real exchange rate parallel to the increase in capital inflows is another factor leading to a decrease in domestic savings. Thus, foreign capital inflow does not lead to an increase in the total savings in the host country as expected since it replaces domestic savings.

Indeed, in the literature, there are plenty of studies determining the negative impact of capital inflows on domestic savings in the context of developing countries. Reinhart and Talvi (1998) analyzed the relationship between capital inflows and domestic saving in Latin America and Asia between 1970 and 1995. Among the link between variables has been investigated by presenting the pairwise correlations of their respective cyclical components. Findings indicated that the overwhelming majority of countries the correlations between foreign and domestic saving are negative. Hachicha (2003) investigated the effect of capital inflows on domestic savings in Tunisia using Johansen’s multivariate cointegration technique. Empirical findings indicate that in the short and long run capital inflows have a negative effect on domestic savings in Tunisia. Kula (2003) analyzed the impact of capital inflows to 9 developing countries in Latin America and South Asia on capital formation and economic growth. Using correlation analysis based on the data covering the period 1969-1998, it was indicated that portfolio investment as some part of financial capital inflows has a negative impact on domestic fund in developing countries. Aizenman et al. (2007) examined whether the increasing international capital movements along with the financial integration offer an additional set of sources of financing capital in developing countries. Using descriptive statistics based on data covering the term of 1991-2001, they concluded that financial integration may have facilitated international capital movements among the countries but failed to offer new net sources of financing capital in developing countries.

In the literature, some studies have extended the analytical framework of the relationship between capital inflows and domestic savings by focusing on the link between capital inflows and investment or economic growth. Mody and Murshid (2002) investigated the relationship between capital inflows and domestic investment in a sample of 60 developing countries using panel regression methodology. They have shown that financial capital inflows have a weaker impact on domestic investment compared to reel capital inflows. Thus, findings indicate that the benefits of financial capital flows to developing countries have accrued to a relatively narrow range of countries best prepared to absorb capital flows. In this way, they concluded that effective policies towards capital inflows have not only brought in more capital but also have strengthened the economic condition of host countries based on capital inflows. Mileva (2008) assessed the effects of capital inflows on domestic investment of some less developed and transition countries. The results of static and dynamic panel techniques employed for the term of 1995-2005 showed that reel capital inflows produce some positive impact on domestic investment and host economies. However, portfolio flows have no impact on domestic investment. These results are consistent with the view that countries with relatively underdeveloped financial markets cannot benefit from capital inflows enough compared to countries with developed financial markets. Hadiwibowo (2010) analyzed the impact of capital inflows to Indonesia on investment using the generalized error correction model. Empirical findings showed that the number of capital inflows was not correlated with the volume of domestic investment. Therefore, the relation between capital inflows and domestic investment has not been strong as generally expected. It is suggested that financial capital inflow is neither sufficient nor necessary condition for successful takeoffs for developing countries. Development the domestic infrastructure and capability is essential to attain the highest benefit from international capital. Adekunle and Sulaimon (2018) examined the relationship between foreign capital flows and economic growth in Nigeria by using annual data over the period of 1986 – 2015. Empirical results of ARDL model estimation indicated that indirect financial capital inflows had significant negative effects on economic growth while direct reel capital inflows exerted a positive influence on growth. It has been therefore recommended that policymakers in Nigeria encourage the inflow of reel capital inflows that stimulate domestic investment and economic growth.

Referring to the literature focusing on the example of Turkey, it is seen that there are many studies which determine the substitution effect of capital inflows on domestic savings. Kara and Kar (2005), they investigated the impact of capital inflows to Turkey by using the annual data of the 1980-2000 period. As a result of the regression analysis, it was observed that foreign direct investments made positive contributions to both domestic savings and domestic investments. On the other hand, short-term capital inflows affected domestic investment and savings negatively. Örnek (2008) examined the impact of foreign capital on domestic savings in Turkey by using data related to the period of 1994-2006. He has applied the Johansen cointegration test and vector error correction model (VECM) for the econometric analysis. The finding indicated that Foreign Direct Investment increase domestic savings while portfolio investments have a negative impact on domestic savings in the short and long term. Another study investigating the effects of foreign capital inflows to Turkey on domestic savings was carried out by Balaban (2016). Balaban has analyzed the data between 2002 and 2015 using the ARDL method. Obtained results have shown that there was a substitution relationship between total capital inflows to Turkey and domestic savings. In other words, the total capital inflows to Turkey have partially substituted domestic saving. Finally, Tüzemen and Yamak (2019) investigated the effects of direct and indirect capital inflows on the domestic savings for the Turkish economy. The ARDL bounds test has been used to analyze the data covering the period of 1986-2015. The results of the ARDL bounds test showed the substitution effect of capital inflows on domestic savings. Thus, they concluded that the savings alone may not be enough to maintain sustainable economic growth in the Turkish economy. It is also important to have an efficient fiscal system to channel savings into productive investment areas rather than consumption.

## 3 Data and Methodology

In this part of the study, we will analyze empirically the impact of foreign financial capital inflows on domestic savings in Turkey using the quarterly data covering the period between 2002 and 2018. In order to obtain the domestic savings (DS) series, resident household consumption and state final consumption expenditures were excluded from GDP. Financial capital inflows (FCI) consist of Portfolio Investments and Other Investments excluding the Foreign Direct Investment (FDI). Thus, capital inflows in our study cover only financial capital inflows and exclude physical capital movements in the form of foreign direct investments. The values related to portfolio investments and other investments are collected from the financial account of balance of payment. All variables are used in the study by proportioning them to GDP and converted into the natural log form. Data sourced from the Central Bank of the Republic of Turkey Electronic Data Dissemination System (EVDS) and Turkish Statistical Institute.

In order to determine the effect of capital inflows to Turkey on domestic savings, the model below is estimated.

$$LDS_t = \alpha_0 + \beta_1 \ LFCI_t + \ u_t \qquad (1)$$

where, LDS is the log of domestic savings, LFCI is the log of foreign savings; u is the white noise error term.

Our empirical analysis commences by checking for the stationary status of the variables by employing the Augmented Dickey Fuller (ADF) and Philips-Perron (PP) unit root tests that are developed by Dickey and Fuller (1981) and Phillips and Perron (1988), respectively. The Augmented Dickey Fuller approach is based on the assumption that the error terms are statistically independent and homogeneous in order to determine the degree of integration of the series. On the other hand, the Phillips-Perron test carries out the unit root test, suggesting that the error terms have poor dependency and heterogeneity.

After determining the order of integration related to the variables through ADF and PP unit root tests, the next step is to determine the impact of financial capital inflows (FCI) on domestic savings (DS) using Autoregressive Distributed Lag (ARDL) procedure developed by Peseran and Shin (1995) and Peseran et al. (2001). There are several significant advantages arising from application of ARDL model. This approach can be applied efficiently in small data sizes. Moreover, this approach can be applied irrespective of whether the repressors in the model are purely I (0), purely I (1) or mutually co-integrated. Besides, this approach provides a method of assessing short run and the long run effect of one variable on the other simultaneously.

In the framework of ARDL model, cointegration analysis is performed by using Bound Testing procedure. For this aim, Equation 1 has been transformed into an unrestricted error correction model (UECM) which is indicated in Equation 2 below.

$$\Delta LDS_t = a_1 + \sum_{i=1}^{p} a_2 \, \Delta LDS_{t-1} + \sum_{i=1}^{p} a_3 \, \Delta LFCI_{t-1} + \ \lambda_1 LDS_{t-1} + \lambda_2 LFCI_{t-1} + \ u_t \qquad (2)$$

where, $a_1$ is the drift component, $a_2$ and $a_3$ represents short run dynamics, $\lambda_1$ and $\lambda_2$ represent long run dynamics, $\Delta$ denotes the first difference operator, u is the white noise error term. The existence of cointegration relationship between the variables is examined by testing the significance of the lagged level of variables using bound testing procedure based on F-statistics computed through a Wald test. The null hypothesis ($H_0$: $\lambda_1 = \ \lambda_2 = 0$) of no cointegration between variables is tested against to the alternative hypothesis ($H_1$: $\lambda_1 \neq \ \lambda_2 \neq 0$) of cointegration among the variables. Two critical values are provided by the Pesaran et al. (2001) for cointegration test, i.e. lower critical value I(0) and upper critical value I(1). When the computed F-statistics is greater than the upper bound value, then the null hypothesis is rejected. If in case F-statistics is less than the lower bound value, we don't reject the null hypothesis. When computed F-statistics fall between I(0) and I(1), the results are inconclusive.

After estimation the long run association and coefficients between the variables, we use the following equation to estimate the short-run coefficients:

$$\Delta LDS_t = a_1 + \sum_{i=1}^{p} a_2 \, \Delta LDS_{t-1} + \sum_{i=1}^{p} a_3 \, \Delta LFCI_{t-1} + \phi \; ECT_{t-1} \quad (3)$$

Where, ϕ is the parameter of error correction term $(ECT_{t-1})$. This coefficient described how the time-series adjust to disequilibrium. A positive coefficient of error correction term indicates a divergence while negative coefficient of error correction term means convergence. ECT can also be explained as the speed at which dependent variable returns to equilibrium from the changes in the independent variables.

## 4 Results and Discussion

Econometric analysis starts with the determination of stationary status of the variables related to Domestic Savings (DS) and Financial Capital Inflows (FCI) by using Augmented Dickey Fuller (ADF) and Philips-Perron (PP) unit root tests. Table 1 presents the results of unit root test. The test results show that Domestic Savings (DS) and Financial Capital Inflows (FCI) are not stationary at their levels. However, by taking the first differentiation, both series become stationary at 1 % and 5 % significance levels. Thus, unit root test results indicated that DS and FCI have integrated of order one I(1).

**Table 1** Results of the Unit Root Tests

| | **ADF** | | **PP** | |
|---|---|---|---|---|
| **Variables** | **Level** | **1. diff** | **Level** | **1. diff** |
| **LDS (intercept)** | -1.38 | -6.65* | -0.38 | -6.81* |
| **LDS (intercept+ trend)** | -1.57 | -6.53* | -2,18 | -6.31* |
| **LFCI (intercept)** | -0.69 | -4.12* | -0.72 | -3.91* |
| **LFCI (intercept+ trend)** | -1.49 | -3.96** | -1.38 | -3.42** |

Notes: * and ** shows significant at 1% level and 5% level, respectively.

After detecting the stationary of variables by same orders, we run the Autoregressive Distributed Lag (ARDL) Bounds Test to indicate the cointegration relationship between LDS and LFCI. Firstly, we estimate the Eq. (2) by OLS in order to test the presence of long-run association between the variables. The optimum lag order of the ARDL model is selected 2 (p=2) based on Schwarz information (SC) criterion. Table 2 reports the results of the Bound Test. The calculated F-statistics is 8.41 and greater than the upper bound values at all 1%, 5% and 10% levels. Thus, the null hypothesis of no cointegration between variables can be rejected while the alternative hypothesis of cointegration among the variables cannot be rejected. Accordingly, we conclude that both domestic savings (LDS) and Financial Capital Inflows (FCI) have a long-run association between them.

**Table 2** Results of the Bound Test

| **k** | **F-statistic** | **% 1 Critical Values** | | **% 5 Critical Values** | | **% 10 Critical Values** | |
|---|---|---|---|---|---|---|---|
| | | I(0) | I(1) | I(0) | I(1) | I(0) | I(1) |
| **1** | 8.41 | 6.84 | 7.84 | 4.94 | 5.73 | 4.04 | 4.78 |

Notes: k symbolizes the repressors. Critical values are from the Table C(iii) case III in Pesaran et. al (2001).

Following the indication of co-integration, we realized the estimation of the coefficients showing the long-term relationship between the variables. According to the Schwarz Information Criterion (SC), the optimum lag length for the domestic savings was

determined as 1 while the capital inflows was 2. Thus, the ARDL (1, 2) model was estimated and results were shown in Table-3. When the long-term coefficients of ARDL are examined, it is seen that the coefficient of foreign capital inflows variable is -0.36. This means that there is a negative relationship between foreign capital inflows and domestic savings rate in the long run. Thus, empirical findings revealed that foreign savings attracted by financial capital inflows to Turkey substitute domestic savings. The lower part of Table 3 gives the diagnostic test results for the prediction of the model and shows that econometric problems are not present.

**Table 3** Long Run Estimates of ARDL

| **Variables** | **Coefficient** | | **t-statistics** |
|---|---|---|---|
| $\mathbf{LFCI_{t-1}}$ | -0.3610* | | -3.5610 |
| | **Diagnostic Test Results** | | |
| **$R^2$** | 0.78 | JB Normality test | 2.6421 (0.2276) |
| **Adj. $R^2$** | 0.75 | BG Autocorrelation test | 3.3742 (0.1761) |
| **Schwarz Criteria** | -1,6712 | White Heteroscedasticity | 11.6512 (0.14560) |
| **F Statistics** | 11.34 (0.00) * | Ramsey RESET test | 1.2761 (0.2367) |

Notes: * denotes the significance levels at 1 % and 5 % respectively. Regarding the diagnostic tests, probability values of test statistics are displayed in parenthesis.

After analyzing the long-term relationship between the variables, the existence of the short-term relationship was realized based on the estimation of the error correction model. Table 4 presents the estimation results performed within the framework of short-term error correction model. The coefficients of financial capital inflows variable are also negative and statistically significant in the short run. The coefficient of the error correction term was negative and statistically significant as we expected. The value of coefficient related to ECM has been calculated as -0.6721. The system is getting adjusted towards long run equilibrium at the speed of 67.21 percent after one period in the case of any external or internal shock. The lower part of Table 3 gives the diagnostic test results for the prediction of the model and shows that econometric problems are not present.

**Table 4** Short Run Estimates of ARDL

| **Variables** | **Coefficient** | | **t-statistics** |
|---|---|---|---|
| $\boldsymbol{ECT_{t-1}}$ | -0,6721** | | 2.5671 |
| $\boldsymbol{\Delta LFCI_t}$ | -0.0121** | | 3.3212 |
| $\boldsymbol{\Delta LFCI_{t-1}}$ | -0.1912* | | -4.7812 |
| | **Diagnostic Test Results** | | |
| **R** | 0.59 | JB Normality test | 1.3547 (0.3254) |
| **$R^2$** | 0.51 | BG Autocorrelation test | 1.0320 (0.5712) |
| **Schwarz Criteria** | -1,7891 | White Heteroscedasticity | 13.0982 (0.1562) |
| **F Statistics** | 15.09 (0.00) * | Ramsey RESET test | 0.8965 (0.3467) |

Notes: * denotes the significance levels at 1 % and 5 % respectively. Regarding the diagnostic tests, probability values of test statistics are displayed in parenthesis.

Empirical findings indicated that foreign savings collected by capital inflows have a negative impact on domestic savings in Turkey. Thus, foreign funds provided by capital inflows to Turkey have a substitution effect rather than completing domestic savings.

That means financial source composition that provides growth performance develops in favor of external resources together with the capital inflows to Turkey much more. In the same time, this case shows that an excessively dependent on foreign supplies for the needed funds of Turkey. Thus, despite the increase in capital inflows, declining domestic savings rates lead to the permanent current account deficit and caused to be current account deficit a chronic macroeconomic problem in Turkey. Consequently, findings indicate that increases in the volume of capital inflows to Turkey enlarge the fragility of the economy and leave it vulnerable to external shocks.

## 5 Conclusions

Together with increasing international capital movements, the impacts of foreign capital inflows on domestic savings of developing countries have been at one of the core subjects examining in the literature. Although it has been expected that financial capital inflows to host countries increased domestic saving, most of the studies in the literature have indicated that the surge of foreign capital to developing countries decreased domestic savings. Thus, capital inflows to developing countries substituted domestic savings rather than complementing domestic savings. The objective of this paper is to investigate whether financial foreign capital displaces domestic savings in Turkey or not. Using the ARDL approach we have analyzed the impact of financial capital inflows on domestic savings in Turkey for the term between 2002 and 2018. The estimation results of the ARDL Bound Test indicated that there is a cointegration relationship between financial capital inflows and domestic saving. When ARDL short- and long-term coefficients are analyzed, it is determined that there is a negative impact of foreign capital inflows to Turkey on domestic saving rate.

Thus, the analysis results support the view that there is a substitution relationship between domestic savings and capital inflows to Turkey. The existence of such a relationship shows that the resource composition that provides growth has changed in favor of the foreign source during the increasing capital inflows towards Turkey. This situation facilitates the reflection of external shocks to the national economy and thus makes the economy vulnerable to crises. Following the results of this study stands out some policy suggestions for Turkey's economy. It is clear that several measures strengthen the management of capital movements should be taken for the Turkish economy. Only when financial capital inflows effectively managed, it may be possible to ensure financial stability and sustainable growth in Turkey.

## Acknowledgments

This work was supported by Scientific Research Projects Coordination Unit of Bandırma Onyedi Eylül University. Project Number: **BAP-19-1009-050.**

## References

Adekunle, W., Sulaimon, M. (2018). *A Re-examination of the Relationship between Foreign Capital Flows and Economic Growth in Nigeria*. MPRA No: 87754.

Aizenman, J., Pinto, B., Radziwill, A. (2007). Sources for Financing Domestic Capital – Is Foreign Saving a Viable Option for Developing Countries? *Journal of International Money and Finance*, vol. 26, pp. 682.702.

Balaban, B. (2016). The effects of Foreign Capital Inflows on Domestic Savings: A case of Turkey. *The Academic Elegance*, vol. 3(6), pp. 117-128.

Dickey, D. A., Fuller, W. A. (1981). Distribution of the Estimators for Autoregressive Time Series with a Unit Root. *Econometrica*, vol. 49, pp. 1057-1072.

Haavelmo, T. (1963). *Comment on Leontief, Wassily, The Rates of Long-Run Economic Growth and Capital Transfer from Developed to Underdeveloped Areas*. Pontificiae Academiae Scientiarvm Scripts Varia, North-Holland Publishing Company, Amsterdam.

Hachicha, N. (2003). Capital Inflows-National Savings Dynamics in Tunisia: Evidence from Cointegration, Weak Exogeneity and Simultaneous Error Correction Modeling. *International Economic Journal*, vol. 17(4), pp. 43-60.

Hadiwibowo, Y. (2010). Capital Inflows and Investment in Developing Countries: The Case of Indonesia. *The International Journal of Applied Economics and Finance*, vol. 4(4), pp. 220-229.

Kara, M. A., Kar, M. (2005). An Econometric Investigation of the Impact of Various types of the Foreign capital Inflows on Investment and Saving. *İktisat, İşletme ve Finans*, vol. 20(228), pp. 93-108.

Kula, F. (2003). Efficiency of International Capital Flows: Some Observations on Turkey. *C.U. İktisadi ve İdari Bilimler Fakültesi Dergisi*, vol. 4(2), pp. 141-154.

Mileva, E. (2008). The impact of Capital Flows on Domestic Investment in Transition Economies. *European Central Bank Working Paper No: 871*.

Mody, A., Murshid, A. P. (2002). Growing up with Capital Flows. *IMF Working Paper* No: WP/02/75.

Örnek, İ. (2008). the Effects of Foreign Capital Inflows on Domestic savings: Turkey Case. *Ankara Üniversitesi SBF Dergisi*, vol. 63(2), pp. 199-217.

Pesaran, M. H., Shin, Y., Smith, R. J. (2001). Bounds Testing Approaches to the Analysis of Level Relationships. *Journal of Applied Econometrics*, vol. 16(3), pp. 289-326.

Pesaran, M. H., Shin, Y. (1995). An Autoregressive Distributed Lag Modelling Approach to Cointegration Analysis. *Cambridge Working Papers in Economics,* No. 9514, Faculty of Economics, University of Cambridge.

Phillips, P. C., Perron, P. (1988). Testing for a Unit Root in Time Series Regression. *Biometrika*, vol. 75, pp. 335–346.

Reinhart, C. M., Talvi, E. (1998). Capital Flows and Saving in Latin America and Asia: A Reinterpretation. *Journal of Development Economics*, vol. 57, pp. 45-66.

Tuzemen, Ö. B., Yamak, R. (2019). The Validity of Haavelmo Hypothesis: The Case of Turkey. *Manisa Celal Bayar University, Yönetim ve Ekonomi*, vol. 26(1), pp. 277-294.

# The Role of IFRS 15 in the Evaluation of the Effects of Business Model Innovation

**Mariusz Karwowski**

Warsaw School of Economics
The Collegium of Business Administration, Department of Management Accounting
al. Niepodległości 162, 02-554 Warsaw, Poland
E-mail: mkarwo@sgh.waw.pl

***Abstract:*** *The proper recognition of revenue is an important element in the preparation of the statement of profit or loss and other comprehensive income and, as such, it is an extremely difficult and complex issue. The challenge is greater in the context of business model innovation (BMI), which now constitutes a key source of growth and value creation. The objective of the research underlying this article is to determine the role of the new IFRS 15 "Revenue from Contracts with Customers" in evaluating the effects of BMI. A review of pertinent literature was conducted as well as an empirical study based on financial statements for the year ending in 2018 of companies from sectors in which BMI very often occurs: biotechnology, games, IT, and the pharmaceutical industry. Based on the research into relevant literature and the empirical study, it was found that IFRS 15 enables companies to match revenue more closely to the work performed to earn it and to calculate the value transferred to customers. Due to the complexity of these rules, when evaluating the effects of BMI, it is important to provide information supplementing the presentation of revenue in the statement of profit or loss and other comprehensive income. In the field of accounting research, this article may be treated as an attempt to look at revenue, the key element of financial statements, from the perspective of BMI.*

*Keywords: IFRS 15, revenue, business model innovation, financial statements*

*JEL codes: M40, M41, O32*

## 1 Introduction

Govindarajan et al. (2018b) claim that financial reports have become less useful in capital market decisions over the last 100 years. Recent research makes an even bolder claim: accounting earnings are practically irrelevant, especially for BMI companies, such as digital enterprises.

Business model innovation (BMI) enables companies to obtain additional revenue from new products or higher margins from specific services and superior business models. This logic assumes a relatively direct link between BMI and financial performance through revenue growth and higher margins (Lichtenthaler, 2018). The direct impact may be reflected through proper recognition of revenue in the statement of profit or loss and other comprehensive income. For this reason, accounting should play an important role in explaining the effect of BMI on a firm's results.

The objective of the research underlying this article is to determine the role of the new IFRS 15 "Revenue from Contracts with Customers" in evaluating the effects of BMI.

## 2 Methodology and Data

A review of pertinent literature was conducted as well as an empirical analysis. The aim of the study of relevant publications was to describe the trend in BMI and its possible impact on revenue. The empirical study was based on a content analysis of the 2018 financial statements of 42 Polish companies in terms of revenue. Table 1 presents the research sample grouped by sector.

**Table 1** The research sample

| Sector | biotechnology | games | IT | pharmaceuticals | Total |
|---|---|---|---|---|---|
| **Preliminary research sample** | 5 | 8 | 33 | 9 | 55 |
| **Exclusion from the research sample** | 1 | 1 | 9 | 2 | 13 |
| **Final research sample** | 4 | 7 | 24 | 7 | 42 |

Source: own study.

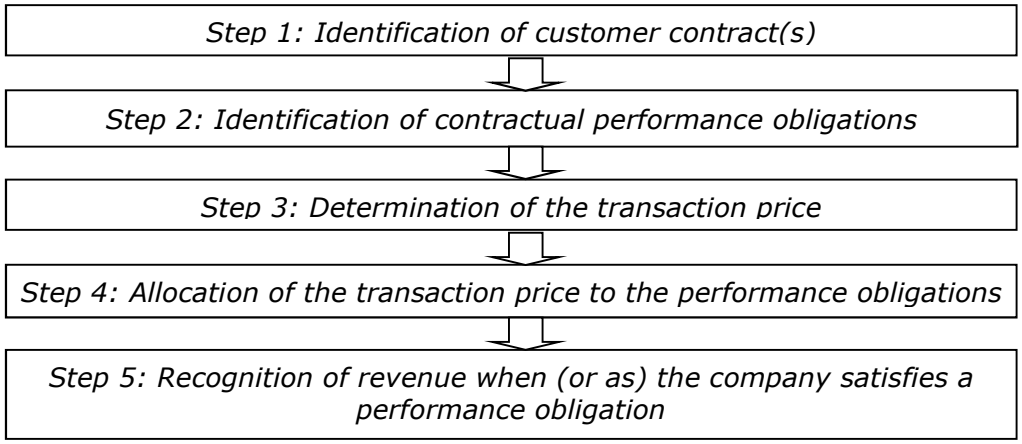
While the preliminary research sample comprised 55 companies, 13 of them were excluded from the final sample because:

- their 2018 financial statements had not yet been published – (5 companies),
- their 2018 financial statements had been prepared according to Polish accounting standards rather than IFRS: Polish standards do not include IFRS 15 – (4),
- their 2018 fiscal years did not coincide with the calendar year: IFRS 15 is effective for annual periods beginning on or after January 1, 2018 – (3),
- there was no revenue – (1).

The final research sample yielded financial statements from companies in four industrial sectors in which BMI often occurs: biotechnology (4 companies), games (7), IT (24), and the pharmaceutical industry (7).

Investors are interested in the effects of BMI on a firm's results. For this reason, one of the most value-relevant disclosures from their perspective is information on revenue and its drivers (Govindarajan et al., 2018b). The aim of the empirical study was to determine the practice of disclosing information on revenue in the financial statements of companies in which BMI often occurs. Consistent with IFRS 15, the five steps of disclosing information recognising revenue were examined. Figure 1 illustrates these steps.

**Figure 1** The Five Steps of Recognising Revenue According to IFRS 15




Source: Karwowski (2016), c.f. IFRS 15.

These steps are used to recognise revenue in accordance with the core principle of IFRS 15 — i.e., recognising revenue in such a way as to depict the transfer of promised goods or services to customers in an amount that reflects the consideration to which the company expects to be entitled in exchange for those goods or services.

## 3 Results and Discussion

### The literature study

BMI is a process that changes the core elements of a firm and its business logic (Ritter and Lettl, 2018; Bucherer et al., 2012; Gambardella and McGrahan, 2010). In the

abstract, it can also be defined as the process of modifying the firm's existing activity system — or designing a replacement system (Amit and Zott, 2010) — or as the discovery of a fundamentally different business model (Schneider and Spieth, 2013; Markides, 2006).

Table 2 illustrates that, overall, BMI constitutes a very important stream of business model research.

**Table 2** Themes of business model literature

| Authors | Themes of business model literature |
|---|---|
| **Lambert and Davidson (2013)** | 1. Basis for enterprise classification<br>2. Enterprise performance<br>3. Innovation |
| **Wirtz et al. (2016)** | 1. Innovation<br>2. Change and evolution<br>3. Performance and controlling<br>4. Design |

Source: Foss and Saebi (2017); Lambert and Davidson (2013); Wirtz et al. (2016).

Wirtz and Daiser (2017) distinguish between three main types of BMI, one of which concerns revenue:

- industry model innovation – innovating in the industry value chain,
- revenue model innovation – innovating in goods, services, and/or value development, as well as pricing models,
- enterprise model innovation – innovating by changing enterprises, partners, and/or networks.

Schneider and Spieth (2013) note that BMI impacts the industry and market structure, an individual firm's results, and its capabilities. The main determinant of the firm's results is revenue. Wirtz and Daiser (2017) list three dimensions of BMI: who, what, and how. They also introduce the concept of sustainability to BMI, emphasizing its inimitability over time. Similarly, Mahadevan (2004) defines 3 specific core elements of BMI, namely:

- who to serve (target customers),
- what to offer (value propositions),
- how to operate (value delivery system).

External factors — technology, changing customer needs, firm-level issues, regulatory and economy, and competition — are also inextricably linked with these core elements.

BMI impacts revenue in a variety of ways. For instance, in the "free" business model, timed or user-generated content constitutes the value proposition for paying customers. Ostensibly, for example, Facebook's customers are its daily users ("asset units"); however, the real revenue-providing customers are the companies that pay for advertisements ("revenue units"). The distinction between these two sets of customers and how the growth in the first set drives growth in the second set are key to investors' understanding of shareholder value creation. An analyst following Facebook, therefore, will search out the number of active users, their geographical distribution, their retention rates, the average time they spend on the website, and the growth or decline in any of these metrics (Govindarajan et al., 2018a). Other examples include app analytics companies that give developers a free tool and use the aggregated analytics data to create reports for a paying customer group, as well as companies with monthly recurring revenue. Although subscriptions are not new, they are now being used increasingly, such as providing software as a service. Frictionless micro-payments are a concept that may have the greatest impact, as they offer the possibility of doing business frequently, in small amounts, and automatically. Finally, in digital transformation it is worth noting that only the first copy of digital products and software need have a high cost, while the cost of subsequent copies could approach zero. Given such a characteristic, there is much more freedom to innovate in the revenue stream (Tyreholt, 2017).

**The empirical study**

Table 3 presents the breakdown of information disclosed regarding revenue in companies characterised by BMI in accordance with the five steps listed in chapter 2.

**Table 3** The breakdown of disclosed revenue information according to the five steps

| Sector | No. of companies | Step 1 | Step 2 | Step 3 | Step 4 | Step 5 |
|---|---|---|---|---|---|---|
| **biotechnology** | 4 | 1 | 1 | 2 | 1 | 1 |
| **games** | 7 | 1 | 0 | 2 | 0 | 3 |
| **IT** | 24 | 4 | 10 | 11 | 6 | 11 |
| **pharmaceuticals** | 7 | 4 | 2 | 3 | 1 | 5 |
| **Total** | **42** | **10** | **13** | **18** | **8** | **20** |

Source: own study.

Of the 42 studied financial statements of BMI companies, 10 (24%) contain information regarding step 1 (57% of pharmaceutical companies but only 14% from the games sector disclose this information). This step requires a company to identify contracts with customers (i.e., agreements between two or more parties creating enforceable rights and obligations). A contract with a client exists when the parties to the contract have approved the contract, the company can identify each party's rights regarding the goods or services to be transferred, the company can identify the payment terms, the contract has commercial substance, and it is probable that the company will collect the consideration to which it will be entitled in exchange for the goods or services that will be transferred to the customer (IFRS 15).

In this regard, the information disclosed by the subject companies may be divided into two categories. The first includes only overall information that such contracts exist, while the second presents details. Relevant to BMI, two elements of customer contracts were distinguished, specifically, providing a customer with:

- the right to return goods within a specified period (beyond the use-by date),
- a guarantee to pay for default losses on a transferred asset.

An interesting case is when companies provide retrospective bonuses and/or volume rebates to certain customers once the quantity of goods or services purchased during a period exceeds a threshold specified in the contract.

In regard to step 2, 13 (31%) of the 42 subject companies provide information (42% of IT companies, while 0% of games companies comply). This step calls on a company to identify the performance obligations in its contracts. Each contract includes promises to transfer goods or services to a customer and, if these goods or services comprise distinct elements, the promises constitute performance obligations that are to be accounted for separately. Goods or services are distinct if the customer can benefit from the goods or services either independently or together with other resources, and the company's promise to transfer the goods or services to the customer is separately identifiable from other promises in the contract (IFRS 15).

Information disclosed by the subject companies in this regard may be divided into three groups. The first group provides information that contracts have only one performance obligation. The second furnishes information that simply identifies the performance obligations in the company's contracts with no detail, while the third group provides some detail.

Specifically, BMI may relate to the existence of different promises in the contract that are distinct goods or services, such as:

- goods produced by a company,
- licences,
- guarantees,

- services of standing ready to provide goods or services (e.g., unspecified updates to software that are provided on a when-and-if-available basis),
- services of arranging for another party to transfer goods or services to a customer (e.g., acting as an agent of another party),
- assets constructed, manufactured, or developed on behalf of a customer.

Licenses are especially important in BMI companies. They establish customers' rights to the intellectual property of a company. A licence of intellectual property may include, but is not limited to, any of the following (IFRS 15):

- software and technology,
- motion pictures, music, and other forms of media and entertainment,
- franchises,
- patents, trademarks, and copyrights.

It is important to determine whether the nature of a company's promise in granting a licence to a customer is to provide the customer with either a right to:

- access the company's intellectual property as it exists throughout the term of the licence, or
- use the company's intellectual property as it exists at the point in time at which the licence is granted.

Information regarding step 3 was provided in the financial statements of 18 (43%) of the 42 subject companies. This included 42% of the biotechnology companies, but only 29% of those in the games sector. According to this step, a company should determine the transaction price — the amount of consideration in a contract to which the company expects to be entitled in exchange for transferring the promised goods or services to a customer. While the transaction price can be a fixed amount of customer consideration, it may sometimes include variable consideration or consideration in a form other than cash. If the consideration is variable, the company must estimate the amount of consideration to which it will be entitled in exchange for the promised goods or services (IFRS 15).

Information disclosed by the subject companies may be divided into two categories. The first includes only information on the need to determine the transaction price. The second category concentrates on variable remuneration applicable to the company. In regard to BMI, variable remuneration includes:

- volume discounts: in estimating the variable remuneration, companies determine what is the customer's expected turnover using the most probable value method,
- compensation for hidden defects: in determining this, account is taken of the company's quality assurance system and the experience gained from it.

Expected variable remuneration in the form of discounts, penalties, and compensation is determined on the basis of past experience. It is recognised as a correction to the transaction price and to revenue (e.g., an increase or decrease) only to the extent that it is highly probable that a material reversal in the amount of cumulative revenue recognised will not occur when the uncertainty associated with the variable consideration is subsequently resolved.

Of the 42 studied financial statements, 8 (19%) contain information responding to step 4 (25% of those in the biotechnology and IT sectors and 0% of games companies). This step highlights the need to allocate the transaction price to the performance obligations in the contract on the basis of the relative stand-alone selling prices of distinct goods or services promised in the contract. If a stand-alone selling price is not observable, the company must estimate it (IFRS 15).

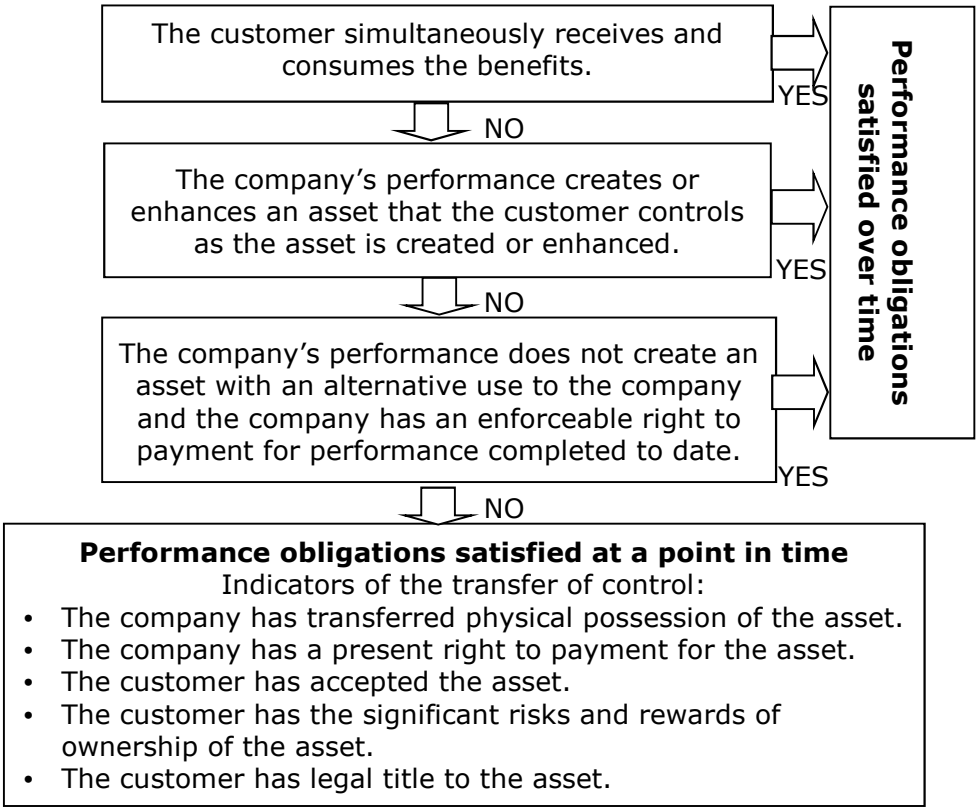
Information disclosed by the subject companies may be divided into two types. The first type includes only information on the need to allocate the transaction price to the performance obligations. The second type is more detailed, but only slightly. In regard to BMI for contracts with more than one performance obligation, the transaction price is allocated to each performance obligation based on the separate sales prices of the individual goods and/or services, giving priority to the observable ones.

As regards step 5, 20 (48%) of the 42 financial statements provide relevant information, including 71% of pharmaceutical companies and 25% from the biotechnology sector. This step asks a company to recognise revenue when (or as) the company satisfies a performance obligation by transferring promised goods or services to a customer (which is when the customer obtains control of the individual goods or services). A performance obligation may be satisfied:

- at a point in time (typically for promises to transfer goods to a customer), or
- over time (typically for promises to transfer services to a customer).

Figure 2 illustrates the criteria for recognising revenue at a point in time or over time.

**Figure 2** Criteria for Recognising Revenue at a Point in Time or over Time




Source: Karwowski (2016), c.f. IFRS 15.

For performance obligations satisfied over time, a company recognises revenue over time by selecting an appropriate method for measuring the company's progress towards complete satisfaction of that performance obligation (IFRS 15).

Of the 20 subject companies responding to step 5, 6 (30%) recognise revenue at a point in time (led by the pharmaceutical sector), 6 (30%) recognise revenue over time (with the IT sector leading), and 8 (40%) employing both methods, indicating that there is no predominant pattern of recognising revenue among BMI companies.

IFRS 15 also includes a consistent set of disclosure requirements that would result in providing users of financial statements comprehensive information about the nature, amount, timing, and uncertainty of revenue arising from the company's contracts with customers.

The first disclosure requirement calls for disaggregation of revenue in BMI companies. Revenue is most often disaggregated by the type of goods or services (e.g., major goods or services), by geographical region (e.g., country or region), or by timing of the transfer of goods or services (revenue from goods or services transferred to customers at a point in time vs. revenue from goods or services transferred over time).

Other disclosure requirements include issues such as the incremental costs of obtaining a contract, the costs to fulfil a contract, and contract balances on contracts with customers (e.g., trade receivables and liabilities under contracts).

## 4 Conclusions

One of the building blocks for BMI companies is revenue, the proper recognition of which is an important element in the preparation of financial statements. It is a difficult and complex issue in terms of the evaluation of BMI. IFRS 15 "Revenue from Contracts with Customers" introduces five steps to be followed in recognising revenue.

Based on the empirical study, it was found that under step 1 — identification of customer contract(s) — BMI companies most often distinguished two elements of contracts with customers. In particular, providing a customer with a right to return the goods within a specified period (beyond the use-by date) and a guarantee to pay for default losses on a transferred asset. Step 1 is connected with step 3 — determination of the transaction price — under which companies specified the way in which variable remuneration for volume discounts and compensation for hidden defects were calculated. The former remuneration estimate is based on the customer's expected turnover using the most probable value method; the latter relies on the company's quality assurance system and the related experience.

Under step 2 — identification of contractual performance obligations — different promises in the contract related to distinct goods or services were listed by BMI companies. In these companies, licenses are especially important. Step 2 relates to step 4 —allocation of the transaction price to the performance obligations — the least frequently addressed step. In regard to BMI for contracts with more than one performance obligation, the transaction price is allocated to each performance obligation based on the separate sales prices of individual goods and/or services, giving priority to the observable ones.

Based on the empirical study, it was found that the most frequently addressed step is the recognition of revenue when (or as) the company satisfies a performance obligation (step 5). No predominant way of recognising revenue was noted. Companies recognise revenue at a point in time, over time, or using both methods.

Based on the research into relevant literature and the study of the financial statements, it was concluded that IFRS 15 enables companies to match revenue more closely to the work performed to earn it and to calculate the value transferred to customers. But due to the complexity of these rules, in understanding and evaluating the effects of BMI, it is important to provide information supplementing the presentation of revenue in the statement of profit or loss and other comprehensive income, such as the introduction of new goods and services, distribution alliances, customer dropouts, and geographical distribution of customers, because investors look for certain clues about the success of a company's BMI (Govindarajan et al., 2018b). Investors, therefore, examine not only reported revenue but also the revenue drivers, especially because the activities of BMI companies often diverge from their revenue-generating activities (Govindarajan et al., 2018a).

## References

Amit, R., Zott, C. (2010). Business model innovation: creating value in times of change. *Working Paper, No. WP-870, IESE Business School*, Spain.

Bucherer, E., Eisert, U., Gassmann, O. (2012). Towards a systematic business model innovation: lessons from product innovation management. *Creativity and Innovation Management*, vol. 21, pp. 183−198.

Foss, N. J., Saebi, T. (2017). Fifteen years of research on business model innovation: how far have we come, and where should we go? *Journal of Management*, vol. 43(1), pp. 200−227. DOI: 10.1177/0149206316675927.

Gambardella, A., McGrahan, A. M. (2010). Business-model innovation: general purpose technologies and their implications for industry structure. *Long Range Planning*, vol. 43(2/3), pp. 262−271. DOI: 10.1016/j.lrp.2009.07.009.

Govindarajan, V., Rajgopal, S., Srivastava, A. (2018a). A blueprint for digital companies' financial reporting. *Harvard Business Review*, August 03. hbr.org/2018/08/a-blueprint-for-digital-companies-financial-reporting (Accessed on 10. 05. 2019).

Govindarajan, V., Rajgopal, S., Srivastava, A. (2018b). Why financial statements don't work for digital companies. *Harvard Business Review*, February 26. Retrieved from: hbr.org/2018/02/why-financial-statements-dont-work-for-digital-companies. (Accessed on 12. 11. 2018)

IFRS 15. IFRS 15 Revenue from Contracts with Customers, Commission Regulation (EC) No 1126/2008 of 3 November 2008 adopting certain international accounting standards in accordance with Regulation (EC) No 1606/2002 of the European Parliament and of the Council (with amendments).

Karwowski, M. (2016). MSSF 15 „Przychody z umów z klientami" a ocena realizacji modelu biznesu. *Studia Ekonomiczne. Zeszyty Naukowe Uniwersytetu Ekonomicznego w Katowicach*, vol. 285, pp. 161−170.

Lambert, S. C., Davidson, R. A. (2013). Applications of the business model in studies of enterprise success, innovation and classification: An analysis of empirical research from 1996 to 2010. *European Management Journal*, vol. 31, pp. 668−681.

Lichtenthaler, U. (2018). The world's most innovative companies: a meta-ranking. *Journal of Strategy and Management*, vol. 11(4), pp. 497−511. DOI: 10.1108/JSMA-07-2018-0065.

Mahadevan, B. (2004). A Framework for Business Model Innovation. *IMRC 2004 Conference*, December 16-18.

Markides, C. (2006). Disruptive innovation: in the need for better theory. *Journal of Product Innovation Management*, vol. 23(1), pp. 19–25.

Ritter, T., Lettl, C. (2018). The wider implications of business-model research. *Long Range Planning*, vol. 51, pp. 1−8. DOI: 10.1016/j.lrp.2017.07.005.

Schneider, S., Spieth, P. (2013). Business model innovation: towards an integrated future research agenda. *International Journal of Innovation Management*, vol. 17(1), pp. 7−34. DOI: 10.1142/S136391961340001X.

Tyreholt, P. (2017). Digital transformation requires business model innovation. Retrieved from: https://www.cybercom.com/About-Cybercom/Blogs/Business-and-technology-in-the-connected-world/digital-transformation-requires-business-model-innovation-1-of-3/ (Accessed on 27.05.2019).

Wirtz, B. W., Pistoia, A., Ullrich, S., Gottel, V. (2016). Business models: origin, development and future research. *Long Range Planning*, vol. 49, pp. 36−54.

Wirtz, B. W., Daiser, P. (2017). Business model innovation: an integrative conceptual framework. *Journal of Business Models*, vol. 5(1), pp. 14−34.

# Methodological Aspects of Evaluating the Efficiency of Public Procurement in order to Improve the Effectiveness of Financial Control in the Regions of Russia

**Oksana Kashina[1], Nataliya Pronchatova-Rubtsova[2], Sergey Petrov[3], Nadezhda Yashina[4]**

[1, 2, 3, 4] Lobachevsky State University of Nizhny Novgorod
Institute of Economics and Entrepreneurship, [1, 2, 3, 4] Department of Finance and Credit,
Bolshaya Pokrovskaya street 37, 603000 Nizhny Novgorod, Russian Federation
E-mail: [1] oksana_kashina@mail.ru, [2] pronat89@mail.ru, [3] petrov_ss@list.ru, [4] sitnicof@mail.ru

***Abstract:*** *The world economy instability, the crisis phenomena and the need to quickly overcome their consequences explain the flexibility requirements of the state financial policy, which ensures the transition to an innovative model of socio-economic development. An important mechanism of state regulation is the public procurement system development, which will allow to rationally use budget funds in the limited financial resources context, given the desire to fully implement public functions. In this regard, the study purpose is the development of an evaluation the public procurement efficiency methodology in order to improve the financial control effectiveness in the Russian regions. The proposed methodology for assessing the public procurement efficiency is based on a systematic and integrated approach, which requires the formation of an indicators' set, including such key indicators as the share of capital and current purchases in regional budget expenditures, savings on the state order conclusion, the share of the contracts' cost with a single supplier of the total contracts' value. In the work, modern scientific tools and various research methods are used: economic-statistical, system-analytical and expert assessments. Methodology approbation was carried out on the example of the Russian regions on the basis of official open data from the Unified Procurement Information System, the Federal Financial Monitoring Service, the Federal Treasury of the Russian Federation for 2016-2018. The practical implementation of the proposed methodology allows ranking the regions on the basis of a consolidated indicator for evaluating the public procurement efficiency, taking into account the established indicators. The analysis results of this annual rating can be used in the state executive bodies work in making concepts for the territorial development aimed at improving public administration, developing a competitive public procurement market, improving the efficiency and transparency of using budget funds to increase the financial control effectiveness and maximize satisfaction social needs.*

*Keywords: public procurement, budget funds, efficiency, evaluation methodology, financial control*

*JEL codes: H57, H61, H7, H83*

## 1 Introduction

The effective functioning of a national economic system is impossible without financial control over spending of budget funds. Placement of a state (municipal) order is one of the ways to spend budget funds. The system of public procurement is of great importance for the functioning of the country as a whole, as well as for individual sectors of financial and economic activity; therefore, there is a need for thorough audit of these expenditure items in order to prevent inappropriate spending of budget funds. In this regard, financial control in the field of state and municipal procurement is a key element of the government's financial control system.

Financial control is aimed at ensuring efficient use of budget funds by authorities performing state municipal functions; therefore, there is an urgent need to ensure that these authorities spend budget funds appropriately and accurately reflect financial results in financial statements (Safro and Baah-Mintah, 2013).

The results of many other studies (Burger and Hawkesworth, 2011; Ameyaw et al., 2012; Safro and Baah-Mintah, 2013; The World Bank, 2017; OECD, 2019) demonstrate that financial control in public procurement can ensure a reasonable and efficient use of public resources, increase the transparency of the public procurement system, reduce or eliminate corruption in the procurement process. A number of researchers paid attention to the formation of a financial control system in public procurement (see, for example, Behn, 2003; Heinrich, 2007). They found that in the modern conditions of the development of the market economy, which involve increased volumes of financial operations conducted by government authorities, it is necessary to improve the government's system of financial control over the use of budget funds in the field of public procurement.

In many countries, public procurement continues to account for a significant portion of Gross Domestic Product (Ameyaw et al., 2012; Safro and Baah-Mintah, 2013); therefore improving the efficiency of the public procurement process is important for the country's development under the conditions of increased volatility of external and internal economic conditions. Public procurement may serve as an economic instrument for guaranteeing national development only when well-planned and implemented, as it affects resource mobilisation, financial sustainability of the country, effectiveness of public debt and public expenditure management, national income generation (Safro and Baah-Mintah, 2013).

From an economic point of view, the public procurement system is more and more frequently seen as a lever to increase the efficiency of public spending (Kloot and Martin, 2000; Mandl et al., 2008). The fact is that work in this area contributes to the achievement of key objectives of the country's socio-economic development. In particular, the study conducted by (McKinsey and Company, 2017) showed that improving the efficiency of expenditure management in the field of public procurement contributes to reducing the budget deficit, and effective public procurement management in healthcare can increase life expectancy (by an average of 1.4 years) (McKinsey and Company, 2017).

Although evaluating the efficiency of the public procurement procedure can be time consuming and complex, a number of individual studies (Schapper et al., 2006; Kumar et al., 2015; Patrucco et al., 2016) established a relationship between the performance of public procurement and the national economic indicators. As shown in the research (OECD, 2019), efficient public spending may improve population well-being and social and environmental conditions in the country.

However, the problem of forming a system of indicators that would enable government authorities to measure consistently and reliably the impact of the procurement system on the country's socio-economic indicators remains relevant.

In this respect, the Organisation for Economic Cooperation and Development (OECD) proposed 'reliable procurements system' indicators (OECD, 2019). In accordance with the recommendations of this organisation, the public procurement system can be recognised as reliable only if it allows to maximise the likelihood of reaching the specific socially meaningful objectives while minimising the use of resources. To measure the level of reliability of the public procurement system, five classes of indicators were developed using a combination of quantitative and qualitative measures (OECD, 2019).

A similar system of performance indicators of the national procurement system was proposed by the World Bank (The World Bank, 2017). In particular, this system includes criteria such as the cost and time of the procurement process; participation of small and medium businesses in procurement; views of businesses on the cost and time of participation in public tenders; total expenditure attributable to the national procurement system; the volume of electronic purchases; time savings when using an electronic procurement system; transparency of government orders; social criteria of public contracts, etc. (The World Bank, 2017).

However, these indicators are quite generalised and, in some cases, difficult to measure in practice. Many of them are only a starting point that can allow for further measurement of the socio-economic consequences of the implementation of public procurement taking into account their specifics in various countries (Debevoise and Yukins, 2010).

In view of the above, the purpose of this study is to develop a methodology for evaluating the efficiency of public procurement in order to improve the effectiveness of financial control in the regions of Russia.

## 2 Methodology and Data

Evaluation of the efficiency of public procurement requires a systematic and comprehensive approach, which necessitates the development of a whole set of indicators. The authors have created a specialised multi-criteria system for evaluating the efficiency of public procurement.

1. Expenditure on the national economy to Gross Regional Product

$$K1=\frac{\text{Expenditure on national economy}}{\text{GRP}} \quad (1)$$

2. Capital procurement to capital expenditure

$$K2=\frac{\text{Capital procurement}}{\text{Capital expenditure}} \quad (2)$$

3. Current procurement to current expenditure

$$K3=\frac{\text{Current procurement}}{\text{Current expenditure}} \quad (3)$$

4. Value of one contract

$$K4=\frac{\text{Total value of contracts for performance of state (municipal) order}}{\text{Number of contracts for performance of state (municipal) order}} \quad (4)$$

5. Region's budget expenditure in the national economy

$$K5=\frac{\text{Expenditure on national economy}}{\text{RF region's total budget expenditure}} \quad (5)$$

6. Capital expenditure to the RF region's total budget expenditure

$$K6=\frac{\text{Capital expenditure of region's budget}}{\text{RF region's total budget expenditure}} \quad (6)$$

7. Current expenditure to the RF region's total budget expenditure

$$K7=\frac{\text{Current expenditure of the RF region's budget}}{\text{RF region's total budget expenditure}} \quad (7)$$

8. Capital procurement to the RF region's total budget expenditure

$$K8=\frac{\text{Capital procurement}}{\text{RF region's total budget expenditure}} \quad (8)$$

9. Current expenditure to the RF region's total budget expenditure

$$K9=\frac{\text{Current expenditure}}{\text{RF region's total budget expenditure}} \quad (9)$$

10. Savings from the conclusion of a state (municipal) order (in shares), K10

11. Dominant suppliers with 80% of the contracted regional order to the total number in the regional state order market

$$K11=\frac{\text{Dominant suppliers}}{\text{Total number of suppliers in regional state order market}} \quad (10)$$

12. Value of contracts with a sole supplier to the total value of contracts

$$K12=\frac{\text{Value of contracts with sole supplier}}{\text{Total number of suppliers in regional state order market}} \quad (11)$$

The requirement of comprehensiveness in evaluating the efficiency of public procurement explains the need to calculate a consolidated indicator ($GP_{complex}$), for the determination of which it is assumed that all individual indicators of the evaluation system shall be of comparable type (Yashina et al., 2018).

Indicators, the increase of which evidences an increase in the efficiency of public procurement, shall be converted using the following formula:

$$P_i^x = \frac{P_{max} - P_i}{P_{max} - P_{min}} \quad (12)$$

Indicators, the increase of which evidences a decrease in the efficiency of public procurement, shall be converted using the following formula:

$$P_i^x = \frac{P_i - P_{min}}{P_{max} - P_{min}} \quad (13)$$

$P_i^x$ — the *i*-th converted indicator of the RF constituent entity (*x*),

$P_{max}$ — the maximum value of the *i*-th indicator among all constituent entities of the RF,

$P_i$ — the value of the *i*-th indicator of the RF constituent entity,

$P_{min}$ — the minimum value of the *i*-th indicator among all constituent entities of the RF.

$GP_{complex}$ is determined by summing up all individually converted indicators, which allows to characterise unambiguously the efficiency of public procurement on the basis of a single consolidated indicator.

$GP_{complex}$ allows to rank the constituent entities of the Russian Federation by level of effectiveness of management of the regional public procurement system. The lowest value of the consolidated indicator corresponds to the leading region in terms of quality of management of the public procurement system, taking into account the created system of indicators.

The methodology we have developed allows to evaluate the efficiency of the public procurement system for any time interval and in dynamics depending on a given period of time, which makes it possible to apply the methodology using reporting data for different periods.

Analysis of the values of individual indicators will allow to identify problem areas for individual parameters of the public procurement system, which, when effectively managed, will improve the quality of public procurement in general.

## 3 Results and Discussion

Approbation of the methodology was carried out across the RF regions based on official open data from the Unified Procurement Information System, the Federal Financial Monitoring Service, and the Federal Treasury of the Russian Federation for 2016-2018. The implementation of the methodology allowed us to create a public procurement efficiency ranking of constituent entities of the Russian Federation by consolidated indicator values (Table).

**Table** Public Procurement Efficiency Ranking of RF Regions, 2016-2018 (fragment)

| RF constituent entity | $GP_{complex\ 2016\text{-}2018}$ | Place |
|---|---|---|
| **Republic of Adygea** | 19.72 | 1 |
| **Magadan region** | 20.13 | 2 |
| **Pskov region** | 20.64 | 3 |
| **Saint Petersburg** | 21.70 | 4 |
| **Republic of Crimea** | 21.93 | 5 |
| **Kaliningrad region** | 22.16 | 6 |
| **Tambov region** | 22.38 | 7 |
| **Ivanovo region** | 22.39 | 8 |
| **Omsk region** | 22.90 | 9 |

| | | |
|---|---|---|
| **Ryazan region** | 23.06 | 10 |
| **Republic of Ingushetia** | 23.12 | 11 |
| **Moscow** | 23.12 | 12 |
| **Nenets Autonomous District** | 23.15 | 13 |
| **Sevastopol** | 23.18 | 14 |
| **Karachay-Cherkess Republic** | 23.19 | 15 |
| **Republic of Karelia** | 23.35 | 16 |
| **Voronezh region** | 23.53 | 17 |
| **Republic of Altai** | 23.53 | 18 |
| **Kaluga region** | 23.57 | 19 |
| **Kurgan region** | 23.60 | 20 |
| **Khanty-Mansy Autonomous District** | 23.75 | 21 |
| **Kamchatka region** | 23.75 | 22 |
| … | | |
| **Nizhny Novgorod region** | 24.30 | 30 |
| **Republic of Tyva** | 24.31 | 31 |
| **Altai region** | 24.34 | 32 |
| **Kostroma region** | 24.35 | 33 |
| **Murmansk region** | 24.35 | 34 |
| **Yamalo-Nenets Autonomous District** | 24.41 | 35 |
| **Republic of Buryatia** | 24.43 | 36 |
| **Orenburg region** | 24.50 | 37 |
| **Samara region** | 24.52 | 38 |
| **Republic of Mari El** | 24.65 | 39 |
| **Kirov region** | 24.70 | 40 |
| … | | |
| **Kemerovo region** | 26.42 | 78 |
| **Irkutsk region** | 26.43 | 79 |
| **Republic of Chechnya** | 26.74 | 80 |
| **Republic of Bashkortostan** | 27.04 | 81 |
| **Republic of Kabardino-Balkaria** | 27.18 | 82 |
| **Tomsk region** | 27.24 | 83 |
| **Primorye region** | 27.61 | 84 |
| **Amur region** | 28.29 | 85 |

Source: authors' calculations based on the data of the Unified Procurement Information System, the Federal Financial Monitoring Service, the Federal Treasury of the Russian Federation

The leaders are the Republic of Adygea and the Magadan region. Among other leading constituent entities are the Pskov region, the Republic of Crimea, the Ivanovo region, Moscow, the Kaliningrad region, St. Petersburg, Sevastopol, etc.

The Tambov region's ranking in the top ten is explained by the centralised procurement system and the introduction of a specialised state procurement information system that allows to track online budget funds spending and to analyse its effectiveness.

The successful practices of the Voronezh region are also worth noting. In 2018, at the XIV All-Russian Forum-Exhibition 'State Order — Fair Purchasing', the region was named one of the eight winners, among 46 constituent entities. The region's winning position was ensured by indicators such as 'Assessment of the information infrastructure of procurement' and 'Removal of administrative barriers'. The Voronezh region's activities aimed at ensuring the efficiency of public procurement have been recognised as the best example perfectly combining the use of legal norms and practices. However, the following problems exist:

1) rules for organising and conducting procurement are different for different customers;

2) there are numerous public procurement methods;

3) there are multiple e-trading platforms;

4) procurement from a sole supplier is commonly used.

The Voronezh region's place in the ranking is explained by the development of procurement regulations; the outsourcing of individual functions of customers to specialised organisations; the optimisation of customers' interaction with electronic platforms, etc.

The Kaluga region can be seen as an example of the government's successful implementation of competition policy with respect to public procurement. This policy is based on, and implemented through, joint procurement. The joint procurement mechanism involves unification of purchases based on the principle of similarity of work specifications.

In order to achieve the strategic goals of increasing the efficiency of public procurement in the Khanty-Mansy Autonomous Okrug, a decision was made to form regional commercial markets.

The Murmansk region is among the top regions due to the principles of independence of business entities, freedom of entrepreneurial activities and increased competition in procurement. However, inefficient expenditure of budget funds resulting from the lack of transparency of procedures, irresponsible customers and insufficient control by regulatory authorities has been identified.

The Kirov region has developed a method for forecasting regional public spending to create a uniform procurement system for organising an effective public procurement system. Customers are required to place bids for public contracts in the first half of the fiscal year, with their actual volume being 100% of the original schedules.

The Amur region ranks last in the 85th place, which is explained by the high cost of contracts and the significant portion of contracts with a dominant or sole supplier.

## 4 Conclusions

During a crisis, many representatives of business community lack financial capabilities to participate in procurement tenders. At the same time, customers have serious requirements for procurement objects. In order to promote competition, the RF Government normalises public procurement, which allows to increase the number of participants and to eliminate excessively strict customer requirements. To maintain competition and to ensure publicity and transparency of procurement, regional public procurement information systems are created, which enable manufacturers, among other things, to post information free of charge. Despite the set of anti-corruption measures that are being taken, the following corruptive actions of suppliers and customers remain an acute problem in the procurement system: setting a lower price for the procurement contract and informing the potential supplier about it; establishing a short period for the performance of the contract; establishing deliberately a non-competitive price or a payment scheme, which is inconvenient for most suppliers.

The results of this study can be used to improve the effectiveness of financial control, the efficiency and transparency of public spending and the competition in public procurement. Territorial development strategies formulated based on these results will meet the needs of society.

## References

Ameyaw, C., Mensah, S., Osei-Tutu, E. (2012). Public procurement in Ghana: The implementation challenges to the Public Procurement Law 2003 (Act 663). *International Journal of Construction Supply Chain Management*, vol. 2(2), pp. 55-65.

Behn, R. (2003). Why Measure Performance? Different Purposes Require Different Measures. *Public Administration Review*, vol. 63(5), pp. 586-606.

Burger, P., Hawkesworth, I. (2011). How to Attain Value for Money: Comparing PPP and Traditional Infrastructure Public Procurement. *OECD Journal on Budgeting*, vol. 11(1), pp. 91-146.

Debevoise, E., Yukins, C. (2010). Assessing the World Bank's Proposed Revision of Its Procurement Guidelines. *The Government Contractor*, vol. 52(21), pp. 1-5.

Heinrich, C. (2007). Measuring Public Sector Performance and Effectiveness in B.G. *The Handbook of Public Administration*, pp. 24–36.

Kloot, L., Martin, J. (2000). Strategic Performance Management: A Balanced Approach to Performance Management Issues in Local Government. *Management Accounting Research*, vol. 11(2), pp. 231-251.

Kumar, A., Nair, A., Piecha, J. (2015). Measuring Efficiency in International Public Procurement. *Journal of Public Procurement*, vol. 15(3). pp. 365-389.

McKinsey and Company (2017). *Government Productivity Unlocking the $3.5 Trillion Opportunity - Executive summary*. Retrieved from: http://www.mckinsey.com/.

Mandl, U., Dierx, A., Ilzkovitz, F. (2008). The effectiveness and efficiency of public spending. *Economic Papers of European Commission*, vol. 301.

OECD (2019). *Productivity in Public Procurement: A Case Study of Finland: Measuring the Efficiency and Effectiveness of Public Procurement*. Retrieved from: https://www.oecd.org/gov/public-procurement/publications/productivity-public-procurement.pdf.

Patrucco, A., Luzzini, D., Ronchi, S. (2016). Evaluating the Effectiveness of Public Procurement Performance Management Systems in Local Governments. *Local Government Studies*, vol. 42(5), pp. 739-761.

Safro, P., Baah-Mintah, R. (2013). Assessing the Effect of the Procurement Act (663) on the Public Financial Management in Ashanti Region. *American Journal of Rural Development*, vol. 1(4), pp. 91-98.

Schapper, P., Malta, J., Gilbert, D. (2006). An Analytical Framework for the Management and Reform of Public Procurement. *Journal of Public Procurement*, vol. 6(1), pp. 1-26.

The World Bank (2017). *The Public Procurement Monitoring System of Montenegro*. Retrieved from: http://documents.worldbank.org/curated/en/960331498841094381/pdf/P162277-06-30-2017-1498841092593.pdf.

Yashina, N., Pronchatova-Rubtsova, N., Petrov, S., Kashina, O. (2018). Methodical Approaches to the Formation of Model Budgets in order to Improve the Effectiveness of the Budget Process in Russia. In: European Financial Systems 2018, *Proceedings of the 15th International Scientific Conference.* Brno: Masaryk University, pp. 857-864.

# Evaluation of Financial Health of Companies in Slovak Republic Based on Selected Mathematical-statistical Methods

**Michaela Kavčáková**

Technical University
Faculty of Economics, Department of Banking and Investments
Němcovej 32, 040 01 Košice, Slovak Republic
E-mail: michaela.kavcakova@tuke.sk

***Abstract:*** *The main purpose of this paper is to evaluate financial health of companies in Slovakia through selected mathematical-statistical methods and to compare them. The data used in the analysis of this paper has been obtained from the Slovak internet portal Finstat and we have been analysing the data between 2013 and 2017. From each group of models used to evaluate the financial health of companies we have chosen one test to use them in this paper – Beaver´s test, Altman´s test and Quick test. These tests differ in the way they calculate financial health, so on that basis we can determine the differences between them and we can determine which type of test is most reflective of the real situation of companies. In our paper, we will use Beaver´s test, Altman´s test and Quick test to evaluate financial health of companies in Slovakia in the chosen industry from 2013 to 2017.*

*Keywords: financial health, financial distress prediction, Beaver´s test, Altman´s test, Quick test*

*JEL codes: C30, C53, G30, M21, M41*

## 1 Introduction

Since the beginning of the last century, many authors have been engaged in assessing the financial health of businesses through creditworthy or bankruptcy models. Everything started after the Great Depression when many companies bankrupt or were in danger. For this reason, researchers have started to deal with the symptoms of companies that lead to their failure and to evaluate their financial health. The objective of the financial health of the company's timely identification of impending threats.

Monitor the financial health of the company (borrowers) is especially important for banks (creditors) to decide whether to borrow or not to borrow money. Banks either create their own procedures for assessing the financial health of companies or use familiar models. The result of evaluation of financial health is also used in the quantification of risk to which the bank will face if the company grants a loan.

The main purpose of this paper is to evaluate financial health of companies in Slovakia through selected mathematical-statistical methods and to compare them. From each group of models used to evaluate the financial health of companies we have chosen one test to use them in this paper – Beaver´s test, Altman´s test and Quick test. To evaluate financial health of companies of industry of beer production (SK NACE 11050) we use program called the FinAnalysis version 2.19 SK. The data used in the analysis of this paper has been obtained from the Slovak internet portal Finstat and we have been analysing the data between 2013 and 2017.

The paper is organized as follow: In the section 2 a preview of the relevant literature is provided. In the section 3, the methodology and data are described and the section 4 presents the results and discussion.

## 2 Literature preview

During the Great Depression, researches began to deal with failure prediction (see e.g. Fitzpatrick, 1932) while there were no advanced statistical methods or computers available for them. Researches started to compare failed and nonfailed firms. In 1966, Beaver presented study, in which he used the univariate approach of discriminant

analysis. Altman in 1968 expanded this study to multivariate analysis, which was the dominant method to predict failure until 1980´s.

Another point of view on evaluating financial health are scoring methods, which use point scales to predict financial developments. The values of the selected financial indicators are transformed into points through point scales. The most famous representatives of this kind of models are Kralick (1991) and Argenti (2003).

Table 6 shows the summary of significant researches and their models for evaluating financial health of company.

**Table 6** Models and authors used to evaluate financial health of companies

| Type of method | Author | Date |
|---|---|---|
| **Univariate discriminant analysis methods** | Fitzpatrick | 1932 |
| | Merwin | 1942 |
| | Walter | 1957 |
| | Beaver | 1966 |
| | Deakin | 1972 |
| | Ohlson | 1980 |
| | Zmijewski | 1984 |
| **Multiple discriminant analysis methods** | Altman | 1968 |
| | Edminster | 1972 |
| | Deakin | 1972 |
| | Blum | 1974 |
| | Beerman | 1976 |
| | Moyer | 1977 |
| | Altman, Halderman & Naarayanan | 1977 |
| | Taffler | 1977 |
| | Springate | 1978 |
| | Altman | 1983 |
| | Booth | 1983 |
| | Fulmer | 1984 |
| | Rose & Giroux | 1984 |
| | Casey & Bartczak | 1985 |
| | Lawrence & Bear | 1986 |
| | Poston, Harmon & Gramlich | 1994 |
| | Neumaier & Neumaier | 1995 |
| | Chrastin | 1998 |
| | Grice & Ingram | 2001 |
| | Grünwald | 2007 |
| **Models based on the scoring method** | Kralicek | 1991 |
| | Argenti | 2003 |

Source: prepared by authors based on table Sanobar (2012)

## 3 Methodology and Data

The financial health of the company we can quantify through the use creditworthy or bankruptcy models. From each group of models, mentioned in Section 2, we choose one test – Beaver´s test, Altman´s test and Quick test to evaluate financial health in industry of beer production (SK NACE 11050).

In this section, we gradually explain the methodology of mentioned models.

**Beaver's test**

Beaver´s test, the author is a financial analyst W.H. Beaver (1966), is based on Univariate Discriminant Analysis – UDA. Beaver analysed which ratios play an important role in the financial problems of companies, with the sample consisting of 79 failed and

79 nonfailed companies. From his analysis, he concluded that the financial ratios had a value of 5 years before the bankruptcy of the company.

For each failed company has been assigned a nonfailed company from the same business sector and about the same size. He observed 30 basic ratios in both of the sets and found their differences. Beaver called this procedure Profile Analysis.

The Beaver´s test parameters are shown in the **Table 7**.

**Table 7** The Beaver test parameters

| Indicator | Trend in endangered companies |
|---|---|
| **equity/total assets** | falling |
| **added value/total assets** | falling |
| **banking loans/liabilities** | growing |
| **cash flow/liabilities** | falling |
| **working capital** | falling |

Source: Bočánek (2018)

**Altman's test**

Altman (1968) has improved the Beaver´s model by using a multi-dimensional approach that better reflects the company's financial situation. Altman's test is one of the most well-known multi-dimensional bankruptcy models.

This test is based on empirical data on failed companies over the past 5 years before bankruptcy and data for prosperous companies over the same period. Subsequently, he used Multiple Discriminatory Analysis to determine the ratios that characterize both the current financial situation of the companies and its development. The essence of this analysis is to find a linear combination of indicators that best distinguishes companies from bankruptcy and prosperity. Altman used 5 financial ratios to formulate the equation.

For stock companies, the equation is:

$$Z=1{,}2*X(1)+1{,}4*X(2)+3{,}3*X(3)+0{,}6*X(4)+1{,}0*X(5), \quad (1)$$

where

$$X(1)=\frac{\text{current assets - short-term payables}}{\text{total assets}},$$

$$X(2)=\frac{\text{accumulated profits or losses brought forward}}{\text{total assets}},$$

$$X(3)=\frac{\text{profit or loss before tax + interest expenses and similar expenses}}{\text{total assets}},$$

$$X(4)=\frac{\text{market value of equity}}{\text{book value of total debt}},$$

$$X(5)=\frac{\text{sales}}{\text{total assets}}.$$

The calculated values are interpreted according to the following rules:

- Z>2,99 – companies with scores above 3 are unlikely to enter bankruptcy,
- 1,81<Z<2,99 – scores between 1,8 and 3 lie in a grey area,
- Z< 1,81 – a score of lower than 1,8, in particular, indicates that the company is heading for bankruptcy.

A modified equation is used to assess the financial health of limited liability companies, which differs from the version used in stock companies by the definition of the X(4) and the weighting of the individual indicators.

$$Z=0{,}717*X(1)+0{,}847*X(2)+3{,}107*X(3)+0{,}42*X(4)+0{,}998*X(5), \quad (2)$$

where

$$X(4)=\frac{\text{equity}}{\text{long-term payables + short-term payables}}.$$

The resulting index is compared with the following values:

- Z>2,9 – financial situation is good (currently and in the future),
- 1,2<Z<2,9 – range of ambiguous results, bankruptcy is possible (grey zone),
- Z<1,2 – financial situation is dire, probable bankruptcy.

The Altman's test has the highest reliability over a 2-year period with a probability of approximately 95%. It can also be used in a different period, but in that case, its reliability decreases.

**Quick test**

In 1990, Kralicek proposed the so-called Quick test, often used mainly in Europe. It is a kind of transition between one-dimensional and multidimensional models. From each significant area of analysis, such as stability, liquidity, profitability and economic outcomes, he used one selected indicator and created a point scale. Kislingerova (2005) slightly modified Kralick's quick test to situation in Czech Republic. Kralicek in his model used so called balance cash flow, while Kislingerová states that when analysing companies located in the Czech Republic, it is necessary to calculate cash flow differently, because the result of balance cash flow would be, considering our conditions, negative.

We assess the financial health of businesses in the industry based on Kislinger's quick test as follows:

$$\text{Ratio of Own Equity in Total} = \frac{\text{equity}}{\text{total assets}} * 100 \quad (3)$$

$$\begin{aligned}\text{Time Required to Pay off Debt in Years} \quad (4)\\ = (\text{long} - \text{term liabilities} + \text{long} - \text{term bank loans} + \text{short}\\ - \text{term liabilities} + \text{current bank loans} + \text{short}\\ - \text{term financial assistance} - \text{short} - \text{term financial assets}\\ - \text{financial accounts}) / (\text{profit for the period after tax}\\ + \text{depreciation and adjustments of intangible and tangible fixed assets}\\ + \text{adjustments for inventory} + \text{adjustments to receivables}\\ + \text{adjustments to financial assets})\end{aligned}$$

$$\text{Ratio of Cash Flow in Operation Income} = \frac{\text{net increase or net decrease in cash}}{\text{total sales}} * 100 \quad (5)$$

$$\begin{aligned}&\text{Percentage of Return on Total Equity}\\ &= \left( \frac{\text{profit for the period after tax} + \text{interest expense} * \frac{100 - \text{current income tax rate}}{100}}{\text{total}} \text{assets} \right.\end{aligned} \quad (6)$$

$$\left. * 100 \right.$$

According to the achieved result, each indicator is classified according to the **Table 8** and the resulting mark is then determined as the arithmetic mean of the marks obtained for individual indicators.

**Table 8** Quick test - score indicators

| Indicator | excellent (1) | very good (2) | average (3) | bad (4) | threat. insolvency (5) |
|---|---|---|---|---|---|
| **Ratio of Own Equity in Total** | >30% | >20% | >10% | >0% | negative |
| **Time Required to Pay off Debt in Years** | <3 years | <5 years | <12 years | >12 years | >30 years |
| **Ratio of Cash Flow in Operation Income** | >10% | >8% | >5% | >0% | negative |
| **Percentage of Return on Total Equity** | >15% | >12% | >8% | >0% | negative |

Source: Bočánek (2018)

The final score for the entire test is calculated as the average of the marks achieved for each indicator. If the resulting criterion is less than 2, the company is considered very good. If the value is higher than 3, the company is in a bad financial situation.

**Data**

As an industry we decided to explore, we have chosen the beer production sector (SK NACE 11050). We have used the internet database Finstat to get the list of companies that we are going to explore, as well as to obtain the necessary data to calculate the mentioned models. We have filtered the sample feed to include companies:

- not cancelled, not in bankruptcy or liquidation,
- earning more than 0€,
- which have available data for 2013-2017 period.

## 4 Results and Discussion

In this section, we are going to evaluate financial health of companies in industry of beer production (SK NACE 11050) according to the tests mentioned in section 3. Calculations are carried out through the FinAnalysis version 2.19 SK, which works with business accounting statements. We are going to write the necessary items into a program that automatically calculates Beaver´s, Altman´s, and Quick Test. Results are shown below.

**Beaver´s test**

FinAnalysis have calculated Beaver's test´s indicators for years 2013-2017. The output is a graph, from which we have to read whether the curve of a given indicator is growing or falling over the years 2013-2017. Based on this identification, we determine if the indicator is at risk. To identify exactly whether the curve is growing or falling we use linear trend lines. Results are shown in table. Red colour represents risk, yellow without change and green colour represents financial health.

**Table 9** Results of Beaver´s test

| | Indicator 1 | Indicator 2 | Indicator 3 | Indicator 4 | Indicator 5 | Overall evaluation |
|---|---|---|---|---|---|---|
| **Heineken Slovensko, a.s.** | Red | Red | Yellow | Green | Red | Yellow |
| **Plzeňský Prazdroj Slovensko, a.s.** | Green | Red | Green | Red | Green | Yellow |
| **Pivovar STEIGER a.s.** | Yellow | Yellow | Yellow | Green | Yellow | Yellow |
| **Banskobystrický pivovar, a.s.** | Red | Red | Green | Yellow | Red | Yellow |
| **ERB - Eduard Rada Breweries, s. r. o.** | Green | Green | Yellow | Yellow | Yellow | Yellow |
| **Prvý piešťanský pivovar, s. r. o.** | Green | Green | Yellow | Yellow | Red | Yellow |
| **Yotta Trade, a.s.** | Red | Red | Yellow | Yellow | Red | Red |
| **SAWPI, s.r.o.** | Red | Green | Red | Yellow | Red | Yellow |
| **Bíliková s.r.o.** | Green | Green | Yellow | Yellow | Green | Green |
| **Persson s. r. o.** | Red | Green | Green | Yellow | Red | Yellow |
| **Stupavar, spol. s. r. o.** | Green | Green | Red | Yellow | Red | Yellow |
| **SESSLER, s.r.o.** | Yellow | Green | Green | Yellow | | Yellow |
| **AlternaTiff, s.r.o.** | Red | Green | Red | Yellow | Red | Yellow |
| **PREŠOVSKÝ PIVOVAR, s.r.o.** | Red | Green | Red | Yellow | Red | Yellow |
| **VINIŠ s.r.o.** | Yellow | Green | Yellow | Yellow | Red | Yellow |
| **Pivovar Kaltenecker s.r.o.** | Red | Green | Red | Red | Green | Yellow |
| **agaSSe, s.r.o.,** | Red | Green | Red | Yellow | Green | Yellow |
| **KASTELÁN s. r. o.** | Green | Green | Yellow | Yellow | Red | Yellow |
| **BaranBeer s.r.o.** | Red | Green | Red | Yellow | Red | Yellow |

| | | | | | | |
|---|---|---|---|---|---|---|
| **CMI – Consulting, s.r.o.** | Red | Red | Red | Red | Red | Red |
| **Pivovarský dom, s. r. o.** | Red | Red | Red | Yellow | Red | Red |
| **EGIDIUS BREWERY, s.r.o.** | Red | Red | Yellow | Yellow | Red | Red |
| **HOP GRUP s. r. o.** | Red | Green | Yellow | Yellow | Red | Yellow |
| **GOLIÁŠ-minipivovar, s. r. o.** | Green | Green | Green | Yellow | Green | Green |
| **TRIBI s. r. o.** | Red | Green | Green | Yellow | Red | Yellow |
| **Covert Rampart s. r. o.** | Red | Red | Yellow | Yellow | Red | Red |

Source: Own calculations

To identify the overall business situation, we have opted for a scaling method. We mark the risk by number 1, no change by number 2 and financial health by number 3. We divide the result by the number of indicators, 5, and we will mark the overall evaluation of the financial health of the company with the appropriate colour. The results are shown in the last column of the **Table 9**.

Most of companies in industry of beer production due to Beaver´s test are without change that means they are stabilised. Five companies are in risk and only two companies are healthy.

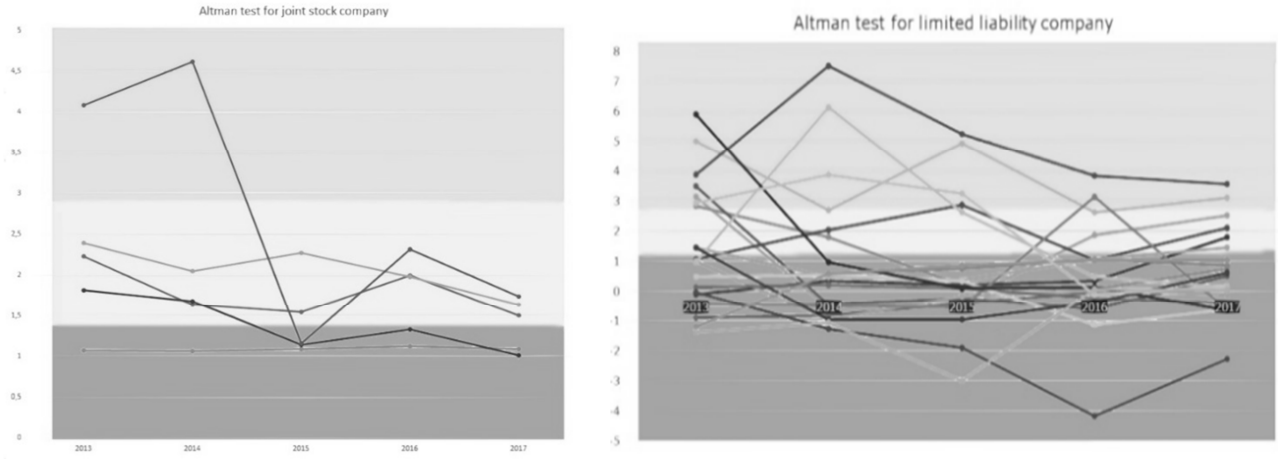
The main disadvantages of Beaver's test are:

- not all financial ratios are testified to be capable of predicting the failure,
- does not allow for simultaneous consideration of several financial variables,
- not all indicators showed the same degree of statistical significance in financial forecasts,
- it is difficult to assess whether an enterprise is overall healthy or at risk of bankruptcy because (as can be seen in the table) one indicator identifies health and the other bankruptcy.

### Altman´s test

Our chosen program, FinAnalysis, have calculated Altman's test´s resulting coefficients for years 2013-2017. The output is a table, which we graphically illustrate in the pictures, so that the industry results are better visible. Red colour represents bankruptcy, yellow grey zone and green colour represents financial health. Following graph on the left represents results for Joint Stock Company and one on the right for Limited Liability Company.

**Figure 5** Results of Altman´s test




Source: own calculations

As we can see in graphs, most of companies in industry of beer production are at risk of bankruptcy or in grey zone. From period 2013-2017 the best years was 2013 and 2014 when there were companies in financial health zone, but their results started decrease.

Overall, based on the Altman's test, we consider the industry to be in a very bad situation and most of the companies established in it are at risk of bankruptcy.

We can see that Altman's test is has many advantages:

- it is one of the most effective Multiple Discriminant Analysis,
- it has being used in various industries to predict bankruptcy,
- it allows for simultaneous consideration of several financial variables on the purpose of developing a bankruptcy prediction model,
- it highlights factors contributing to a company's financial health and uncovers emerging trends that indicate improvements or deterioration in financial condition,
- it helps managers align business strategies with capital allocation decisions and provide transparency of financial condition to lenders and equity capital providers,
- it avoids biases of subjective assessments, conflicts of interest, brand and large company bias.

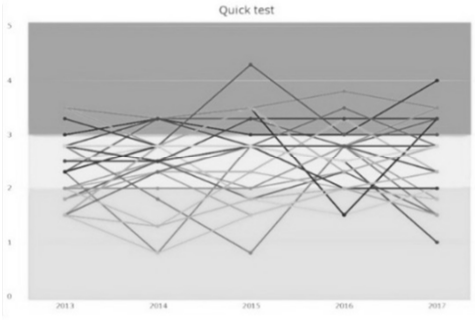
On the other hand, Altman's test is not perfect, because:

- the test uses unadjusted accounting data - it uses data from relatively small firms and it uses data that is around 60 years old,
- the test's predictive ability dropped off considerably from there with only 72% accuracy two years before failure, down to 48%, 29%, and 36% accuracy three, four, and five years before failure, respectively,
- the US-developed test is clearly not fully applicable to transforming economies, such as the economy of Slovakia and the Czech Republic.

**Quick test**

The FinAnalysis Quick test output is a table with total grades for individual years 2013-2017. As with Altman's test, we put these total grades in a graph. Our chosen program, FinAnalysis, have calculated Quick test´s resulting coefficients for years 2013-2017.

**Figure 6** Results of Quick test




Source: own calculations

Based on a Quick test, most companies are in the grey zone and, compared to the Altman's test, several companies are also located in the financial health zone.

Overall, based on the Quick test, we consider the industry to be in a grey zone with more fluctuations in the financial health than in the bankruptcy zone.

Like the Altman's test, the Quick test has the advantage that it allows for simultaneous consideration of several financial variables on the purpose of developing a bankruptcy prediction model. The advantage over the Altman's test is that Quick Test is designed for conditions in Europe and thus better displays the situation of businesses in Slovakia and the Czech Republic and it does not have weights assigned to individual indicators, so one very good indicator cannot change the overall results.

The main disadvantage of the all mentioned tests is that the connection between the value of financial ratios of bankrupt and likely will change over time as obsolete and outdated. They need to be redesigned to the current economic situation and each country should modify main models to its own conditions.

According to these tests, most of the beer production companies are located in the grey zone or in the risk zone. This may be because the trend in the world in recent years is that people increasingly consume beer from small breweries (choice of breweries, wheat beer, EJL, IPA, APA, and so on). Since these types of beers are demanded, breweries and restaurants are also tapping the beer and putting it to their own drink menu, resulting in even greater consumption of these beers. This means that demand for "classic" beers commonly available in bottles and cans produced in large quantities, is declining.

As a result, companies producing such beers should expand their offer to include the specialty beers mentioned above (as Šariš did in Slovakia and included its own EJL beer, which appeared in the brewery and restaurant for some time as "the choice of breweries") to increase their demand for products, and hence sales, to help repay liabilities.

We also have calculated the percentage of compliance of tests in calculating the financial health of companies in the industry of beer production. The highest match, up to 38%, has a Beaver's test with Quick Test. With the percentage of 23%, the Altman's test coincides with Quick test and with the percentage of 19% with Beaver's test. Only the 8% percent of the evaluation matched all three tests. At 12%, the tests did not agree at all.

## 5 Conclusions

In this paper we used chosen creditworthy and bankruptcy models - Beaver's test, Altman's test and Quick test for evaluating financial health of companies established in industry of beer production (SK NACE 11050) between period 2013-2017. The aim of the paper was to evaluate financial health of companies in Slovakia though selected mathematical-statistical methods and to compare them. We used program FinAnalysis version 2.19 SK and Finstat database to calculate situation of financial health of each company through Beaver's test, Altman's test and Quick test. We have found that most companies in the sector under review are located in the grey zone or in the bankruptcy zone. Based on the calculated results, we compared the examined models for compliance in the evaluating of financial health. We also pointed out the advantages and disadvantages of each model.

Future research can use alternative methods to diagnose the financial health of companies such as Data Envelopment Analysis.

## Acknowledgments

This paper was supported by VEGA project No. 1/0794/18.

## References

Altman, E. I. (1968). Financial ratios, discriminant analysis and the prediction of corporate bankruptcy. *The Journal of Finance*, vol. 23(4), pp. 589-609.

Beaver, W. H., Correia, M., McNichols, M. F. (2011). Financial statement analysis and the prediction of financial distress. *Foundations and Trends® in Accounting*, vol. 5(2), pp. 99-173.

Bellovary, J. L., Giacomino, Don E., Akers, M. D. (2007). A review of bankruptcy prediction studies: 1930 to present. *Journal of Financial education*, vol. 33, pp.1-42.

Bočánek, M. (2018). *FinAnalysis aplikace pro finanční analýzu firmy: Uživatelská příručka*. Plzeň, Atlantis PC s.r.o.

Kim, H., Gu, Z. (2006). A logistic regression analysis for predicting bankruptcy in the hospitality industry. *The Journal of Hospitality Financial Management*, vol. 14(1), pp. 17-34.

Kislingerová, E. (2008). *Finanční analýza krok za krokem*. 2. vydání. Nakladatelství CH Beck. ISBN 80-7179-321-3.

Kotulič, R., Király, P., Rajčániová, M. (2007). *Finančná analýza podniku*. 1. vydanie. Bratislava, lura Edition. ISBN 9788080781170.

Oreský, M. (2017). *Finančná a ekonomická analýza obchodného podniku*. 1. vydanie. Bratislava, Wolters Kluwer. ISBN 9788081687631.

Sanobar, A. (2012). Business bankruptcy prediction models: A significant study of the Altman's Z-score model. Available at SSRN 2128475, 2012.

# Bitcoin as a Panacea for the Venezuelan Crisis

**Agata Kliber[1], Katarzyna Świerczyńska[2]**

[1] Poznan University of Economics and Business
Faculty of Informatics and Electronic Economy, Department of Applied Mathematics
Al. Niepodległości 10, 61-875 Poznań, Poland
E-mail: agata.kliber@ue.poznan.pl

[2] Poznan University of Economics and Business
Faculty Economics, Department of Economic Journalism and Public Relations
Al. Niepodległości 10, 61-875 Poznań, Poland
E-mail: Katarzyna.swierczynska@ue.poznan.pl

***Abstract:*** *The aim of the article is to verify which asset: gold, oil or bitcoin can be considered a safe-haven in a crisis-driven Venezuela. Our study covers the period 01.05.2014-31.07.2018, as in August 2018 Venezuela changed its currency to Bolivar Soberano. We estimate a threshold vector autoregression model for the returns of all the above-specified assets, where the threshold variable was the return of Venezuelan Stock Exchange General Index (IBC). We allow for three regimes: the extreme upward movements of the index (the hype), the moderate behavior, and the extreme downward changes (the crisis). We verify whether the relationships between the three pairs of assets (IBC and gold, IBC and oil, IBC and bitcoin) change depending on the regime. We also assume that the error term from the regression model follows a GARCH model. Our results suggest that both gold and oil could have been considered a safe-haven asset in a crisis-driven Venezuela, as the instruments changed in the opposite direction to the IBC when the extreme downward movements of the index have been observed. Additionally, their volatility was much smaller and uncorrelated with the volatility of the IBC. Eventually, our results suggest that investing in bitcoin has been considered by the investors as an alternative to investment not only in the moments of the extreme changes of the index, but also in its "moderate" regime.*

*Keywords: safe haven asset, Bitcoin, Venezuela, crisis, gold*

*JEL codes: G01, GG11*

## 1 Introduction

The aim of the article is to verify which asset: gold, oil or bitcoin could have served best as a safe haven in Venezuela over the period 2014-2018. When creating a portfolio, an investor tries to minimize the risk by including various instruments which are likely to react in a different way to the changing market conditions. An asset that is negatively correlated with the main asset during the economic downturn is called a safe-haven. Presence of such assets in a portfolio allows for overcoming possible losses in the times of market turbulences.

In our study we aim at looking for such an asset – or group of assets – in a crisis-driven Venezuela. The country is specific due to its relative abundance of one of the most valued natural resources – oil. Venezuela was considered rich in the early 1960s, producing more than 10 percent of the world's crude and having a per capita GDP many times higher than that of its neighbors: Brazil and Colombia (see: Johnson, 2018). However, plummeting oil revenues (90% of the country export earnings came from oil up to 2014, while in 2015 over 60% of the government revenues depended on the oil industry – see e.g. Mu and Hu, 2018) and years of government mismanagement have killed off the country's economy and led to a humanitarian crisis. The government headed by Nicolás Maduro since 2013, declared a state of emergency in 2016. That year the inflation rate hit 800%. By 2018 inflation rate was an estimated 80,000% (Carmody, 2019). In such situation people started to trade US dollars in black market, as well as invest in cryptocurrencies. At the same time, about a year after oil production falling, economic collapse and mounting U.S. sanctions, the drop of national currency value, which made it

hard to access credit, Venezuelan government started to acquire gold form the citizens and began selling it abroad, i.a. to Turkey and United Arab Emirates (Pons and Armas, 2019).

There were several factors, mostly state-driven, which created the conditions for the rise of cryptocurrencies market during the economic turmoil in Venezuela. Under the socialist regime of President Maduro, electricity was so heavily subsidized that it became essentially free (Chun, 2018). Therefore, bitcoin mining turned out to be an investment at no cost. Despite the fact that in 2016 Maduro banned mining of bitcoin (and other cryptocurrencies), bitcoin trading was perfectly legal. In early 2018 the mining of cryptocurrencies became legal again, because the Government decided to launch the national cryptocurrency – Petro, backed by Venezuela's oil reserves (see: Suberg, 2018). In the extreme economic conditions, especially hyperinflation, the emergence of electronic exchanges enabled people to use cryptocurrencies in everyday life, even to buy groceries (Helms, 2019). Nowadays Venezuela is cryptocurrency investment leader in Latin America.

More and more authors aim at disentangling a problem whether bitcoin can be considered a safe-haven asset. The opinion of different scholars on investment properties of bitcoin varies, depending on the portfolio composition (stock indices, commodities, oil, etc.), data frequency (daily or weekly), and time span. Bouri et al. (2018) found that Bitcoin can act as a safe-haven against global financial stress. Some researchers suggest that cryptocurrencies reduce risks if included in portfolios of assets (Guesmi et al., 2018; Symitsi and Chalvatzis, 2019). On the other hand, Symitsi and Chalvatzis (2019) note, that the decrease in the overall portfolio risk due to the low correlation of bitcoin with other assets is not offset by its high volatility. Eventually, Kliber et al. (2019) claim, that bitcoin can act as a safe-haven only in a crisis-driven country, such as Venezuela, and when investment in local currency is analyzed.

There is a general consensus in the literature that gold is a proper safe-haven asset. Many researchers analyzed this with formal econometric models, proving causality between gold and stock market (see e.g. Baur and Lucey, 2010; Anand and Madhogaria, 2012; Coudert and Raymnd-Feingold, 2011, Liu et al., 2016 and many others). Such relationships have been tested on a number of world-wide markets including G7 countries (Coudert and Raymond-Feingold, 2011), BRICS (Mensi et al., 2018), and China (Hedi Aroui et al., 2015). This justifies including gold in the research. On the contrary, the possibility to treat oil as a safe haven is not equally evident. In the case of the mature German, US and Japanese markets it could be classified as a safe haven against equity (Nguyen and Liu, 2017). Yet, there are also works which show, that oil does not definitely play such a role for Chinese stock (Yang et al., 2018) and that it shows a high level of co-movement with BRICS stock indices (Mensi et al., 2018). Based on the mixed evidence, we decided to check whether it could be considered a safe-haven in Venezuela.

We switch to the most popular definition of safe-haven – i.e. the asset that is negatively correlated with the base one during the period of distress. Additionally, we consider the "safety" property of such an asset, assuming that its volatility should not exceed the volatility of the base one. Thus, we apply a threshold VAR model between stock index and each of the possible safe-haven assets, where the trigger variable was the stock index. We allow for three regimes: extreme upwards and downwards movement of the base asset and the regime of its "moderate" behaviour. Not to complicate the model, volatility is approximated by the squared returns of the residuals from the TVAR. We use daily data between 2014 and 2018 (in August 2018 Venezuela changed its currency to Bolivar Soberano – therefore we end our sample in this moment). The results suggest that the "classical" assets: such as gold and oil, have been indeed negatively correlated with the stock exchange returns during the moments of the extreme downward movements of the index. What is interesting, in the period of hyperinflation increasing oil prices seem to have affected the phenomenon. On the contrary, bitcoin could have been considered as an additional investment asset not only during the period of distress, but also in the middle regime. However, the magnitude of its volatility was similar to the

magnitude of IBC volatility, which means that the decrease in the overall portfolio risk due to the low correlation of bitcoin with the stock exchange, might have not been offset by its high overall risk level.

## 2 Methodology and Data

A safe haven asset is an asset that holds its value in adverse market conditions, offering investors the opportunity to protect wealth. The way of testing for safe-haven assets vary among scholars (see: Baur and Lucey, 2010; Bouri, 2017a-b; Dyhrberg, 2016a; Dyhrberg, 2016b; Shahzad et al. 2019; Klein et al., 2018; Baur et al., 2018; Smales, 2019). Our motivation was the approach of Baur and Lucey (2010) where the authors estimated a regression model for the returns of gold, where the explanatory variables were the returns of bonds and stocks, as well as the extreme negative returns of bonds and stocks. The authors concentrated on 1%, 2.5%, 5% lower quantiles. It was also assumed that the error term from the regression model follows an asymmetric GARCH model.

We modified the approach in the following way. We estimated a threshold VAR model between the IBC (stock index) and each of the possible safe-haven assets, where the trigger variable was the IBC. In this respect we followed Nguyen and Liu (2017), who claim that the linkages among the assets at the critical moments play an essential role for financial survivability, even if they are ephemeral. We allowed for three regimes that were estimated in the model based on the dynamics of the IBC. In this part we could verify whether the estimated regimes corresponded to the extreme up- and down-movement of the IBC as well as to its "moderate" behavior and whether the relationship with the safe-haven candidate changed in the regimes. As noted by Nguyen and Liu (2017) the asset selection in the normal market conditions does not necessarily apply to the critical market conditions. To assess risk of each potential safe-haven asset we used a non-parametric approximation of volatility – squares of the residuals. We compared their magnitudes with the volatility of the IBC.

We estimated a TVAR model for each pair: the IBC and gold, the IBC and oil and the IBC and the BTC. In each case we allowed for three regimes that were estimated based upon the data. The threshold variable was the IBC. In Figures 5-7 we present the values of the thresholds $\theta$ obtained for each data pair. In each case we checked whether the nature of the relationships changed together with the change of the regime. The estimated TVAR model has the following form:

$$Y_t = \begin{cases} \alpha_{1,1} + \alpha_{1,2} Y_{t-1} + u_{1,t}, & \theta \leq \theta_1 \\ \alpha_{2,1} + \alpha_{2,2} Y_{t-1} + u_{2,t}, & \theta_1 < \theta \leq \theta_2 \\ \alpha_{3,1} + \alpha_{3,2} Y_{t-1} + u_{3,t}, & \theta > \theta_2 \end{cases} \quad (1)$$

where $Y_t = \begin{bmatrix} GOLD_t \\ IBC_t \end{bmatrix}, Y_t = \begin{bmatrix} OIL_t \\ IBC_t \end{bmatrix}$ or $Y_t = \begin{bmatrix} BTC_t \\ IBC_t \end{bmatrix}$ in the case (1), (2), and (3) respectively. The first index in parameter $\alpha_{i,j}$ denotes the regime. To estimate the model, we used package tsDyn of R (Di Narco et al., 2009; Stigler, 2010). The model was estimated through maximizing the loglikelihood function and the optimal number of lags was chosen based on the BIC information criterion.

We collect the data on the development of the following magnitudes:

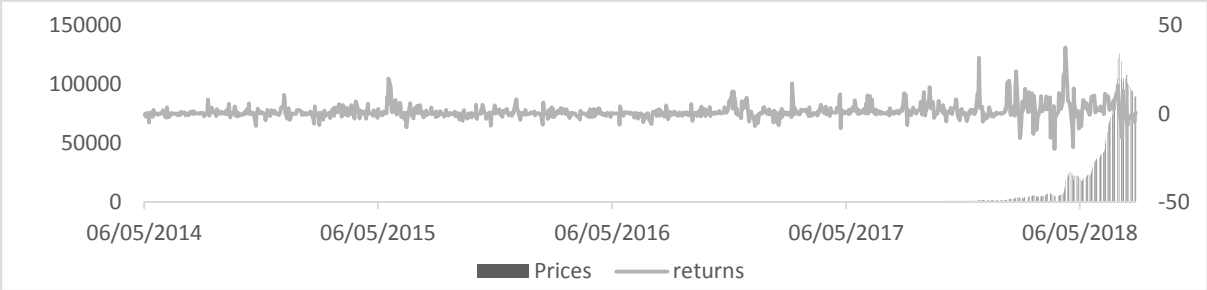
- Caracas Stock Exchange Main Index: IBC index[5],
- Gold price in US dollars,

[5] The IBC Index from the Caracas Stock Exchange (Venezuela), also known as the General Index, is a capitalization-weighted index of the 15 most liquid and highest capitalized stocks traded on the Caracas Stock Exchange (Bolsa de Valores de Caracas).

- Oil price in US dollars,
- Bitcoin price in bolivar fuerte (Local Bitcoins).

The data was taken daily and covered the period 01-05-2014 to 31-07-2018. The reason to end the sample in June 2018 was that on the 20th of August 2018 the official currency of Venezuela – bolivar fuerte (VEF) has been replaced by bolivar soberano (VES).

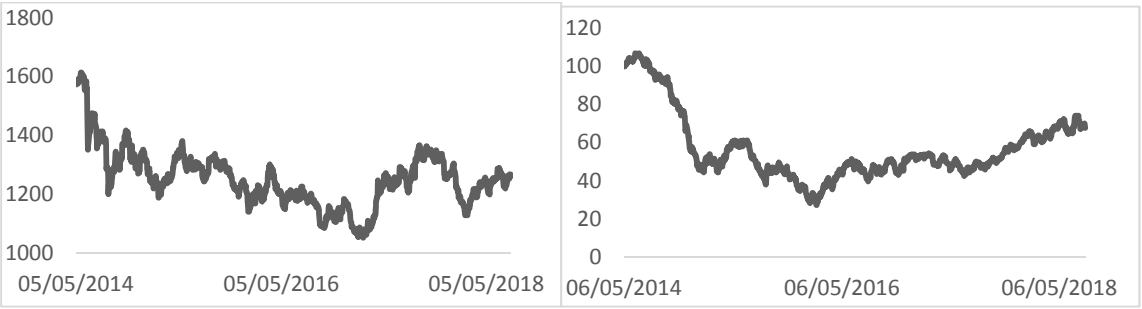
**Figure 7** Prices and Returns of the Main Index of Venezuela Stock Exchange




Source: CEIC database

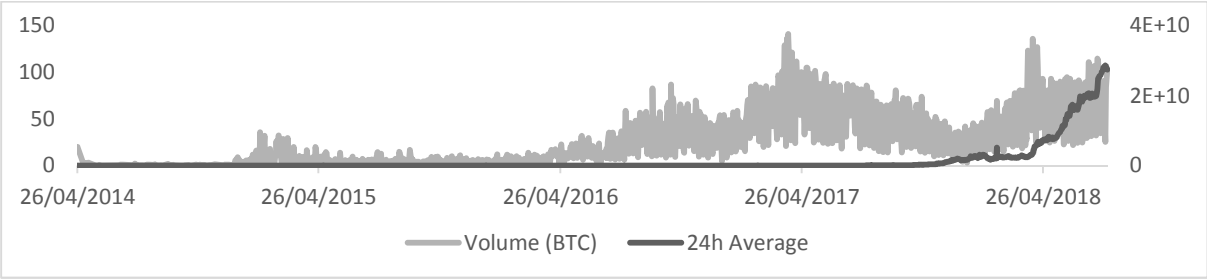
In Figure 1 we present the dynamics of the IBC index- the prices and log-returns. We can see that due to the hyperinflation the prices of the index exploded starting from the mid-2017. Due to the hyperinflation, jumping form 2,820% in 2017 to 12,870% in 2018, the value of the bolivar dropped drastically.

**Figure 8** Gold prices(left pane) and Oil Prices (right pane) in US Dollars over 2014-2018




Source: database stooq.pl

**Figure 3** 24hrs Average Price (right axis) and Volume (left axis) of Bitcoin Trade in Bolivars



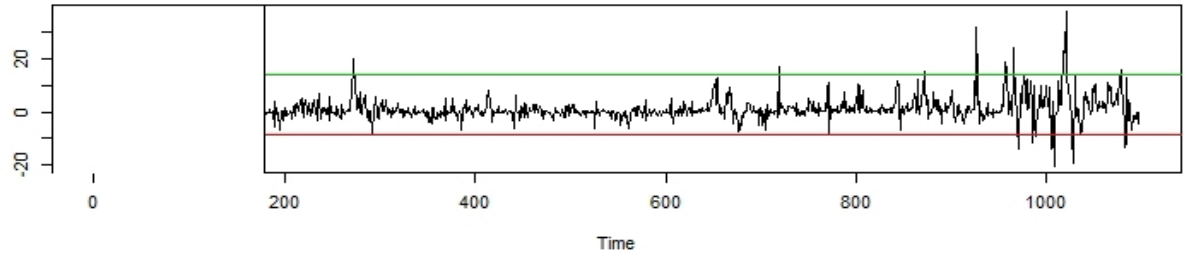

Source: localbitcoins

In Figures 2-3 we present the dynamics of prices of gold, oil, and bitcoin trade in bolivar, respectively. In the case of bitcoin, we also show the volume of trade, which had its peak in 2017.

## 3 Results and Discussion

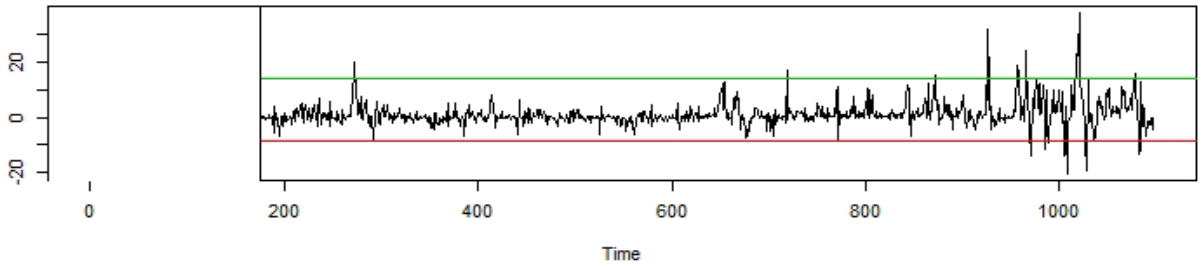
In Figures 4 to 6 we present the results of the threshold estimates. In the case of the IBC and gold, as well as the IBC and oil we observe that the upper and lower regimes indeed cover the extreme IBC movements – respectively: jumps and declines. The middle regime covers the "average" changes of the index. As the middle regime covers the average volatility of prices/returns, we assume it represents relative stability – "normal" conditions. Lower regime covers the drop of prices, while the upper, an extreme rise of prices, both representing the time of crisis. The latter associated with the hyperinflation in Venezuela. We observe that the most extreme upward and downward movements took place in the end part of the sample covering the years: 2017 and 2018 (the hyperinflation period).

**Figure 4** Threshold Values for the TVAR Model between IBC and GOLD



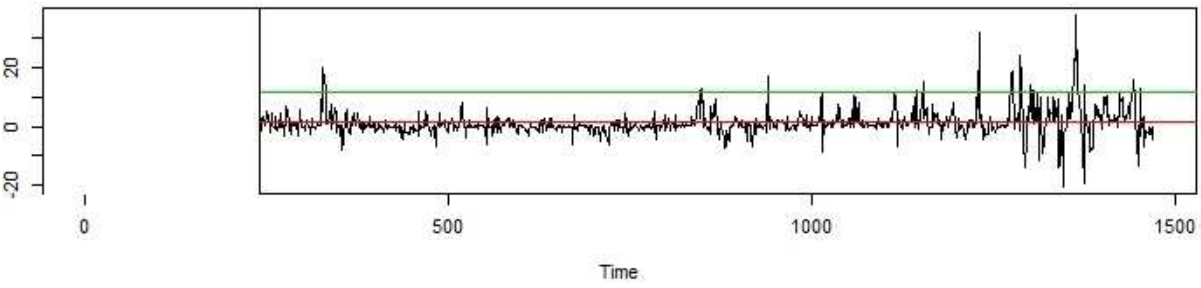

Source: own calculations using tsDyn package

**Figure 5** Threshold Values for the TVAR Model between IBC and OIL




Source: own calculations using tsDyn package

**Figure 6** Threshold Values for the TVAR Model between IBC and VEF-BTC (LocalBitcoins)




Source: own calculations using tsDyn package

On the contrary, the regimes estimated for the pair IBC-bitcoin are shifted when compared to the two previous cases. The "lower" and "middle" regimes contain similar number of observations, while the "upper" one covers the highest jumps of the IBC. We can suppose that this model correctly distinguishes the period of hyperinflation.

In Tables 1 - 3 we present the estimates of the TVAR model. In the case of gold (Table 1) and oil (Table 2), we can see that only changes of the IBC could depend on changes in

the other asset, not the other way around – which is a sound conclusion. Moreover, in the lower and upper regime the changes of the IBC were inversely correlated with the changes of gold (i.e. increases of gold were followed by the declines of the IBC and declines of gold by the increases of the IBC). As in the period of distress we observed not only declines but also increases of the IBC, this result can support the thesis that gold could have been a safe-haven asset in Venezuela in the analysed period. Distinctively, increasing prices of oil could have also speeded up the inflation in Venezuela – as we observe positive relationships between the changes of oil and IBC prices. The strength of relationships in lower regime, measured by *p*-value was weaker in the case of the IBC-oil pair than in the analogous regime of IBC-gold pair. What is interesting – in the "normal" situation no interrelations between the assets have been observed.

**Table 10**. TVAR model estimates: GOLD and IBC

| **REGIME:** | **Equation:** | | **Intercept** | **GOLD(-1)** | **IBC(-1)** |
|---|---|---|---|---|---|
| **REGIME [1]** | GOLD | parameter | 0.8922 | -0.058 | 0.093 |
| **(IBC ≤ -8.58)** | | (t stat) | (-0.9132) | (-0.2633) | (-0.0679) |
| | IBC | parameter | -14.4641 | -2.2891 | -1.0326 |
| | | (t stat) | (3.9640)*** | (1.1431)* | (0.2947)*** |
| **REGIME [2]** | GOLD | parameter | 0.0141 | -0.0297 | -0.0158 |
| **(-8.58;14.16)** | | (t stat) | (-0.0261) | (-0.0305) | (0.0083). |
| | IBC | parameter | 0.463 | -0.1319 | 0.4367 |
| | | (t stat) | (0.1132)*** | (-0.1325) | (0.0361)*** |
| **REGIME [3]** | GOLD | parameter | -0.2202 | -0.2805 | 0.0012 |
| **(IBC≥14.16)** | | (t stat) | (-0.696) | (-0.3168) | (-0.033) |
| | IBC | parameter | 8.6207 | -3.6737 | 0.2752 |
| | | (t stat) | (3.0213)** | (1.3750)** | (0.1431). |

Source: own computation; Note: . – denotes 10% significance level, * - 5%, **- 1%, ***- 0.1%

**Table 11**. TVAR model estimates: OIL and IBC

| **REGIME** | | | **Intercept** | **OIL(-1)** | **IBC(-1)** |
|---|---|---|---|---|---|
| **REGIME [1]** | OIL | parameter | 0.3264 | 0.0893 | 0.0889 |
| **(IBC ≤ -8.58)** | | (t stat) | (-2.4685) | (-0.3056) | (-0.1838) |
| | IBC | parameter | -15.5453 | -0.9449 | -1.1372 |
| | | (t stat) | (3.9792)*** | (0.4926). | (0.2962)*** |
| **REGIME [2]** | OIL | parameter | -0.0389 | 0.0484 | 0.0149 |
| **(-8.58;14.16)** | | (t stat) | (-0.0703) | (-0.0305) | (-0.0224) |
| | IBC | parameter | 0.4633 | 0.0203 | 0.4381 |
| | | (t stat) | (0.1134)*** | (-0.0492) | (0.0361)*** |
| **REGIME [3]** | OIL | parameter | 0.03252 | 0.2522 | 0.0317 |
| **(IBC≥14.16)** | | (t stat) | (-1.8777) | (-0.411) | (-0.0889) |
| | IBC | parameter | 8.649 | 1.42 | 0.2446 |
| | | (t stat) | (3.0269)** | (0.6625)* | (0.1433). |

Source: own computation; Note: . – denotes 10% significance level, * - 5%, **- 1%, ***- 0.1%

Eventually, the results presented in Table 3 for the pair IBC-BTC are a little bit puzzling. First of all, the intercept in upper regime is negative, while in the lower one – positive. As the threshold variable was lagged by one day, we can read this result as an evidence of very high volatility in the upper regime, since the high values of the IBC were immediately followed by the deep declines. Moreover, in the lower regime, no dependence between the variables have been identified. In the middle regime, the variables changed in the same direction, while in the upper (crisis) one – changes in bitcoin prices seemed to follow the changes in IBC, but also in the same direction. Thus, bitcoin (traded in bolivars) could have served rather as a diversifier and additional way of earnings, than as a safe-haven asset.

**Table 12**. TVAR model estimates: BTC(VEF) and IBC

| REGIME | | | Intercept | BTC(-1) | IBC(-1) |
|---|---|---|---|---|---|
| **REGIME [1] (IBC ≤ 1.24)** | BTC | parameter | 0.9764 | 0.4225 | 0.1081 |
| | | (t stat) | (0.2384)*** | (0.0307)*** | (-0.109) |
| | IBC | parameter | 0.042 | 0.0082 | 0.2919 |
| | | (t stat) | (-0.1033) | (-0.0133) | (0.0473)*** |
| **REGIME [2] (1.243;11.65)** | BTC | parameter | 1.6066 | 0.0578 | 0.0089 |
| | | (t stat) | (0.6108)** | (-0.0445) | (-0.1294) |
| | IBC | parameter | 0.3292 | 0.0558 | 0.6592 |
| | | (t stat) | (-0.2647) | (0.0193)** | (0.0561)*** |
| **REGIME [3] (IBC≥11.65)** | BTC | parameter | -11.9503 | -0.7367 | 0.7837 |
| | | (t stat) | (4.0275)** | ((0.0716)*** | (0.2126)*** |
| | IBC | parameter | -5.5108 | -0.0052 | 1.0258 |
| | | (t stat) | (1.7456)** | (-0.031) | (0.0921)*** |

Source: please provide a source; Note: . – denotes 10% significance level, * - 5%, **- 1%, ***- 0.1%

Our results indicate, that in the time of crisis IBC fall was preceded by the rise in gold and oil prices (Table 4). On the other hand, the IBC rise in the conditions of hyperinflation is preceded by the drop in the gold prices and rise in oil prices. This means that the Venezuelan market is responsive to any changes in gold prices, but in the case of oil, it is susceptible especially to the rise of prices. This supports the results of Yang et al. (2018).

**Table 4**. TVAR model comparative results for selected pairs of variables

| | **Regime:** | **IBC \| Gold** | | **IBC \| Oil** | | **IBC \| BTC** | | | **BTC \| IBC** | |
|---|---|---|---|---|---|---|---|---|---|---|
| IBC | lower | - | + | - | + | | | BTC | | |
| | middle | | | | | + - | + - | | | |
| | upper | + | - | + | + | | | | + | + |

Source: own elaboration based on the results.

Note: + and – signs denote respectively: changes of variables in the same and opposite directions.

At the same time, our results indicate that relationships between bitcoin and IBC are of very different nature. First of all, the model did not distinguish a clear "lower" regime (see: Figure 6), which could have affected our conclusions. However, it revealed that bitcoin and the IBC are correlated in the normal market conditions: IBC price follows the BTC ups and downs. Moreover, in the period of hyperinflation, the rise in the BTC prices was preceded with the IBC rise. This can support the thesis that bitcoin has become an alternative mean of value storage in Venezuela.

The results are supported by the comparison of volatilities of each pair of the assets, approximated with the squares of residuals from the TVAR models. For the sake of consistency, the charts are presented in the Appendix. The analysis reveals that the volatility of gold and oil is much smaller than the volatility of IBC, while the volatility of bitcoin even exceeded the volatility of IBC. Thus, if we include into the definition of safe haven the condition that risk of such asset should be smaller than the risk of the underlying one, we should conclude that gold used to be the best candidate.

## 4 Conclusions

Due to hyperinflation, the bolivars became practically useless. Therefore, Venezuelans started to sell their jewelry to survive. At the same time, the Government encouraged them rather to invest in gold (Alex, 2018). Moreover, the state started to pay a premium over international prices to make it worthwhile for those who could smuggle gold out of the country to exchange it for dollars (see: Business Today, 2019). Gradually, instead of using bolivars, Venezuelans started to pay in dollars, which in fact has two exchange

rates – the official one and the black market one. Bitcoin became an alternative. The popularity of bitcoin in Venezuela boomed when prices of energy were so low, that mining of cryptocurrencies had become rather costless. After the ban on bitcoin mining, people were still able to exchange it in electronic platforms. LocalBitcoins was the first one which offered trade in local currency and in local language.

In our study we investigated whether gold, oil or bitcoin could have been treated as a safe-haven asset in Venezuela over the period 2014-2018. We estimated a threshold vector autoregression model for the returns of gold, oil, and bitcoin, where the threshold variable was the return of Venezuelan Stock Exchange General Index (IBC). We allowed for three regimes: the extreme upward movements of the index (the hype), the moderate behavior (normal), and the extreme downward changes (the crisis). We concluded, that gold was a better safe haven than oil for Venezuelan investors, while btcoin could have been considered merely a weak safe haven. Gold proved to be negatively correlated with the IBC only in the moment of the extreme upward and downward movements of the main stock index, while bitcoin used to move in the same direction in the middle and high regime.

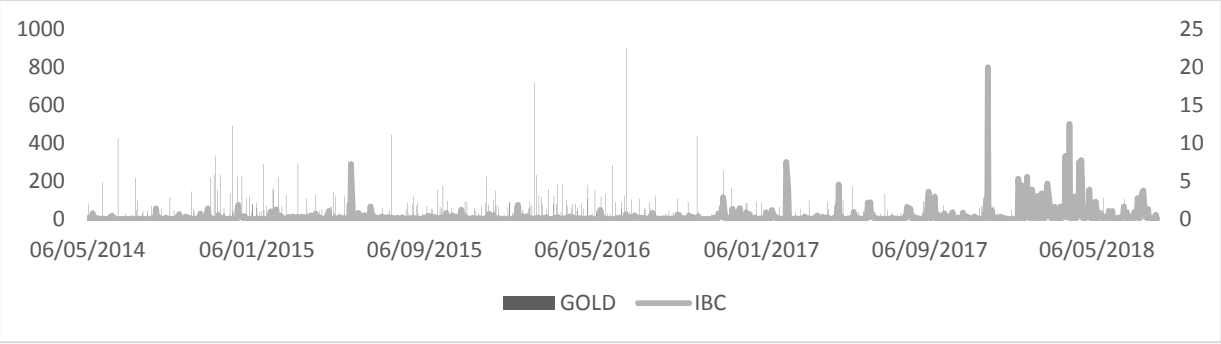
The results of our analysis suggest that bitcoin in fact could have become an alternative storage of value, used in everyday life, while gold still seem to be the asset of last resort, that is used in most extreme situations only. Eventually, we must stress out that our model for the pair BTS and IBC did not allow us to distinguish the regime of the most-extreme downward changes, which could be explained by the fact that another type of dependencies dominated. However, our previous findings, where the extreme-low regime was forced, suggests that also in the case of most extreme downward movements of IBC, negative relationships with BTC are observed (Kliber et al., 2019). Lastly, and surprisingly, we found that the rise of oil prices could have had a negative effect on Venezuela, because it could accelerate the hyperinflation and deepen the crisis.

## Acknowledgments

The research is supported by the Poznan University of Economics and Business under the interdepartmental research grant "The future of money: cryptocurrencies, local money and cashless society".

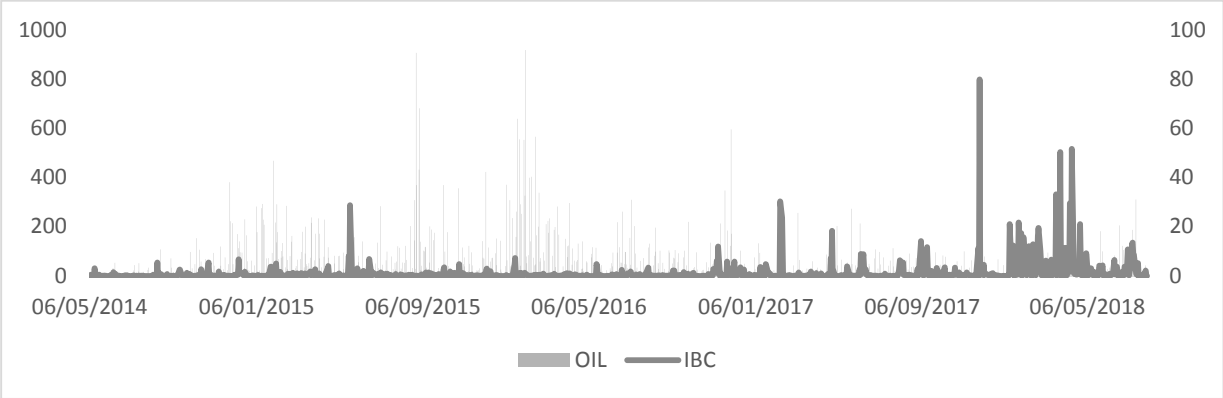
### Appendix

**Figure 7** Comparison of Volatilities of Gold (right axis) and IBC (left axis) – Approximated with Squared Residuals from the TVAR Model



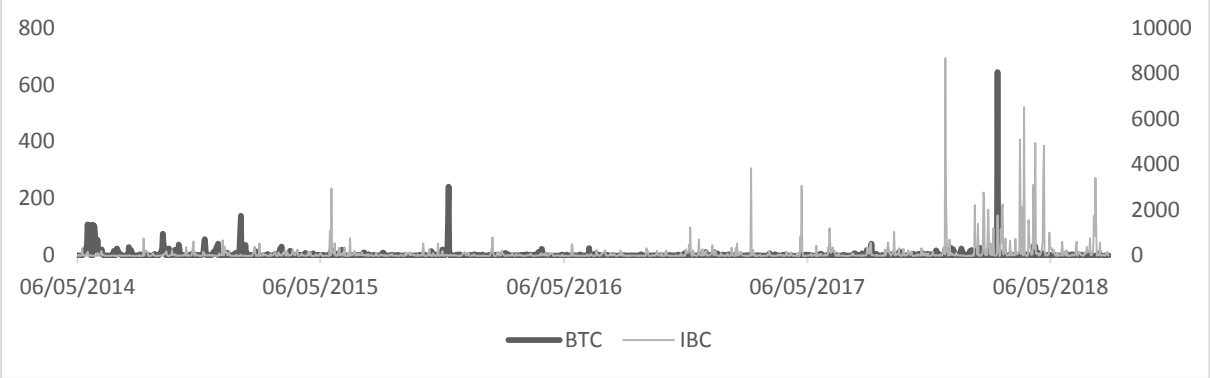

Source: author´s

**Figure 8** Comparison of Volatilities of Oil (right axis) and IBC (left axis) – Approximated with Squared Residuals from the TVAR Model




Source: author´s

**Figure 99** Comparison of Volatilities of Bitcoin (right axis) and IBC (left axis) – Approximated with Squared Residuals from the TVAR Model




Source: author´s

## References

Alex, G. O. (2018). *Hungry Venezuelans are selling gold rings and family heirlooms just to buy groceries.* Miami Herald. Retrieved from: https://www.miamiherald.com/news/nation-world/world/americas/venezuela/article222199935.html.

Anand, R., Madhogaria, S. (2012). Is Gold A Safe-Haven? – An Econometric Analysis. *Procedia Economics and Finance*, vol. 1, pp. 24 – 33.

Baur, D. G., Lucey, B. M. (2010). Is gold a hedge or a safe haven? An Analysis of Stocks, Bonds and Gold. *Financial Review*, vol. 45, pp. 217–229.

Baur, D. G., Dimpfl, T., Kuck, K. (2018). Bitcoin, gold and the US dollar – A replication and extension. *Finance Research Letters*, vol. 25, pp. 103-110.

Bouri E., Jalkh N., Molnár P., Roubaud D. (2017a). Bitcoin for energy commodities before and after the December 2013 crash: Diversifier, hedge or more? *Applied Economics*, vol. 49(50), pp. 5063-5073. DOI: http://dx.doi.org/10.1080/00036846.2017.1299102.

Bouri, E., Gupta, R., Lau, C. K. M., Roubaud, D., Wang, S. (2018). Bitcoin and Global Financial Stress: A Copula-Based Approach to Dependence and Causality in the Quantiles. *Quarterly Review of Economics and Finance*, vol. 69, pp. 297–307.

Bouri, E., Molnar, P., Azzi, G., Roubaud, D., Hagforse, L. (2017b). On the hedge and safe haven properties of Bitcoin: Is it really more than a diversifier? *Finance Research Letters*, vol. 20, pp. 192-198.

Business Today (2019). *Here's how Venezuela is turning its worthless bank notes into gold*. Retrieved from: https://www.businesstoday.in/top-story/how-venezuela-turns-its-worthless-bank-notes-into-gold/story/318441.html.

Carmody, M. (2019). *What Caused Hyperinflation in Venezuela. The Conversation*. Retrieved from: http://theconversation.com/what-caused-hyperinflation-in-venezuela-a-rare-blend-of-public-ineptitude-and-private-enterprise-102483.

Chun, R. (2017). *Big in Venezuela: Bitcoin Mining*. The Atlantic. Retrieved from: https://www.theatlantic.com/magazine/archive/2017/09/big-in-venezuela/534177/.

Coudert, V., Raymond-Feingold, H. (2011). Gold and Financial Assets: Are There Any Safe Havens in Bear Markets? *Economics Bulletin,* vol. 31(2), pp. 1613–1622.

Di Narco, A. F., Aznarte, J. L., Stigler, M. (2009). tsDyn: Time series analysis based on dynamical systems theory.

Dyhrberg, A. H. (2016a). Bitcoin, Gold and the Dollar – A GARCH Volatility Analysis. *Finance Research Letters*, vol. 16, pp. 85–92.

Dyhrberg, A. H. (2016b). Hedging capabilities of Bitcoin. Is it the virtual gold? *Finance Research Letters*, vol. 16, pp. 139–144.

El Hedi Arouri, M., Lahiani, A., Nguyen, D. K. (2015). World Gold Prices and Stock Returns in China: Insights for Hedging and Diversification Strategies. *Economic Modelling*, vol. 44, pp. 273–282.

Helms, K. (2019). *Venezuelan explains how bitcoin saved his family*. Bitcoin.com News. Retrieved from: https://news.bitcoin.com/venezuelan-bitcoin-saves-family/.

Johnson, K. (2018). *How Venezuela Struck it poor*. The Foreign Policy. Retrieved from: https://foreignpolicy.com/2018/07/16/how-venezuela-struck-it-poor-oil-energy-chavez/.

Klein, T., Thu, H. P., Walther, T. (2018). Bitcoin is not the New Gold – A comparison of volatility, correlation, and portfolio performance. *International Review of Financial Analysis*, vol. 59, pp. 105-116. DOI: https://doi.org/10.1016/j.irfa.2018.07.010.

Kliber, A., Marszałek, P., Musiałkowska, I., Świerczyńska, K. (2019). Bitcoin: Safe Haven Hedge or Diversifier? Perception of Bitcoin in the Context of a Country's Economic Situation. *Physica A*, vol. 524, pp. 246-257.

Liu, C.-S., Chang, M.-S., Wu, X., Chui, C. M. (2016). Hedges or Safe Havens--Revisit the Role of Gold and USD against Stock: A Multivariate Extended Skew-t Copula Approach. *Quantitative Finance*, vol. 16(11), pp. 1763-1789. DOI: https://doi.org/http://www.tandfonline.com/loi/rquf20.

Mensi, W., Hkiri, B., Al-Yahyaee, K. H., Kang, S. H. (2018). Analyzing Time-Frequency Co-movements across Gold and Oil Prices with BRICS Stock Markets: A VaR Based on Wavelet Approach. *International Review of Economics and Finance*, vol. 54, pp. 74–102.

Mu, X. Z., Hu, G. W. (2018). Analysis of Venezuela's oil-oriented economy: from the perspective of entropy. *Petroleum Science*, vol. 15, pp. 200-209. DOI: https://doi.org/10.1007/s12182-018-0215-4.

Nguyen, P., Liu, W. (2017). Time-Varying Linkage of Possible Safe Haven Assets: A Cross-Market and Cross-Asset Analysis. *International Review of Finance,* vol. 17(1), pp. 43–76.

Pons, C., Armas, M. (2019). Venezuela sold 73 tonnes of gold to Turkey, UAE last year: legislator, Reuers. Retrieved from: https://www.reuters.com/article/us-venezuela-politics-gold/venezuela-sold-73-tonnes-of-gold-to-turkey-uae-last-year-legislator-idUSKCN1PV1XE.

Shahzad, S. J. H., Bouri, E., Roubaud, D., Kristoufek, L., Lucey, B. (2019). Is Bitcoin a better safe-haven investment than gold and commodities? *International Review of Financial Analysis* (in press). DOI: https://doi.org/10.1016/j.irfa.2019.01.002.

Symitsi, E., Chalvatzis,K.J. (2019). The economic value of Bitcoin: A portfolio analysis of currencies, gold, oil and stocks. Research in International Business and Finance, vol.48, pp. 97-110. DOI: https://doi.org/10.1016/j.ribaf.2018.12.001.

Smales, L. A. (2019). Bitcoin as a safe haven: Is it even worth considering? *Finance Research Letters* (in press). DOI: https://doi.org/10.1016/j.frl.2018.11.002.

Stigler, M. (2010). tsDyn: Threshold cointegration: overview and implementation in R.

Suberg, W. (2018). Venezuela Says Crypto Mining Now 'Perfectly Legal,' Announces Petro Presale. *Cointelegraph*. Retrieved from: https://cointelegraph.com/news/venezuela-says-crypto-mining-now-perfectly-legal-announces-petro-presale.

Yang, L., Tian, S., Yang, W., Xu, M., Hamori, S. (2018). Dependence Structures between Chinese Stock Markets and the International Financial Market: Evidence from a Wavelet-Based Quantile Regression Approach. *North American Journal of Economics and Finance*, vol. 45, pp. 116–137.

# FinTechs as Alternative Financial Market Players

**Monika Klimontowicz[1], Krystyna Mitręga-Niestrój[2]**

[1] University of Economics in Katowice
Department of Banking and Financial Markets
ul. 1 Maja 50, 40-287 Katowice, Poland
E-mail: monika.klimontowicz@ue.katowice.pl

[2] University of Economics in Katowice
Department of Banking and Financial Markets
ul. 1 Maja 50, 40-287 Katowice, Poland
E-mail: krystyna.mitrega-niestroj@ue.katowice.pl

***Abstract:*** *The dynamic development of technology has resulted in changing customer needs, expectations and market behaviour. As a result bank and other financial entities were forced to change their product and distribution policy. Among external factors influencing banking market conditions, the dynamic development of nonbank technology-oriented service providers is thought to be one of the highest potentials to impact the market structure. This trend is also visible in Poland, where development of FinTech companies in different financial services market areas is noticable. The paper presents different approaches to the FinTech phenomenon. It shows the taxonomy of the FinTech companies and analysis the segments of financial markets which are characterised by low market entry barriers. The main aim of the article is to outline the Polish FinTech landscape – to characterise the FinTech market, showing main participants, drivers of development and challanges. The research method includes inductive and deductive methods, together with comparative analysis.*

*Keywords: FinTech, financial innovations, new technology, financial services*

*JEL codes: G2, L8, O3*

## 1 Introduction

FinTech is one of the phenomena which are involving much interest and debate in modern finance. Alongside the term FinTech which stands for Finance + Technology, other neologisms are appearing: InsurTech, PropTech, Wealthtech, RegTech, LegalTech, BigTech etc. (BBVA, 2018). FinTech is a highly emergent phenomenon and there is a lack of a commonly accepted definition in both theory and practice. At the same time, narrow and broad approaches to this concept can be distinguished. A. L. Bettinger, the Vice President bank Manufacturers Hanover Trust, was the first to use the term FinTech, as an acronym for financial technology, which combines bank expertise with management techniques and the use of computers (Schueffel, 2016). Independently, the same term was used at the beginning of the '90s as a name of one of Citigroup's projects which assumed the bank's technological cooperation with players outside the financial sector (Kerényi and Molnár, 2017).

Although Fintech is a very contemporary phenomenon, its pra-genesis is very distant in the time since from the very beginning, the development of finance progressed along with the development of technology.

In the broadest sense according to Arner et al. (2015) the term FinTech "refers to the application of technology to finance". A similar approach could be found in KPMG publications - Fintech as "a portmanteau of finance and technology" (KPMG, 2018). According to Dimler et al. (2018), it is the industry in which financial services are changed with technology. A broad understanding of the term may be found in the work of Das (2018) who considers it as "any technology that eliminates or reduces the of costs financial intermediation". Financial Stability Board (2019) understands Fintech in terms of innovation and states that it is a "technology-enabled innovation in financial services" which could lead to new business models, services, products, applications, processes in the area of financial services. In this broad sense of the term, FinTech (or FinTechs)

refers to both entities that use technology and operate inside and outside of the traditional, regulated financial system and offer financial services. These entities such as banks and technology companies, can both - compete, cooperate or have a coopetitive relationship on the financial services market.

However, many definitions have a narrower approach to FinTech and emphasis the new actors involved in this "industry". The World Economic Forum (2017) considers FinTech as "new entrants that promised to rapidly reshape how financial products were structured, provisioned and consumed". The new entrants mentioned above are understood as market participants outside the traditional financial system that recently entered a market, use innovative technologies and change financial services' business models. The FinTechs, however, are not only specialised startups (although they play a major role in the development of the "FinTech industry") but also grownups *(*maturing firms) which "enable, enhance and disrupt financial services" using innovative technology (EY, 2017). The three different approaches to FinTech are shown in Table 1. It should be mentioned however that the competitive impact of the third group of entities in financial services is rising, namely the BigTechs. These large, established technology companies (such as Amazon, Apple and Google), as Financial Stability Board states could "alter the universe of financial services providers" (Financial Stability Board, 2019).

**Table 1** Three approaches to FinTech

| **BROAD OBJECT-ORIENTED APPROACH** | **FINTECH** NARROW SUBJECT-ORIENTED APPROACH | MIXED APPROACH |
|---|---|---|
| **Traditional financial institutions and new entrants outside the financial system** | Entities, also new entrants - not traditional financial services providers | Cooperation/coopetition among traditional financial institutions and new entrants outside the financial system |
| **use innovative technologies to deliver existing financial services and create new ones more effectively, which enable to deliver new value to customers** | | |

Source: based on Harasim and Mitręga-Niestrój (2018)

FinTech disrupts three main areas of financial services, involving: 1) financing, 2) savings and investment, and 3) money transfers and payments. Fintech covers an expanding range of services and products, such as for e.g.: p2p lending platforms, crowdfunding, p2p transfers, digital exchange platforms, robotic trading, digital currencies (Stamegna and Karakas, 2019). The FinTech industry is evolving with the innovative technologies, which among others enable to respond better to consumer needs, to make financial transactions among different parties more accessible, user-friendly, flexible, safer and improve their experiences, alongside with optimization of costs (Gromek, 2018). The technologies developed by FinTechs include among others: BigData analytics, blockchain, Artificial Intelligence (AI), Biometrics Recognition, Internet of Things. In addition to the technology there are other drivers propelling FinTech's growth, such as i.a.:

- customer demand, particularly amongst millennials, for fast, convenient, low-cost financial services, also influenced by e-commerce expansion, visible not only in developed countries but the emerging market and frontier economies too, and additionally reinforced by the post-crisis loss of confidence in traditional financial institutions. (Financial Stability Board, 2017);
- a more friendly and proactive approach to FinTech by financial regulatory and supervisory authorities and governments in many countries.

The technology, which is the key enabler of FinTech development, allows IT companies to compete with traditional financial institutions, mainly banks. This leads to the creation of a completely new ecosystem for the provision of financial services and this evolution is also visible in Poland, where FinTech is developing very dynamically. Polish consumers positively embrace the trend of digitalization and want to use innovative financial services.

Such services are offered in Poland both by start-ups and by mature, supervised entities, e.g. banks, payment institutions, insurance companies and investment firms (KNF, 2018). The Polish experience in this field may be the inspiration for other European and non-European financial markets.

The main aim of the article is to outline the Polish FinTech landscape – to characterise the FinTech market, showing main participants, drivers of development and challenges.

## 2 Methodology and Data

The phenomenon of FinTech is a new field of research. Its multidimensional character causes the necessity to apply different research method including both inductive and deductive methods, together with comparative analysis. The theoretical analysis of term and definitions conducted in this paper was based on in-depth literature review including scientific articles and papers on new financial market players, FinTechs and other non-bank institutions, research reports, websites of domestic and foreign organisations dealing with FinTechs and financial innovations. In this part of the paper, the inductive method and comparative analysis were mostly applied.

The empirical part of the paper includes the analysis of quantitative data gathered during empirical research conducted by the Financial Stability Board, Accenture, Cashless Poland, FinTech Poland, Deloitte. This analysis is primarily based on deductive methods - descriptive statistical methods and comparative analysis. The calculations were made using the Statistica.

## 3 The Polish Financial Technology Market - Results and Discussion

The financial technology market analysis includes the characteristic of FinTech entities, products and services provided by FinTechs, their customers' target group and prerequisites for their further development.

The Polish financial technology market includes the following main segments:

- banks and their FinTech accelerators;
- interbank entities;
- nonbank entities;
- insurance companies (InsurTech).

It is assumed that in the nearest future the next segment of neobanks/challenger banks will appear (Cashless.pl et al., 2018).

Banks operating in the Polish financial market have been very active in technology and innovations' implementations since the early '90s last century. Primary they used their internal resources in the process of creating and implementing new solutions to the market (in-house model). The banks are great examples of ventures that are driving innovation. They constantly invest in improvements and novelties in various areas, such as modern sales channels (including online channels), remote client service technologies, digitalization of traditional branches or new payment methods. Today they apply different business models as FinTech takeovers, cooperation (outsourcing) and coopetition. The new field of banks' activity is managing innovations' accelerators. Such accelerators enable banks to boost innovations with control over the ideas' development and attract new talents. Additionally, the time-to-market process is shortened as the ideas, capital and other resources are cumulated in one place.

The development of the Polish financial technology market is supported by the activity of interbank companies that provides services for banks and intermediate between banks and their customers. The most important in this group are the National Clearing House (KIR), the Polish Payment Standards (PSP) and online payment integrators. The KIR has been implementing FinTech projects since the very beginning of technology application in the banking market. Today, as a result of PSDII implementation, KIR is involved in the project focused on building communication hub between banks and third-party providers. The next, PSP is an example of coopetition between banks. It was established by six

largest banks operating in the Polish banking market and is open for other banks. PSP is the operator of BLIK, a Polish mobile payment system and scheme. The last group of interbank initiatives consists of integrators of online payments. Those entities offer customers the possibility to choose the most convenient payment method as payment transfer, card payment or BLIK payment. The specific for Polish market is the instant online payment called pay-by-link enabling connection with a bank which manages a client's personal account. Taking into account money transfers' safety and speed, it is thought to be one of the leading European online payment method (Cashless.pl et al., 2018).

Not only financial institutions have recognised the market potential of FinTech projects. If the payments, customer identification, and offer personalisation is a key factor of market success, the implementation of innovations using financial technologies is observed.

InsurTech is the smallest part of the market. They are highly specialised and include entities offering the solutions for insurance companies as for example Screenity of Play Insurance platform.

The key banks, interbank and nonbanks' FinTech projects are presented in table 2.

**Table 2** The selected initiatives in the main segments of the FinTech market

| BANKS AND THEIR ACCELERATORS | INTERBANK FINTECH | NONBANK FINTECHS |
|---|---|---|
| HUGE THING, Poczta Polska, Bank Pocztowy, ING, Społeczny StartUp, Bank Pekao, UniCredit Foundation, Bank Zachodni WBK, Grupa Santander, Accelerator, ELEVATOR LAB | blik, mojeID, Wpłatomat, CHMURA FAKTUR, płacę online imoje, goodie, KIR, PayByNet | FLOTA, Planet mobile, mobile, OPEN PAYMENT SYSTEM, 1, PLAY Ubezpieczenia, screenity, YU! PAY HOW YU! DRIVE, Bilkom, U |

Source: Own work based on Widawski and Brakoniecki (2017), Cashless.pl et al. (2018)

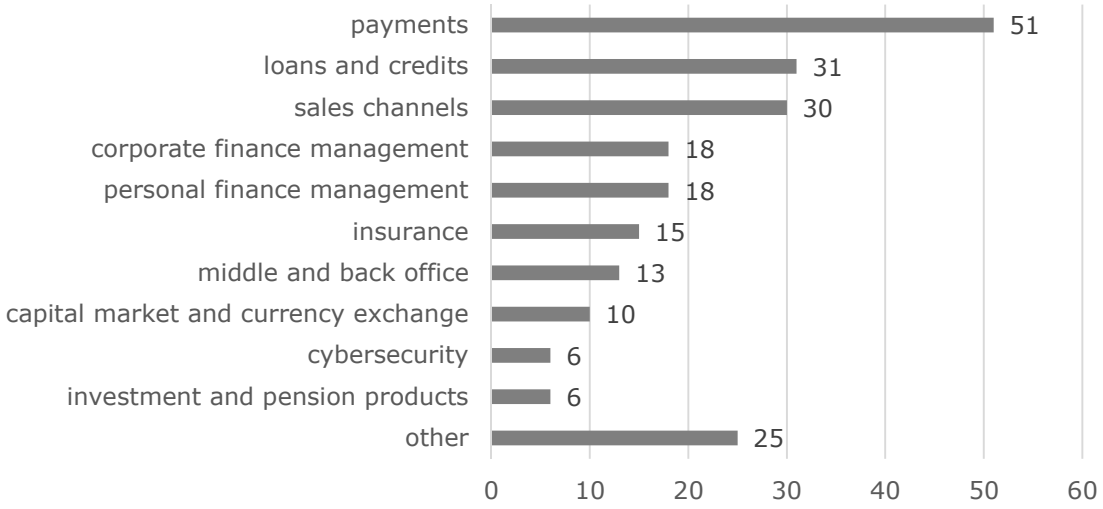
According to Deloitte Poland has the biggest FinTech market (embracing IT solutions dedicated to the financial sector both from traditional and non-traditional entities) in Central and Eastern Europe, with an estimated value of EUR 856 million in 2016 (Deloitte, 2016). The non-banking FinTech sector was estimated to reach net profit from EUR 10.5 to 14 million in 2017 (Piechowiak, 2018).

In Poland, there are about 200 FinTech startups. According to research conducted by the Cashless portal in cooperation with FinTech Poland and Accenture, 60% of them have been present on the market for less than five years, and only 3% have been present on the market for more than 20 years. Their future depends primarily on customer trust, relaxation of legal regulations and good financing (Skwierawska, 2019).

FinTech operates in following areas of financial services: payments, loans and credits, insurance, capital market and currency exchange, personal and corporate finance management, cybersecurity, middle or back office, and sales channels. Over half of Polish FinTechs (51%) operate in the area of payments, 31% in the area of loans and credits, and 30% develop new sales channels. Only 6% operate in the very promising area of cybersecurity (see Figure 1). Payments have become one of the daily activity. Those results may be also confirmed by a systematic increase in the number of banks

customers using their internet and mobile services. Searching for value creation and delivery FinTechs use the broad spectrum of technologies. The main tool pointed out by them was API (69% responders) as a basic communication mechanism. It was followed by: intelligence automation/data science (45% responders), Big Data (37% responders), eID – identity verification (25% responders) and cloud computing (22% responders). Only 6% of FinTech declared using blockchain technology (Cashless.pl et al., 2018).

**Figure 1** Products and services offered by Polish FinTech (%)




Source: Own work based on Cashless.pl et al. (2018).

In 2018 the total number of customers who use the internet and mobile banking at least once a month exceeded 15 billion and 3.6 billion specifically. Table 3 presents the number of customers using internet banking in banks that altogether, in 2018, serves almost 95% of internet banking customers and the dynamics of the number of customers' changes.

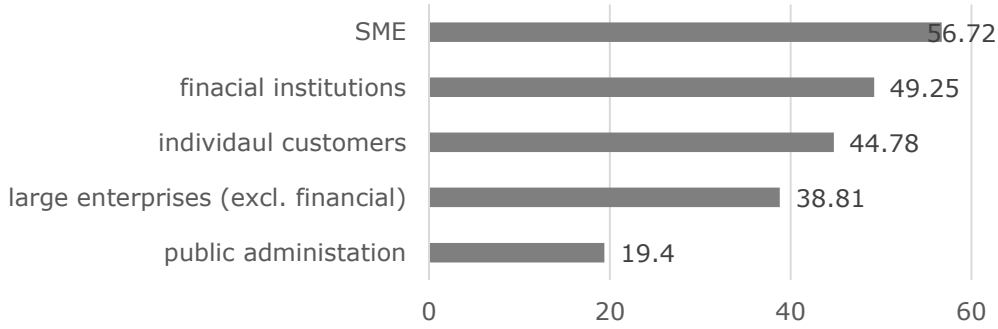
**Table 3** The changes in the number of active internet banking customers in selected banks operating in the Polish banking market

| | **The Number of Customers (in thousands)** | | | | | **The Dynamics of Changes (in relation to the previous year)** | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 2014 | 2015 | 2016 | 2017 | 2018 | 2015 | 2016 | 2017 | 2018 |
| **PKO BP** | 3095.2 | 3408.2 | 3579.0 | 3767.8 | 3863.0 | 110.1 | 105.0 | 105.3 | 105.3 |
| **mBank** | 1790.3 | 1850.9 | 1982,6 | 2072.2 | 2284.4 | 103.4 | 107.1 | 104.5 | 104.5 |
| **ING Bank Śląski** | 1668.0 | 1825.3 | 1836,1 | 2037.5 | 2240.0 | 109.4 | 100.6 | 111.0 | 111.0 |
| **Pekao** | 1346.7 | 1576.7 | 1708.6 | 1846.3 | 2045.4 | 117.1 | 108.4 | 108.1 | 108.1 |
| **Santander** | 1594.0 | 1674.4 | 1770.3 | 1863.5 | 1984.0 | 105.1 | 105.6 | 105.3 | 105.3 |
| **Alior Bank** | 534.9 | 707.6 | 734.4 | 879.0 | 721.8 | 132.3 | 103.8 | 119.8 | 119.7 |
| **BGŻ BNP Paribas** | 384.0 | 298.0 | 451.1 | 500.6 | 584.1 | 77.6 | 151.4 | 111.0 | 111.0 |
| **Credit Agricole** | n/a | n/a | 382.1 | 396.5 | 408.8 | n/a | n/a | 103.8 | 103.8 |
| **Raiffeisen** | 187.4 | 236.0 | 232.1 | 184.8 | 233.9 | 126.0 | 98.3 | 79.6 | 79.6 |
| **The sum:** | 10600 | 11577 | 12676 | 13549 | 14365 | 109.2 | 109.5 | 106.9 | 106.9 |
| **Total number of customers (the whole market):** | 11919 | 13107 | 13988 | 14696 | 15182 | 110.0 | 106.7 | 105.1 | 105.1 |

Source: Own work based on PRNews data (https://prnews.pl/raporty)

The Polish FinTechs do not have the precise sales model concerning the key target group. They serve both individual customers (business to customer model - B2C) and enterprises (business to business model – B2B). Among the enterprises, the most important are financial institutions and small and medium-size companies (SME) - see figure 2.

**Figure 2** Customer Segments of Polish FinTech (%)




Source: own work based on Cashless.pl et al. (2018)

The Polish FinTech market is still at the initial stage of development. Most of the entities defined as FinTech have been operating in the market since recently and have generated less than PLN 5 million revenues. They ate still searching for the most efficient business model and target group (Cashless.pl et. Al., 2018). The established financial services industry, in contrast to the emerging FinTech players, is somewhat focused on its core business and is highly regulated. Such asymmetry creates a space for FinTech vendors to compete with banks and insurers on B2C services. On the other hand, a rapidly changing environment may motivate the established financial entities to change their approach and start entering new, non-core areas. This may, in turn, encourage FinTech companies to collaborate, rather than compete, with banks and insurers. Their further development will be influenced by the following market characteristic (Deloitte, 2018, p. 151-167):

- Polish banks lead in implementing innovations, are following digital market trends and delivering high-quality user experience backed with smart functionality; they are tapping into payment market with joined initiatives like the m-payment system and a planned national payment card;
- growing awareness and customer expectations are driving the need for alternative approaches to banking services;
- Polish society is accustomed to trusting banks for money and financial advice what might be difficult to overcome;
- the Polish payment market is highly innovative and the latest technologies are quickly adopted; the latest developments on the market include promising niche solutions such as e-money, loyalty programmes integrated with payment cards and Bitcoin payments;
- demand for customer loans is raising; lending platforms are gaining the momentum but regulations might soon reduce the profitability of online lenders;
- despite legal ambiguities, crowdfunding remains a promising, underdeveloped area;
- the model of cooperation and coopetition between banks and FinTech companies has not as yet been formed,
- IT will drive the development of the insurance sector in the coming years,
- smartphone applications facilitate the entire insurance process,
- large IT vendors dominate the market;
- ensuring the security of mobile banking and cloud-based solutions is a future trend, with little recognition for biometrics on the Polish market;
- national and European regulations concerning data management may be a significant challenge for many financial institutions

- regulatory bodies are placing special emphasis on the issue of security, especially in the era of digital transformation among financial services institutions.

Creating the FinTech ecosystem requires implementing the central strategy focused on supporting and monitoring this promising sector. It is especially important, as Poland, despite the FinTech potential, has one of the lowest level of DESI index which measures the digital economy and society (24$^{th}$ position among 28 countries with the DESI=45; the average for Europe is 54). DESI index includes the assessment of connectivity, human capital, use of internet services, integration of digital economy and digital public services (EC, 2018). Fortunately, some initiatives have been implemented by central institutions as the Polish Financial Supervision Authority which established, with cooperation with other ministries, the Special Task Force for Financial Innovation in Poland FinTech and also established a programme for regulatory sandbox for FinTech development.

## 4 Conclusions

The development of the Polish financial market has been strictly connected with innovations' implementations since early '90s last century. Since the very beginning, its development has required the implementation of technology and new solutions. For years, banks as the dominant market players took part in innovations' implementations and infrastructural initiatives. In Poland "banks are Fintechs" or they closely cooperate with IT companies, especially in payment services. Although the banks still play an active role in introducing new technology in financial services, they are not the only ones that implement technological innovations in the Polish financial system. Apart from them, among the authors of FinTech projects are start-up companies and mature nonbank entities. The rising number of initiatives developed in different segments of the financial market allows to state that FinTech companies might be an important market player in the nearest future, competing for customers with traditional financial institutions. However, it is not still clear what will be their business model and target market. The contemporary market characteristic shows the dominant position of banks and their active role in shaping the financial market in Poland. As a result, the further development of the FinTech market will require some central initiatives focused on creating the schemes supporting innovations' creation, development, implementation, commercialization and education.

## References


Arner, D. W., Barberis, J. N., Buckley, R. P. (2015). The Evolution of Fintech: A New Post-Crisis Paradigm? *University of Hong Kong Faculty of Law Research Paper*, No. 2015/047.
Retrieved from: https://www.researchgate.net/publication/313365410_The_Evolution_of_Fintech_A_New_Post-Crisis_Paradigm, p. 4.

BBVA (2018). *'Fintech', 'proptech', 'femtech', 'edtech' and other related neologisms.* Retrieved from: https://www.bbva.com/en/fintech-proptech-femtech-edtech-and-other-related-neologisms/.

Cashless.pl, Fintech Poland, Accenture (2018), *Mapa Polskiego Fintechu*. Retrived from: https://www.cashless.pl/system/uploads/ckeditor/attachments/1908/Mapa_Polskiego_Fintechu_2018.pdf.

Das, S. R. (2018). *The Future of FinTech*. Retrieved from: https://assets.kpmg.com/content/, p. 3.

Deloitte (2018). *FinTech in CEE*. Charting the course for innovation in financial services technology. Retrieved from: https://www2.deloitte.com/content/dam/Deloitte/global/Documents/About-Deloitte/central-europe/ce-fintech-in-cee-region-2016.pdf, p. 6.

Dimler, N., Peter, J., Karcher, B. (2018). *Unternehmensfinanzierung im Mittelstand: Lösungsansätze für eine maßgeschneiderte Finanzierung*. Wiesbaden: Springer Gabler, p. 9.

EC (2018). Indeks gospodarki cyfrowej i społeczeństwa cyfrowego (DESI) 2018 Sprawozdanie krajowe dotyczące Polski. Retrieved from: http://ec.europa.eu/information_society/newsroom/image/document/2018-20/pl-desi_2018-country-profile-lang_4AA5832E-C9B3 -06C3-2FC79E4892C59A17_52340.pdf.

EY (2017). *EY FinTech Adoption Index 2017: The rapid emergence of FinTech*. Retrieved from: https://www.ey.com/Publication/vwLUAssets/ey-fintech-adoption-index-2017/$FILE/ey-fintech-adoption-index-2017.pdf, p. 5.

Financial Stability Board (2017). *Financial Stability Implications from FinTech Supervisory and Regulatory Issues that Merit Authorities' Attention*. Retrieved from: http://www.fsb.org/wp-content/uploads/ R270617.pdf, p. 6.

Financial Stability Board (2019). *FinTech and market structure in financial services: Market developments and potential financial stability implications - Financial Stability Board*. Retrieved from: www.fsb.org/emailalert, p. 1, 21.

Gromek, M. (2018). *An overview of the FinTech sector in the greater Stockholm region*. Version 2.0. Stockholm Fintech Report 2018, p. 20.

Harasim, J., Mitręga-Niestrój, K. (2018). FinTech – dylematy definicyjne i determinanty rozwoju. *Prace Naukowe Uniwersytetu Ekonomicznego We Wrocławiu*, No. 531, p. 173.

Kerényi, Á., Molnár, J. (2017). The Impact of the Fintech Phenomenon-Radical Change Occurs in the Financial Sector? *Financial and Economic Review*, vol. 16, p. 33.

KNF (2018). *Sektor FinTech w Polsce – podstawowe informacje*. Retrieved from: https://www.fintech.gov.pl/fintech/pl/komponenty/img/11_63917.2018%20-%20KNF_FOLDER_PL_OST_63917.PDF, p. 1.

KPMG (2018). *The Pulse of Fintech 2018*. Retrieved from: https://assets.kpmg/content/dam/kpmg/xx/pdf/2018/07/h1-2018-pulse-of-fintech.pdf, p. 57.

Piechowiak, Ł. (2018). *Ile wart jest pozabankowy Fintech w Polsce?* Retrieved from: https://fintek.pl/ile-wart-jest-pozabankowy-fintech-w-polsce/.

Schueffel, P. (2016). Taming the Beast: A Scientific Definition of Fintech. *Journal of Innovation Management Schueffel JIM*, vol. 4(4), p. 36.

Skwierawska, N. (2019), Polskie fintechy natrafiły na niespodziewane przeszkody. *Cyfrowa Rzeczpospolita*. Retrieved from: https://cyfrowa.rp.pl/biznes/33900-banki-musza-bardziej-polubic-fintechy.

Stamegna, C., Karakas, C. (2019). Fintech (financial technology) and the European Union State of play and outlook. *BRIEFING EPRS | European Parliamentary Research Service*. Retrieved from: https://www.fintech2019.eu/wp-content/uploads/2019/03/EPRS_BRI2019635513_EN.pdf, p. 1.

World Economic Forum (2017). *Beyond Fintech: A Pragmatic Assessment of Disruptive Potential in Financial Services*. Part of the Future of Financial Services. Retrieved from: http://www3.weforum.org/docs/Beyond_Fintech_-_A_Pragmatic_Assessment_of_Disruptive_Potential_in_Financial_Services.pdf, p. 5.

# Analysis of Consumption Tax Dependence on Beer consumption in the Czech Republic

**[1]Eva Kolářová, [2]Vendula Kolářová**

[1] Tomas Bata University in Zlín
Faculty of Management and Economics, Department of Finance and Accounting
Mostní 5139, 760 01 Zlín, Czech Republic
E-mail: ekolarova@utb.cz

[2] Tomas Bata University in Zlín
Faculty of Management and Economics, Department of Management and Marketing
Mostní 5139, 760 01 Zlín, Czech Republic
E-mail: vkolarova@utb.cz

***Abstract:*** *The tax on alcohol falls under excise duties, which form part of the state budget. Alcohol is one of the most harmful psychotropic substances. There is probably no one in the Czech Republic who does not know beer. It's the most popular alcoholic beverage. The total amount of alcohol consumption is logically made by the consumption of each type of alcohol. Alcohol consumption in the Czech Republic is one of the largest in the EU according to the 2017 OECD results. It may also depend on the level of consumer income and the price of alcohol affected by the tax rate on alcoholic beverages. Furthermore, macroeconomic indicators such as unemployment, GDP growth and inflation may also affect consumption. The aim of our article is to determine whether the level of taxation will affect the reduction of beer consumption, whether the amount of wages will affect the amount of beer consumption, whether the ban on smoking in restaurants and public spaces will affect beer consumption.*

*Keywords: Tax Policy, Consumption Tax, Alcohol, Beer, Revenue*

*JEL codes: H27*

## 1 Introduction

Alcohol use is part of many cultural, religious and social practices, and provides perceived pleasure to many users. The harmful use of alcohol is one of the leading risk factors for population health worldwide and has a direct impact on many health-related targets of the Sustainable Development Goals. The harmful use of alcohol is mentioned in numerous global strategies and action plans, but WHO's Global strategy to reduce the harmful use of alcohol continues to be the most comprehensive international policy document providing guidance on reducing the harmful use of alcohol at all levels. (WHO, 2018)

The Czech Republic has adopted a European Action Plan on Reducing Harmful Alcohol Use already in 2011, but has since done almost no actual steps for its implementation. According to Vladimir Poznyak of the WHO, all countries can do much more to reduce the health and social impact of harmful alcohol use. Proven and cost-effective steps include raising taxes on alcoholic beverages, prohibiting or restricting alcohol advertising, and reducing the physical availability of alcohol. (WHO, 2016)

On average, Europeans consume 10.7 litres of pure alcohol per year. Men consume more alcohol than women. (WHO, 2016) Approximately 70% of the adults in the WHO European Region drink alcohol. (WHO, 2014)

Current data from the Annual Report on Drugs in the Czech Republic show that the consumption of alcohol in our population is still high. According to research results, around 690 000 people daily or almost daily drinking alcohol. (Drogy-info.cz, 2016). The WHO Global Alcohol and Health Report 2018 reports that per capita absolute alcohol consumption per capita in the Czech Republic has risen to 14.4 liters per year. (WHO, 2018)

According to the c, it is clear that the trend of alcohol consumption and smoking is not favorable in the Czech Republic. Although the consumption of alcohol and smoking decreased in 2015, the trend in the following year is rising again (CZSO, 2018). Taxation is always classified as a fundamental and key tool for managing national income, especially in most developed and developing countries (Tabandeh et al., 2013). The tax is therefore the most important means of financing government spending. From an economic point of view, tax is seen as a mechanism for redistributing income from the rich to the poor, in addition to generating revenue for public finances. (Saez, 2004)

Beer is one of the most consumed alcoholic beverages in the Czech Republic. High beer consumption has a negative impact on human health. There are many different factors that can affect beer consumption and production. One factor is price. The price of beer includes costs of the producer, profit, value added tax and excise tax on beer.
Bandara and Chovancová (2012) reported that the brewing industry of the Czech Republic has a long history. Compared to foreign counterparts, there are plenty of domestic brands on the domestic market, which is the Czech alcohol market.

## 2 Data and Methodology

According to the World Health Organization, Europe is the region with the highest alcohol consumption. From an economic point of view, the costs of treatment, prevention, research, law enforcement and loss of productivity due to alcohol consumption in higher and middle income countries are approximately 1-3% of gross domestic product (Rehm et al., 2009), in the original EU15 in in 2003 it was 1.3% of GDP (Anderson and Baumberg, 2006). According to Babor et al. (2003), which, based on more than 500 studies on alcohol policy, assessed the cost-effectiveness of each strategy, it is advisable to pay particular attention to taxation, to limit accessibility in the form of age limits for alcohol and alcohol testing behind the wheel. Anderson et al. (2009) reached a similar conclusion in their exploratory study. In September 2011, the European Regional Committee approved the "European Action Plan for Reducing Harmful Alcohol Use 2012-2020". Based on previous European Alcohol Action Plans, the main objectives and action points of the new Action Plan are aligned with the World Health Organization's World Alcohol Strategy (WHO, 2011).

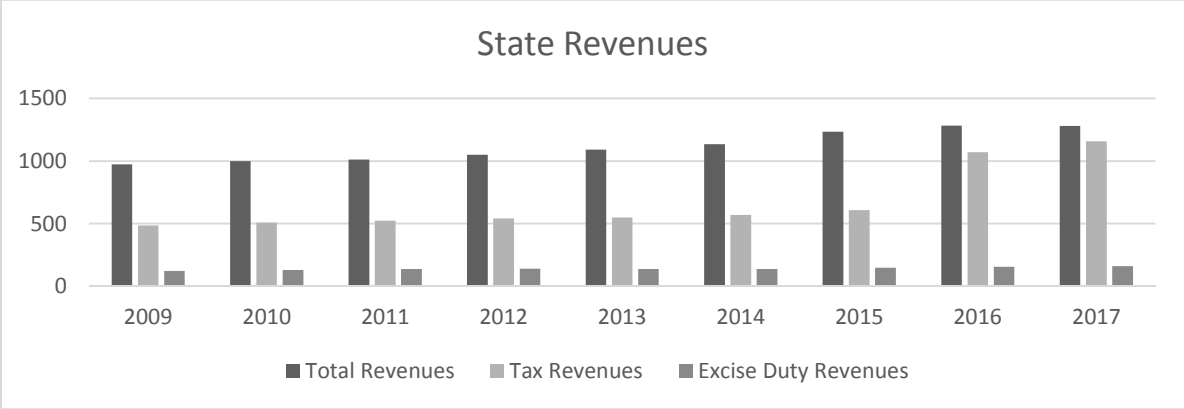
Excise duties are used in all developed economies of the world as a fiscal policy tool to generate tax revenue for the state budget and to act as a tool for regulation of consumption. Alcohol revenue is the third largest excise tax revenue in the Czech Republic.

**Table 1** Revenues according to State Closing Account of Czech at bil CZK

| | **2009** | **2010** | **2011** | **2012** | **2013** | **2014** | **2015** | **2016** | **2017** |
|---|---|---|---|---|---|---|---|---|---|
| **Total Revenues** | 975 | 1000 | 1013 | 1051 | 1092 | 1134 | 1235 | 1282 | 1280 |
| **Tax Revenues** | 485.4 | 508.0 | 523.4 | 540.8 | 549.6 | 569.0 | 608.2 | 1071.5 | 1155.6 |
| **Excise Duty Revenues** | 123.8 | 130.9 | 139.2 | 139.6 | 137.6 | 139.3 | 148.6 | 156.3 | 160.8 |

Source: MFCR (2018)

**Figure 1** Revenues According to State Closing Account of Czech




Source: MFCR (2018)

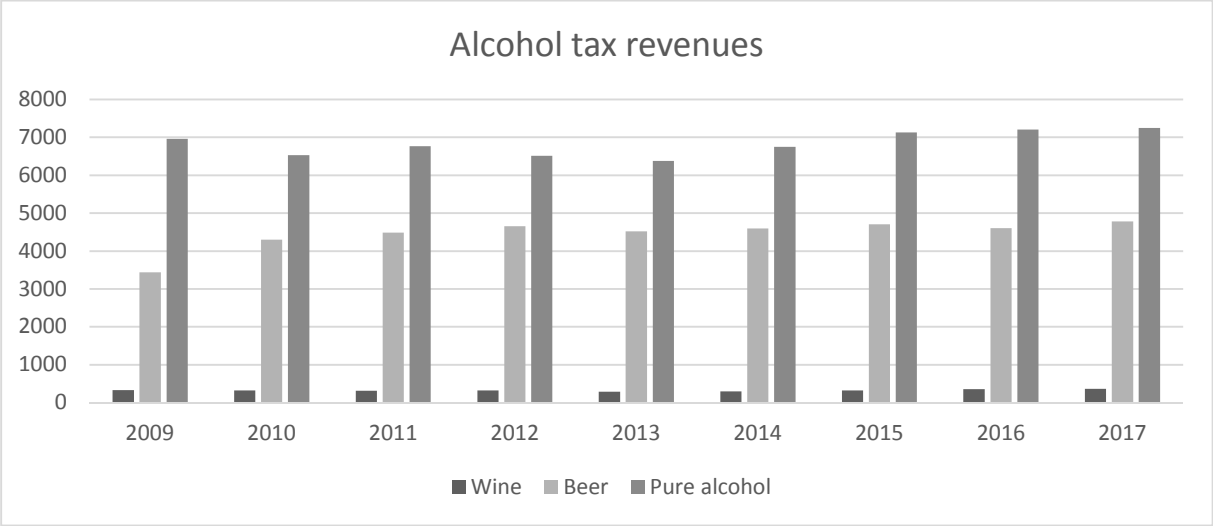
It is clear from the graph that excise tax revenues did not increase much from 2009 to 2017. The table below shows the excise tax revenues on alcohol, beer and wine.

**Table 2** Tax revenues from alcohol in Czech republic

| | **2009** | **2010** | **2011** | **2012** | **2013** | **2014** | **2015** | **2016** | **2017** |
|---|---|---|---|---|---|---|---|---|---|
| **Total in bil. CZK** | 10.73 | 11.14 | 11.57 | 10.55 | 11.18 | 11.7 | 12.4 | 12.2 | 12.4 |
| **Wine in mil. CZK** | 326 | 320 | 313 | 321 | 284 | 295 | 321 | 358 | 366 |
| **Beer in mil. CZK** | 3439 | 4297 | 4488 | 4656 | 4516 | 4593 | 4709 | 4605 | 4779 |
| **Pure alcohol in mil. CZK** | 6965 | 6528 | 6767 | 6510 | 6382 | 6754 | 7132 | 7206 | 7251 |

Source: MFCR (2018)

**Figure 2** Revenues from Wine, Beer and Alcohol According to the State Closing Account of the Czech Republic




Source: MFCR (2018)

When we focus on the tax on beer, its growth since 2009 is evident because of the fact that in 2010 the excise tax on beer.

**Table 3** Excise duty charges according to production in CZK/hl.

| | Basic Tax | Production to10 000 hl | Production to 50 000 hl | Production to 100 000 hl | Production to 150 000 hl | Production to 200 000 hl |
|---|---|---|---|---|---|---|
| 2009 | 24 | 11 | 14.40 | 16.80 | 19.20 | 21.60 |
| 2010-2019 | 32 | 16 | 19.20 | 22.40 | 25.60 | 28.80 |

Source: MFCR (2018)

To illustrate this, we compared excise taxes on a pint of beer containing 12% of the content of weight wort extract in CZK in Europe in selected countries. We used the current exchange rate, 1 CZK = 25.54 euro.
The highest excise tax per pint of beer is in Norway (34.70 CZK), Finland (18.33 CZK), Great Britain (14.98 CZK), Turkey (16.44 CZK) and Sweden (12.01 CZK). Conversely, the lowest excise duty will be paid by citizens in Romania (CZK 1.15), Bulgaria (CZK 1.17), Germany (CZK 1.21), Luxembourg (CZK 1.22) and Spain (CZK 1.27). In the Czech Republic, the excise tax for a pint of beer is CZK 1.92. (The Brewers of Europe, 2012, 2013).

The paper deals with the consumption of alcoholic beverages in the Czech Republic and the influences affecting this consumption. Its aim is to determine whether the level of taxation will affect the reduction of beer consumption, whether the amount of wages will affect the amount of beer consumption, whether the ban on smoking in restaurants and public spaces will affect beer consumption. To obtain basic data, data from the Czech Statistical Office, the State Closing Account of the Czech Republic, the Customs Office and tax laws were used. Furthermore, data obtained from a questionnaire survey in the Zlín region were used.

**Hypotheses**

On the basis of the data obtained, following hypotheses were stated:

Hypothesis H□ - The level of taxation will not affect the reduction of beer consumption

Hypothesis H□ - Banning smoking in restaurants and public areas will not affect the consumption of microbrewery beer in the Czech Republic.

Hypothesis H□ - The amount of wage does not affect the amount of beer consumption.

**Research methods**

The basic research methods were induction, analysis and subsequent synthesis methods. Research was conducted in 2019, but basic statistical information was only available until year 2017. Basic hypotheses were set and dependencies were tested on SPSS.

From statistical methods, we used a regression analysis that allows us to identify and mathematically describe statistical dependencies, verify deductive theories, and help test the strength and direction of the quantified relationship. The normal distribution of data was determined by Shapiro-Wilk test and we used Pearson's correlation coefficient. The analysis is currently used to describe economic reality, to test its hypotheses and to apply econometric models and methods in individual areas of economic theory.

## 3 Results and Discussion

The research was conducted in 2019. Statistical data were used to prove hypothesis H1.

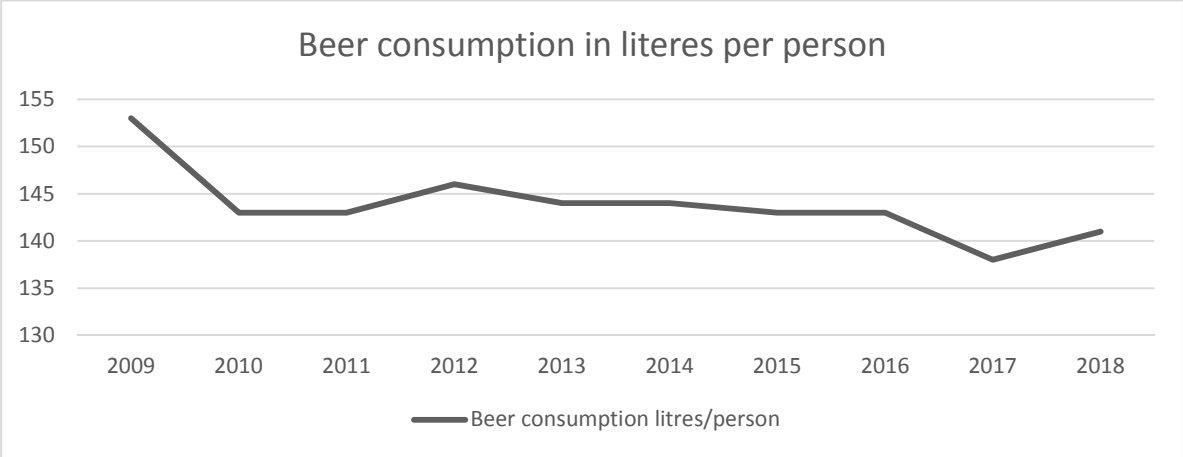
**Table 4** Beer consumption in the Czech Republic in liters per person

| Personal beer consumption | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **2009** | **2010** | **2011** | **2012** | **2013** | **2014** | **2015** | **2016** | **2017** | **2018** |
| 153 | 143 | 143 | 146 | 144 | 144 | 143 | 143 | 138 | 141 |

Source: Eurostat, Czech Customs Office

As shown in Table 3, the 2010 tax rate for beer increased by 33%. According to Table 4, in 2010 beer consumption decreased from 153 liters per person to 143 liters per person.

**Figure 3** Beer Consumption in the Czech Republic




Source: Eurostat, Czech Customs Office

The data follows that by increase the level of taxation, beer consumption decreases. We reject hypothesis H1 and confirm the alternative hypothesis. Beer consumption may be influenced by other factors beside the level of taxation.

There are many factors influencing the consumption of beer. The effect of climate change can double the price of beer. From these influences I focused on the ban on smoking in restaurants, which was introduced in the Czech Republic in 2017. In European Union countries has been gradually introduced since 2006 banned smoking in restaurants and public areas. The slower are the countries that tolerate smokers in restaurants. This stems from Eurostat statistics. Basic data was obtained from the Czech Statistical Office, the State Closing Account of the Czech Republic, the Customs Office for the years 2009 to 2018 and from the questionnaire survey in the Zlín Region.

**Table 5** The European Union's relationship to smoking

| | **2006** | **2017** | |
|---|---|---|---|
| | **% smokers** | **% smokers** | **% decrease/increase** |
| Belgium | 26 % | 19 % | - 6 % |
| Bulgaria | 36 % | 35,5 % | - 0.5 % |
| Czech Republic | 29 % | 28,5 % | - 0,5 % |
| Denmark | 32 % | 18 % | - 14 % |
| Germany | 30 % | 25,5 % | - 4,5 % |
| Estonia | 33,5 % | 23 % | - 10.5 % |
| Ireland | 29 % | 19 % | - 10 % |
| Greece | 42 % | 36 % | - 6 % |
| Spain | 34 % | 27 % | - 7 % |
| France | 33 % | 36 % | + 3 % |
| Italy | 31 % | 24,5 % | - 6.5 % |
| Cyprus | 31 % | 27 % | - 4 % |
| Latvia | 36 % | 33 % | - 3 % |
| Lithuania | 34 % | 28 % | - 6 % |
| Luxembourg | 26 % | 21 % | - 5 % |
| Hungary | 36 % | 26 % | - 10 % |
| Malta | 25 % | 24 % | - 1 % |
| Netherland | 29 % | 19 % | - 10 % |
| Austria | 31 % | 28 % | - 3 % |
| Poland | 35 % | 29 % | - 6 % |

| | | | |
|---|---|---|---|
| Portugal | 24 % | 25,5 % | +1.5 % |
| Romania | 31 % | 28 % | - 3 % |
| Slovenia | 23,5 % | 28 % | + 4.5 % |
| Slovak | 25 % | 26 % | + 1 % |
| Finland | 26 % | 20 % | - 6 % |
| Sweden | 18 % | 7 % | - 11 % |
| UK | 32 % | 17,5 % | - 14.5 % |

Source: Eurostat

The introduction of a ban on smoking in restaurants in 2004-2007 in states - Belgium, Denmark, Germany, Ireland, Italy, Lithuania, Slovenia, Finland, Sweden, United Kingdom.

Increase / decrease -6%, -14%, -4.5%, -10%, -6.5%, -6%, +4.5%, -6%, -11%, -14.5%

The introduction of a ban on smoking in restaurants in the years 2008-2011 in the states - Greece, Spain, France, Cyprus, Latvia, the Netherlands, Austria, Poland, Portugal, Slovakia.

Increase / decrease -6%, -7%, +3%, -4%, -3%, -10%, -3%, -6%, +1.5%, +1%

The introduction of a ban on smoking in restaurants in 2012-2017 in the states - Bulgaria, Czech Republic, Hungary, Romania

Increase / decrease -0.5%, -0.5%, -10%, -3%

The data for Croatia are unknown.

We focused on the consumption of beer in restaurants. The second hypothesis was the influence of the ban on smoking in restaurants on the consumption of draft beer. We tried to prove this hypothesis. Table 5 shows that the gradual introduction of the ban in the European Union, the number of smokers has fallen and we want to focus on the Czech Republic whether this ban reduced the number of restaurants and thus the consumption of beer.

From 2017 to reduce the consumption of draft beer. The consumption of draft beer in restaurants and pubs decreased again in 2018, the share in total consumption decreased by two percentage points to 36 percent. (Novinky, 2019) Beer production in the Czech Republic for 2018 is increasing, but it is also due to the export of beer, which increased by 11.8%. (ČTK, 2019) In 2018, beer consumption increased again.

According to the survey concluded at eleven microbreweries in the Zlín Region, in the year of smoking ban the consumption of draft beer decreased. However, in 2018 the consumption increased again due to extensive advertising of new products. Hypothesis H□ - Banning smoking in restaurants and public areas will not affect the consumption of microbrewery beer in the Czech Republic, can be dismissed. We can conclude, that the consumption of beer is also affected by the smoking ban.

Next, we tested the dependencies for demonstration Hypothesis H□ - The amount of wage does not affect the amount of beer consumption.

**Table 6** Czech Republic average wage

| **Year** | **2009** | **2010** | **2011** | **2012** | **2013** | **2014** | **2015** | **2016** | **2017** | **2018** |
|---|---|---|---|---|---|---|---|---|---|---|
| Average wage (CZK) | 23344 CZK | 23864 CZK | 24455 CZK | 25101 CZK | 25128 CZK | 25686 CZK | 26467 CZK | 27589 CZK | 29504 CZK | 31225 CZK |

Source: Czech Statistical Office

Next, we tested the following dependencies in the SPSS statistical program:

- Tax revenue from beer on average wage in the Czech Republic – dependence exists

- Beer consumption on average wage in the Czech Republic - weak dependence
- Consumption of pure alcohol and spirits over time in the Czech Republic – dependence exists
- Alcohol consumption to average wage - weak dependence

Other dependencies were negligible.

**Statistical results**

Based on the hypothesis test of equality of correlation coefficient to zero ($r(26) = 0.061$, $p = 0.75$), we do not have enough evidence to reject the hypothesis H□. We will therefore further assume that the correlation coefficient is statistically significantly equal to zero and therefore there is no statistically significant dependence between the consumption of beer per person and the average salary of the population as in the Czech Republic.

The output of the statistical model is shown in the following tables.

**Table 7** Model Summary – Number of wage to beer tax rate dependency

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 1 | .853 [a] | .728 | .694 | 275.187 |

Source: own calculations in SPSS

a. Predictors: (constant) t

**Table 8** Anova[a] – Number of wage to beer tax rate dependency

| Model 1 | Sum of Squares | Mean | Square | F | Sig |
|---|---|---|---|---|---|
| Regression | 1622885.345 | 1 | 1622885.345 | 21.430 | .002[b] |
| Residual | 605823.055 | 8 | 75727.882 | | |
| Total | 2228708.400 | 9 | | | |

Source: own calculations in SPSS

a. Dependent Variable: Number of income from beer tax
b. Predictors: (constant) t

**Table 9** Coefficients[a] – Number of wage to beer tax rate dependency

| Model 1 | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. |
|---|---|---|---|---|---|
| | B | Std. Error | Beta | | |
| (constant) t | 3481.000 | 187.989 | | 18.517 | .000 |
| | 140.255 | 30.297 | .853 | 4.629 | .002 |

Source: SPSS

a. Dependent Variable: (constant) t

There is a dependence between average wages and tax revenues from beer. In the same way, we calculated the other dependencies.

## 4 Conclusions

According to Široký (2015) selective excise taxes are used on products with long-term constant consumption that are showing inflexible price elasticity of supply and demand. Furthermore, the product must comply with the harmfulness aspect from the point of healthcare or environment protection, or product's high exclusiveness and luxury. Boňek (2001) adds, that those taxes have two main goals. First, to put off so called harmful

consumption, or consumption of tobacco and alcohol beverages, and second, to gain funds for public budget to cover expenses associated with the sale of those products.

Even Wagenaar et al. (2009, pp. 187) they dealt with the relationship between the amount of alcohol tax and its consumption. Almost all studies have shown an inverse relationship between these variables. With rising taxes, thus decreasing alcohol consumption, but nearly a third were not statistically significant.

Chaloupka et al. (2002) they also conducted research on the subject and managed by him, the price increase of alcoholic beverages reduces alcohol consumption.

Beer is one of the most consumed alcoholic beverages in the Czech Republic.

Hypothesis H1 was disproved by statistics from the years 2019 and 2010, when the beer taxation increased by 33%, and by the research of Wagenaar et al.

Another decrease in beer consumption occurred in 2017. There were no increases in taxation that year, but the beer consumption was affected by the ban of smoking in pubs and restaurants. The next year though, there was another increase in consumption that could have been affected by many influences. High summer temperatures made for one factor, another factors might have been violations of the smoking ban, creating designated smoking areas, or increasing beer export. The smoking ban influenced the beer consumption and so we dismissed hypothesis H2.

Next we tested different dependencies:

Tax revenue from beer on average wage in the Czech Republic

Beer consumption on average wage in the Czech Republic

Other tested dependencies were negligible.

The dependency of beer consumption on average wage turned out to be weak.

Beer is part of Czech culture. Had the excise tax been progressively increased, such as the taxation of tobacco, tax revenue from beer would be higher. Sudden increase of the levels of taxation, such as the 33% one of 2009, resulted in decrease of consumption and therefore decrease of tax revenue.

Tax on beer has been 9 years did not change, but the increase in 2010, we confirmed that beer consumption has fallen. This demonstrates that policy measures cannot be considered a single tool affecting consumption.

## Acknowledgments

This paper was supported by Project IGA/FaME/2018/014: Influence of the specific risk factors of the financial statements on the company's competitiveness with an impact on the tax area.

## References

Anderson, P., Baumberg, B. (2006). Alcohol in Europe: A public health perspective. *A report for the European Commission*. London: Institute of Alcohol Studies.

Allmani, A., Nadia, O., Pasquale, P., Francesco, C. (2014). *Trends in Consumption of Alcoholic Beverages and Policy Interventions in Europe: An Uncertainty "Associated" Perspective.*
Substance Use & Misuse. Retrieved from: http://www.tandfonline.com/doi/full/10.3109/10826084.2014.913382.

Babor, T. F., Caetano, R., Casswell, S., Edwards, G., Giesbrecht, N., Graham, K., (2003). Alcohol: No Ordinary Commodity. Research and Public Policy. *Oxford: Oxford University Press*.

Bandara, W. M. C., Chovancová, M. (2012). Consumer Ethnocentrism and Attitudes Towards Foreign Beer Brands: With Evidence from Zlin Region in the Czech Republic. Zlín: *Journal of Competitivenes*, vol. 4(2), pp. 3-19.

Boněk, V. (2001*). Lexikon - daňové pojmy*. Ostrava, Sagit, Lexikony - Sagit, no. IV.

Eurostat (2013). *The Brewers of Europe: "Beer statistics 2012 edition" and "Excise Duty rates for beer in Europe, October 2012" and Eurostat Excise Duty Tables*, Part I Alcoholic Beverages.

Drogy-info.cz (2016). *Výroční zpráva o stavu ve věcech drog v České republice v roce 2016*.
Retrieved from: https://www.drogyinfo.cz/data/obj_files/32732/786/VZ_2016_drogova_situace_v_CR.pdf.

Chaloupka, F., Grossman, M., Saffer, H. (2002). The Effect of Price on Alcohol Consumption and Alcohol-Related Problems. In: Alcohol Research & Health. *The journal of the National Institute on Alcohol Abuse and Alcoholism*, vol. 26(1), pp. 22-34. Retrieved from: https://pubs.niaaa.nih.gov/publications/arh26-1/22-34.htm.

MZČR (2017). *Předpis č. 65/2017 Sb. - Zákon o ochraně zdraví před škodlivými účinky návykových látek.* Praha: Sagit.

MFČR (2018). *Státní rozpočet*. Retrieved from: https://www.mfcr.cz/cs/verejny-sektor/statni-rozpocet/plneni-statniho-rozpoctu.

MFČR (2006-2017). *Státní závěrečný účet ČR 2006-2017*. Retreived from: https://www.mfcr.cz/cs/verejny-sektor/statni-rozpocet.

Novinky (2019). *Spotřeba piva v Česku*. Retrieved from: https://www.novinky.cz/ekonomika/502060-spotreba-piva-v-cesku-stoupla-vystav-pivovaru-byl-rekordni.html.

Rehm, J., Mathers, C., Popova, S., Thavorncharoensap, M., Teerawattananon, Y., Patra, J. (2009). *Alcohol and Global Health 1: Global burden of disease and injury and economic cost attributable to alcohol use and alcohol-use disorders*. London: Lancet.

Saez, E. (2004). Direct or indirect tax instruments for redistribution: short-run versus long-run. *Journal of public economics*, vol. 88(3), pp. 503-518.

Široký, J. (2013). *Daně v Evropské unii: aktualizované a přepracované vydání včetně CD*. Praha: Linde Praha.

Tabandeh, R., Jusoh, M., Nor, N. G. M., Zaidi, M. A. S. (2013). Causes of Tax Evasion and Their Relative Contribution in Malaysia: An Artificial Neural Network Method Analysis. *Jurnal Ekonomi Malaysia*, vol. 47(1), pp. 99-108.

Wagenaar, A., Salois, M. J., Komro, A. (2009). Effects of beverage alcohol price and tax levels on drinking: a meta-analysis of 1003 estimates from 112 studies. *Addiction*, vol. 104(2), pp. 179-190. Retrieved from: http://doi.wiley.com/10.1111/j.13600443.2008.02438.x.

World Health Organization (2011). *European action plan to reduce the harmful use of alcohol 2012–2020*. Retrieved from: https://www.stap.nl/en/home/european-alcohol-policy.html.

World Health Organization (2018). *Global status report on alcohol and health 2018*. Retrieved
from: http://www.who.int/substance_abuse/publications/global_alcohol_report/gsr_2018/en/.

# Does Gender Matter in the Performance of Family Firms? Evidence from the Czech Republic

**Daniela Kolouchová[1], Ondřej Machek[2], Aleš Kubíček[3]**

[1] University of Economics, Prague
Faculty of Business Administration, Department of Marketing
Nam. W. Churchilla 4, 13067 Prague 3, Czech Republic
E-mail: daniela.kolouchova@vse.cz

[2] University of Economics, Prague
Faculty of Business Administration, Department of Strategy
Nam. W. Churchilla 4, 13067 Prague 3, Czech Republic
E-mail: ondrej.machek@vse.cz

[3] University of Economics, Prague
Faculty of Business Administration, Department of Strategy
Nam. W. Churchilla 4, 13067 Prague 3, Czech Republic
E-mail: ales.kubicek@vse.cz

***Abstract:*** *This study aims to examine the effect of women's presence in key management position on family company performance. On a sample of 343 observations of female-led firms and 2 668 observations of male-led Czech family firms from the period 2008-2013, we perform regression analysis and Student's t-test to find the differences in return on assets and its predictors. Women's directorship is a statistically significant predictor of family business performance as measured by return on assets. Women who reach the top management positions in a family business perform better than their male counterparts, and family firms led by women use more debt and are smaller than family firms led by men. Female managers in family businesses are likely to contribute to their organization's current and future success, as well as to the success of their families. Supporting the advancement of women to higher positions and, at the same time, supporting family firms may be beneficial to society.*

*Keywords: family firms, gender, performance, women's directorship*

*JEL codes: M30, M31*

## 1 Introduction

In most countries, regardless of company size, family businesses account for a major share of business. Family businesses are significant in terms of employment, turnover, added value, investments and accumulated capital (Allouche et al., 2008). It is therefore no wonder that the interests of researchers have been attracted towards studying the field of family business. At the same time, the role of women CEOs and their effect on performance of firms, as well as market perception of female CEO appointment, has become a popular topic of research.

A significant power in family firms is held by women who, however, often do not have formal roles in the business. In the family business literature, this is often referred to as "invisible women". Frishkoff and Brown (1996) labelled women in family businesses, often in unpaid roles, as mom, spouse, caretaker, sounding board, negotiator or bookkeeper.

Nowadays, women's professional and family roles are changing. Female senior managers are becoming a phenomenon which receives considerable popular attention (Gillis-Donovan and Moynihan-Bradt, 1990). While women CEOs represented a few percents in the 70s, today, they account for up to 24% across the globe (Grant Thornton, 2014).

While many authors found that family businesses perform better than non-family businesses (Allouche et al., 2008), little is known about performance gaps between family businesses owned or managed by males and females. The goal of this article is to

compare the performance of companies where women play the key role in management or ownership. A review of literature regarding the effect of gender on firm performance and the role of women in family businesses suggests a general research question: Do female-led family firms enjoy better performance than male-led family firms?

## 2 Literature Review

The literature has little to say about the effect of female senior managers on family business performance. Therefore, the literature review will be focused on two key issues, which together constitute the theoretical foundations of this study: the effect of gender on firm performance and the role of women in family businesses.

The past literature agrees that there are differences in masculine and feminine management styles (Dezsö and Ross, 2008; Psychogios, 2007) and perception of business-related issues (Král et al., 2016). The way women interact and communicate with their colleagues or subordinates is different than those of men. While women prefer cooperation, communication and other interpersonal skills, men seem to prefer rationality, domination and risk-taking (Schmitt et al., 2008). A number of past articles have dealt with differences in the management style of women and men. In their meta-analysis, Eagly et al. (2003) found that female managers acted more like good teachers or coaches and encouraged creative solutions to problems. Dezsö and Ross (2008) suggest that feminine leadership style is more valuable in innovation-based industries (according to these authors, female representation in top management improves firm performance but only to the extent that a firm's strategy is focused on innovation). Women also seem to be able to appreciate good performance and remunerate their subordinates more than men, while men are more likely to criticize subordinates (Eagly et al., 2003). To sum up, a number of studies show that there is an academic consensus on the differences between masculine and feminine management styles.

Many authors mention the term "perception bias" which means that investors could focus more on gender stereotypes than on leadership capabilities when evaluating investment decisions. Based on observations of stock market reactions, Campbell and Mínguez-Vera (2010) suggest that investors believe that female directors add value to companies. This is somehow contradictory to the previous findings of Lee and James (2007) who suggested that an announcement of a male CEO appointment is viewed more favorably by investors (Lee and James, 2007). However, many authors didn't find any evidence of perception bias (Martin et al., 2009). Campbell and Mínguez-Vera (2008) suggest that gender diversity has a positive effect on firm value.

Women are still underrepresented in management and supervisory boards of companies (Bertrand and Hallock, 2001). At the same time, the presence of women in management boards is known to have significant impact on a company. Flabbi et al. (2014) found that female leadership had effects on female wages and that performance of firms where female leadership is involved increases with the share of female workers. Smith et al. (2006) found that the proportion of women in top management jobs tends to have positive effects on firm performance, even after controlling for numerous characteristics of the firm and direction of causality. Khan and Vieito (2013) found that female-led firms enjoy a higher return on assets. On the other hand, according to some authors such as Kolev (2012), female-led firms underperform male-led firms. Dezső and Ross (2008) found evidence of a positive relationship between firm performance and female participation below the CEO level, but no positive effects from having a female CEO. They conclude that "female management style" enhances firm performance by facilitating teamwork and innovation but is rendered less effective by the leadership attributes of the CEO position. A more recent meta-analysis of Post and Byron (2015) found that female board representation is positively related to accounting returns. However, according to the review of Mohan (2014), the question of whether a gender behavioral difference that affects firm performance exists remains an unresolved issue.

In the past, women were primarily labeled as "family members" rather than owners or employees in family firms (Frishkoff and Brown, 1996). In these underestimated and

often unpaid roles, "invisible" women provided an important support to the success of their family businesses. Poza and Messer (2001) describe six different types of roles adopted by spouses of successful family firms: jealous spouse, chief trust officer, partner or co-preneur, vice-president, senior advisor, and free agent.

Wicker and Burley (1991) found that once a women works in a family business, her influence increases, which may be a source of conflicting goals and tensions (Rodriguez et al., 1999). According to the past literature, here are five sources of conflicts which can potentially harm the company as well as the family: justice, role, work-family balance, identity, and succession conflict (Danes et al., 2000; McClendon and Kadis, 1991). The existence of multiple decision-makers in family firms can create further tensions (Kaye, 1996). The management of such conflicts is of utmost importance for family businesses to survive and increase productivity.

The involvement of women may help preserve family unity and the continuity of family businesses due to their "emotional leadership" (Jimenez, 2009). Women have an important role in the transmission of the family and firm values to their children (Dugan et al., 2008). Salganicoff (1990) refers to women as "chief emotional officers" which complement the rational and more aggressive decision-making of their male counterparts. Female family business managers may convince others "that considerate caring relationships in family business contribute to effective management" (Frishkoff and Brown, 1996). Allen and Langowicz (2003) found that female-owned family businesses were more productive than male-owned family businesses, and that the integrative role of women resulted in a greater loyalty and agreement in these family firms.

Based on the above arguments, we hypothesize that *female-led family firms are more profitable than family firms led by men*.

## 3 Materials and Methods

The quantitative research sample contains data on Czech family businesses from 2008 to 2013 from various industries. The sample of family firms was obtained using the surname-matching approach (Hnilica and Machek, 2014). In order to identify family firms we used the database Albertina which contains financial data on all Czech economic subjects with a registered tax identification number. It should be emphasized that we didn't use randomization to collect the sample; instead, we used non-probability consecutive sampling method. The population is unknown, since there is no official database of Czech family firms and companies have no legal obligation to disclose if they are family firms or not; under such circumstances, non-probability sampling is the only option.

To identify a rough sample of family firms in the Czech Republic, we selected all companies with more than 50 employees in which there were at least two people of the same surname in the management board, in the supervisory board, or among owners. A firm is classified as female-led if one of the following functions is occupied by a woman: CEO, head clerk, or executive director. After carefully checking for possible namesakes and blank (non-disclosed) values, we obtained 343 observations of female-led family firms and 2 668 observations of male-led family firms.

To investigate the extent of gender influence on firm performance, we employ multivariate regression analysis. We measure the performance of a firm by return on assets (ROA). The influence of gender is captured by a binary variable, which equals 1 for a female-led firm and 0 otherwise. Since industries experience different market conditions, it is important to control for industry affiliation. Hence, we introduce four binary dummy variables, each representing an industry (Manufacturing, Construction, Wholesale and retail, Transport, network industries, agriculture and mining). Regression analysis also controls for years since market conditions vary from one year to another, so the individual years from 2008 to 2013 are represented by five dummy variables. We also decided to control for company size (natural logarithm of a firm's total firm assets);

level of debt (liabilities over total assets); and firm age (which captures differences in firm competitiveness associated with history). We decided not to include other possible control variables to avoid multicollinearity issues. To deal with heteroskedasticity, we used a linear regression model with robust standard errors.

## 4 Results

Table 1 displays the means of dependent and control variables (excluding industry and year dummies) and their comparison using the Student's t-test with unequal variances. The t-statistics for testing the difference of means between the two groups of firms are statistically significant at the 10% level or higher for all variables except of firm age. The age is relatively low compared to Western countries. This is due to the fact that a free-market economy has existed only since 1989 in the Czech Republic; before this, the economy was centrally planned. Whereas at the beginning of 1990s we could hardly speak of any family businesses in the Czech Republic (with a possible exception of those somewhat drawing upon the heritage of their predecessors who ran their own family businesses before nationalization), some 25 years later it is quite common that owners already have transferred their businesses to their heirs or have at least started considering it. From this perspective, the reality of family businesses in the Czech Republic resembles the situation in other non-socialistic countries around the world.

The mean test for the return on assets supports that female-led firms are more profitable than male-led firms. As compared to male-led firms, female-led firms witnessed greater debt ratio and lower firm size as measured by total assets. Businesses led by women were younger (non-significant) and smaller (significant, as measured by total assets). However, the Student's t-test does not account for simultaneous effects of control variables, so the results should be interpreted with caution.

**Table 1** Tests of Difference in Means

| Variable | Female-led firms (mean) | Male-led firms (mean) | t-statistic |
|---|---|---|---|
| **Return on assets** | 0.068 | 0.057 | 2.07** |
| **Firm age** | 14.470 | 14.280 | 0.69 |
| **Debt ratio** | 0.556 | 0.508 | 3.13*** |
| **Total assets (CZK million)** | 272 104 | 388 860 | -2.59*** |

Note: ** Significant at 0.05 *** Significant at 0.01.

Regressions are performed in Stata 14 on the data set described in the previous section. Firm performance is measured by return on assets, which is an indicator not influenced by the capital structure. Table 2 displays the regression results. In addition to the explanatory variables displayed in the table, regressions include dummy variables representing NACE industry sectors and individual years.

**Table 2** Regression Results for Gender and Firm Performance

| Explanatory Variable | Coefficient | p value | t-statistic |
|---|---|---|---|
| **Intercept** | 0.103*** | <0.001 | 4.738 |
| **Female CEO** | 0.014*** | 0.008 | 2.637 |
| **Firm age** | -0.001 | 0.147 | -1.450 |
| **Total assets** | 0.002 | 0.108 | 1.607 |
| **Debt ratio** | -0.090*** | <0.001 | -14.220 |

Note: *** Significant at 0.01

All coefficients are statistically significant except of firm age and total assets. The most important is the female CEO binary variable which is statistically significant at the 1% level. That supports the hypothesis that female-led family firms are more profitable than male-led firms, even after controlling for industry and year effects.

According to the regression results, profitability also tends to decrease with the level of debt (significant), which can be explained by the fact that debt is associated with financial costs that reduce the income. In our sample, firm age did not significantly affect profitability. Company size (as measured by total assets) seems to have positive effects on performance, which suggests the presence of scaling effects, but the significance of the coefficient is only close to the 0.1 level.

## 5 Discussion

The research suggests that family firms controlled by females are generally run more efficiently than male-led firms, carry more debt than other firms, and have lower size as measured by total assets than male-led firms. To explain the findings, we propose explanations and confront them with prior literature.

First, there are assumptions which need to be fulfilled for a company to be a successful family firm, and which can be better achieved by females than males. Frishkoff and Brown (1993) stated that in previous eras "the outward division of labor in the family business seemed to be split along semantic lines ... the family part belonged to the wife, the business part belonged to the husband". According to Rodriguez et al. (1999), the increasing influence of women in family firms represents a source of conflicts and tensions. One of the basic prerequisites of a successful family business is a clear division of responsibilities. Also, a continuous preparation of children for the takeover of a family business in the future is necessary. The role of women in teaching their children to love their company is indisputable (Dugan et al., 2008).

Another potential explanation of better performance of female-led family firms may be that those women who get into top management positions are better qualified than their male counterparts. One of the possible reasons is the idea that only successful women achieve to overcome various obstacles, including possible negative social pressures and discrimination, to become CEOs and their skills should affect a firm's performance positively.

Work-family conflicts can potentially harm the family as well as the business (Danes et al., 2000; McClendon and Kadis, 1991). However, female attributes such as group orientation, emotion, cooperation, together with the core values of family firms (loyalty and trust) may help overcome such conflicts. The integrative role of women in families, together with all the above-mentioned factors, may help support family unity, as well as continuity of family businesses (Poza and Messer, 2001), which can eventually positively affect firm performance.

Female-led family firms have been found to use more debt. A greater risk aversion also belongs to frequently cited female attributes (Eckel and Grossman, 2008). While female-led firms can truly be more risk-averse, they may also have an aversion to diluting control by issuing new equity; in this case, debt is a source of finance that does not dilute control. However, there may be a nonlinear relationship between control and debt (De La Bruslerie and Latrous, 2012). Women also seem to be more risk-averse and they carefully evaluate investment decisions. These attributes can contribute to a greater stability of firms led by women.

According to past authors, it also seems that support of a husband is of utmost importance. Spousal emotional support indeed greatly contributes to family business achievement and sustainability (Danes et al., 2009); it seems that family firms where both the husband and the wife manage the firm are better performers than other family firms (Machek et al., 2015).

## 6 Conclusion

Family firms are the most important form of business organization in the world. Their unique attributes include trust, loyalty, and cooperation, which are typical for feminine

stereotypes, so it may seem that female-led firms could perform better than male-led firms. This article has sought to test this hypothesis.

Regression analysis using data from the Czech Republic from various industries over the period 2008–2013 led to the conclusion that female CEOs have a positive effect on family firm performance, even after controlling for industries and years. Holding everything else constant, female-led firms are likely to be more profitable in terms of return-on-assets than male-led firms. We also found that female-led firms are smaller and carry more debt than male-led firms.

Several practical implications arise from this study. If female managers are better bosses in family firms, they are likely to contribute more to their organization's current and future success, as well as to the success of their families. Taking this into account, supporting the advancement of women to higher positions and, at the same time, supporting family firms may be beneficial to the society, including its male members. Such support may include, among others, providing consulting services, more flexible working hours, and job sharing, but also reducing inheritance tax, support of start-ups, or providing easier access to long-term financing. Recently, the European Commission began encouraging women entrepreneurs, for instance, by inaugurating The European Network of Mentors for Women Entrepreneurs in 2011.

However, the study also has some limitations. Unlike past studies, this study did not focus on market perception or firm value, but on return on assets as a direct measure of firm performance. Another limitation is the focus on Czech firms. However important they are, the unique characteristics of family firms are not directly measurable, which complicates quantitative analysis of data. Many other factors and lurking variables can explain differences in profitability and leverage.

Family firms, including female-led ones, will also face multiple challenges in the near future. More precisely, it seems that family firms' managers, especially in European countries, face more intensive competition, as well as slower economic growth. They will also have to deal with increasing internationalization and globalization.

## Acknowledgments

We appreciate the funding support received from the Czech Science Foundation for this project entitled "Privately-held Firms with Multiple Owners: The Role of Family and Responsible Ownership" (registration no.: GA17-10948S).

## References

Allen, I. E., Langowitz, N. S. (2003). *Women in family owned businesses*. Boston, MA: MassMutual & Center of Women's Leadership, Babson College.

Allouche, J., Amann, B., Jaussaud, J., Kurasniha, T. (2008). The Impact of Family Control on the Performance and Financial Characteristics of Family versus Nonfamily Businesses in Japan: A Matched-Pair Investigation. *Family Business Review*, vol. 21(4), pp. 315-329.

Bertrand, M., Hallock, K. F. (2001). The gender gap in top corporate jobs. *Industrial & Labor Relations Review*, vol. 55(1), pp. 3-21.

Campbell, K., Mínguez-Vera, A. (2008). Gender diversity in the boardroom and firm financial performance. *Journal of Business Ethics*, vol. 83(3), pp. 435-451.

Campbell, K., Mínguez-Vera, A. M. (2010). Female board appointments and firm valuation: Short and long-term effects. *Journal of Management & Governance*, vol. 14(1), pp. 37-59.

Danes, S. M., Leichtentritt, R., Metz, M. E., Huddleston-Casas, C. (2000). Effects of Conflict Styles and Conflict Severity. *Journal of Family and Economic Issues*, vol. 21(3), pp. 259-286.

Danes, S. M., Stafford, K., Haynes, G., Amarapurkar, S. S. (2009). Family capital of family firms: Bridging human, social, and financial capital. *Family Business Review*, vol. 22(3), pp. 199-215.

De La Bruslerie, H., Latrous, I. (2012). Ownership structure and debt leverage: Empirical test of a trade-off hypothesis on French firms. *Journal of Multinational Financial Management*, vol. 22(4), pp. 111-130.

Dezső, C. L., Ross, D. G. (2008). Girl Power: Female participation in top management and firm performance. *University of Maryland und Columbia Business School Working paper*, August 2008.

Dugan, A., Krone, S., LeCouvie, K., Pendergast, J., Kenyon-Rouvinez, D., Schuman, A. M. (2011). *A Woman's Place: The Crucial Roles of Women in Family Business*. New York: Palgrave Macmillan.

Eagly, A. H., Johannesen-Schmidt, M. C., van Engen, M. (2003). Transformational, transactional, and laissez-faire leadership styles: A meta-analysis comparing women and men. *Psychological Bulletin*, vol. 129(4), pp. 569-591.

Eckel, C. C., Grossman, P. J. (2008). Men, Women and Risk Aversion: Experimental Evidence. In: Plott, C. and Smith, V., eds., *Handbook of Experimental Economics Results*. New York: Elsevier, pp. 1061-1073.

Flabbi, L., Macis, M., Moro, A., Schivardi, F. (2014). Do female executives make a difference? The impact of female leadership on gender gaps and firm performance. Cornell University, *ILR School working paper*, October 2014.

Frishkoff, P. A., Brown, B. M. (1996). Women on the move in family business. In: Aronoff, C. E., Astrachan, J. H. and Ward, J. L., eds., *Family and business sourcebook II*. Marietta, GA: Business Resources, pp. 446–450.

Gillis-Donovan, J., Moynihan-Bradt, C. (1990). The Power of Invisible Women in the Family Business. *Family Business Review*, vol. 3(2), pp. 153-167.

Grant Thornton (2014). *Annual women in business tracker finds little change at the top of*
*the corporate ladder*. Retrieved from: http://www.grantthornton.global/en/insights/articles/Women-in-business-classroom-to-boardroom/.

Hnilica, J., Machek, O. (2014). Toward a Measurable Definition of Family Business: Surname Matching and its Application in the Czech Republic. *International Advances in Economic Research*, vol. 21(1), pp. 119-120.

Jimenez, R. M. (2009). Research on women in family firms: Current status and future directions. *Family Business Review*, vol. 22(1), pp. 53-64.

Khan, W. A., Vieito, J. P. (2013). CEO gender and firm performance. *Journal of Economics and Business*, vol. 67, pp. 55-66.

Kaye, K. (1996). When the family business is a sickness. *Family Business Review*, vol. 9(4), pp. 347-368.

Kolev, G. I. (2012). Underperformance by female CEOs: A more powerful test. *Economics Letters*, vol. 117(2), pp. 436-440.

Král, P., Machek, M., Karel, T. (2016). Comparative Advertising in the Czech Republic: An Empirical Study. *Central European Business Review*, vol. 5(4), pp. 34-46.

Lee, P., James, E. (2007). She-E-Os: Gender effects and investor reactions to the announcements of top executive appointments. *Strategic Management Journal*, vol. 28(3), pp. 227-241.

Machek, O., Hnilica, J., Kolouchová, D., Machek, M. (2015). Are couple-run companies more profitable than professionally managed firms? *International Advances in Economic Research*, vol. 21(3), pp. 351-353.

Martin, A., Nishikawa, T., Williams, M. (2009). CEO gender: Effects on valuation and risk. *Quarterly Journal of Finance and Accounting*, vol. 48, pp. 23–40.

McClendon, R., Kadis, L. B. (1991). Family therapists and family businesses: A View to the future. *Contemporary Family Therapy*, vol. 13(6), pp. 641-651.

Mohan, N. (2014). A review of the gender effect on pay, corporate performance and entry into top management. *International Review of Economics & Finance*, vol. 34, pp. 41-51.

Post, C., Byron, K. (2015). Women on boards and firm financial performance: A meta-analysis. *Academy of Management Journal*, vol. 58(5), pp. 1546-1571.

Poza, E. J., Messer, T. (2001). Spousal Leadership and Continuity in the Family Firm. *Family Business Review,* vol. 14(1), pp. 25-36.

Psychogios, A. G. (2007). Towards the transformational leader: Addressing women's leadership style in modern business management. *Journal of Business and Society*, vol. 20(1-2), pp. 169-180.

Rodriguez, S. N., Hildreth, G. J., Mancuso, J. (1999). The dynamics of families in business: How therapists can help in ways consultants don't. *Contemporary Family Therapy*, vol. 21(4), pp. 453-468.

Salganicoff, M. (1990). Women in family business: Challenges and Opportunities. *Family Business Review*, vol. 3(2), pp. 125-138.

Schmitt, D. P., Realo, A., Voracek, M., Allik, J. (2008). Why can't a man be more like a woman? Sex differences in Big Five personality traits across 55 cultures. *Journal of Personality and Social Psychology*, vol. 94(1), pp. 168-182.

Smith, N., Smith, V., Verner, M. (2006). Do women in top management affect firm performance? A panel study of 2,500 Danish firms. *International Journal of Productivity and Performance Management*, vol. 55(7), pp. 569-593.

Wicker, A. W., Burley, K. A. (1991). Close coupling in work-family relationships: Making and implementing decisions in a new family business and at home. *Human Relations*, vol. 44(1), pp. 77-92.

# Analysis of Migration Processes and Assessment of their Impact on the Development of International Money Transfers of Ukraine

**[1]Irina Kolupaieva, [2]Olena Shevchenko, [3]Ivan Mytsenko, [4]Alina Borysova,**

[1]Kharkiv Institute of Trade and Economics of Kyiv National University of Trade and Economics
International Economic Relations and Finance Department
Otakara Yarosha Lane, 8
61045, Kharkiv, Ukraine
e-mail: volirinawork@gmail.com

[2]Donbass State Engineering Academy, Economic and Management Department
Akademichna sreet, 72
84313, Kramatorsk, Ukraine
e-mail: cpk_ddma@ukr.net

[3]Central Ukrainian National Technical University
International Economic Relations Department
Universytetska Avenue, 8
25006, Kropyvnytskiy, Ukraine
e-mail: mignarodnaekonomika@gmail.com

[4]Kharkiv State University of Food Technology and Trade,
Kharkiv, Ukraine,
E-mail: alinaborysova@ukr.net

***Abstract:*** *The main purpose of the research is to analyse migration processes of Ukraine and to determine the factors influencing the development of the market of international money transfers in Ukraine as a significant direction of strengthening the financial system of the country. According to the purpose, the dynamics of migration in Ukraine according to the geographical structure was analyzed, factors of influence on migration processes in Ukraine were determined. The impact of migration processes on the development of international money transfers was analyzed. Factors that affect the volumes of money transfers by official channels were determined. The estimation of factors according to the degree of influence and the dynamics of influence on money transfers was carried out. Measures to increase migrant remittances were identified.*

*Keywords: migration policy, international money transfers, financial system, transmission, money transfer channel*

*JEL Classification: J18, J61, F22, F24*

## 1 Introduction

Migration is the redistribution of labour between regions or countries, and it is necessarily connected with the change of permanent residence, the change of the spatial position of migrants in relation to the territorially consolidated structures of the population. In Ukraine, migration process has uncontrolled significance as a result of the ineffectiveness of the state migration policy, which leads to a negative impact on the financial system of the country - reduction of financial resources due to the decrease of revenues to the budget, caused by the reduction in production and consumption, resulting from the outflow of labour force. Taking into account the fact that the intensification of labour migration processes prompts workers to make international money transfers, money flows not only through formal channels (banking system), but also through informal (those that are not controlled by state authorities) ones. In this regard, a significant amount of these funds is being transferred to the shadow sector, which leads to the decrease of the financial potential of the country. Therefore, estimation of migration processes and the increase of money transfers through official channels needs to become an urgent task for strengthening the financial system of the country.

Among the researchers, who investigated Migration processes and their impact on the financial system, are Stark et al. (2017) analyze migration policies comparing entry fee and quota conditions; Rayp et al. (2017) review cross-country immigration policies; Lanati and Thiele (2018) evaluate impact of foreign aid on migration; Markowski (2008) analyses economic aspects of migration; Zapadnyuk (2012) and Kornienko (2017) investigate socio-economic aspect of regional asymmetry; Malynovska (2011) reviews circular migration; Lastovetska (2015) determines mutual influence of the volume of informal money transfers and the level of dollarization of the Ukrainian economy and others.

However, the problem of determination factors which impact on migration processes and determination the factors influencing the development of the market of international money transfers in Ukraine as a significant direction of strengthening the financial system of the country remains unresolved.

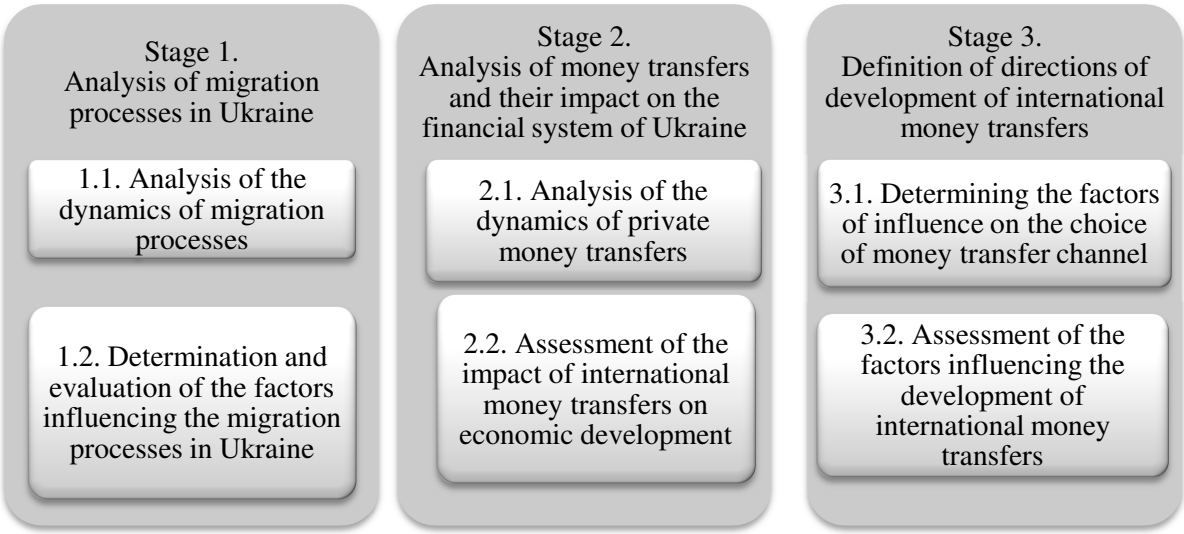
**The purpose of the research**

The purpose of the research is to analyse migration processes of Ukraine and determine the factors influencing the development of the market of international money transfers of migrants in Ukraine as a significant direction of strengthening the financial system of the country.

## 2 Methodology and Data

According to the goal established, an algorithm of its accomplishment has been developed. The algorithm of estimating migration processes and determining the factors influencing the development of the international money transfer market of migrants in Ukraine in terms of strengthening the financial system of the country is presented in Figure 1.

**Figure 1** Algorithm of Construction a Model of Estimation of Migration Processes and Estimating Factors of Influence on Money Transfers



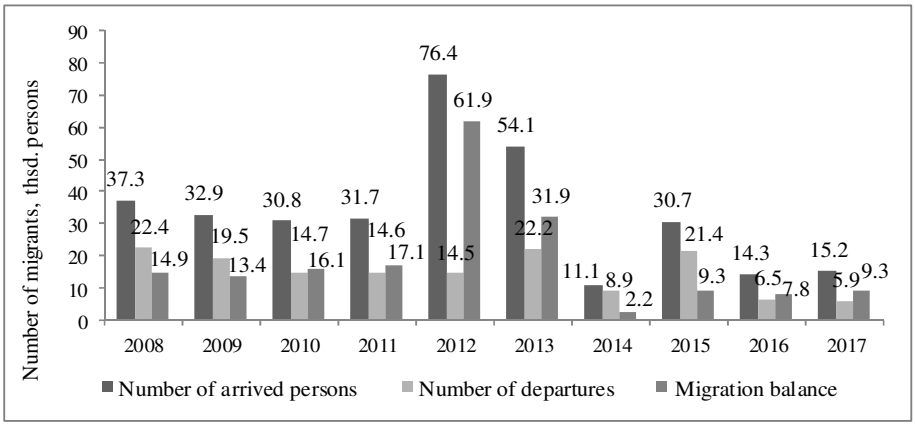

Source: elaborated by the Authors

## 3 Results and Discussion

The rapidity of migration processes in Ukraine, given the number of crises of the last decade, has a significant impact on the migration worldview of the population and development of the state as a whole. Therefore, migration processes in Ukraine need to be analyzed and identified.

The dynamics of the number of Ukrainian migrants during 2008-2017 is presented in Fig. 2.

**Figure 2** Dynamics of the Number of Ukrainian Migrants during 2008-2017

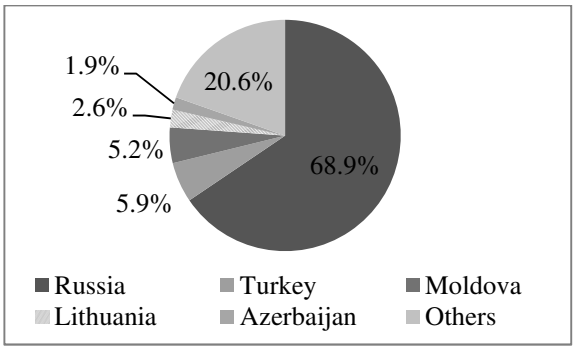



Source: constructed by the authors according to the data http://www.ukrstat.gov.ua; https://dmsu.gov.ua

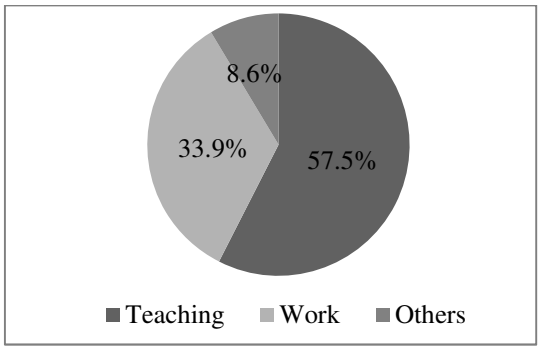
As a result of the analysis of the dynamics of the number of Ukrainian migrants, it has been found that throughout the years the country had a positive migration balance, indicating Ukraine's potential of attractiveness for foreign migrants.

Ukraine is the most attractive country for immigrants from Russia, Turkey, Moldova (Fig. 3).

**Figure 3** Indicators of Immigration to Ukraine, 2017 Year




Geographical structure of immigrants

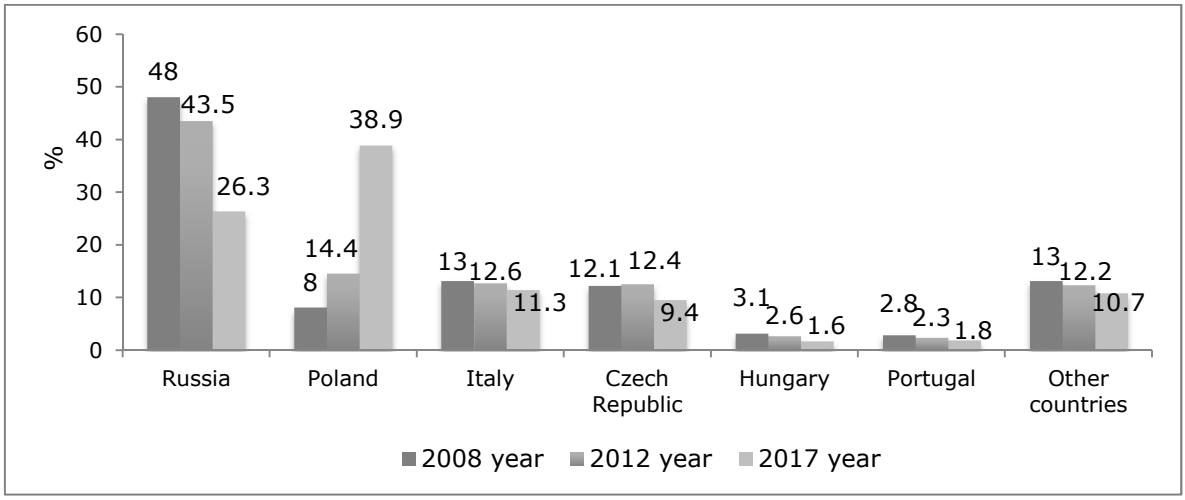



Causes of Immigration

Source: constructed by the authors according to the data http://www.ukrstat.gov.ua

Regarding emigration, Russia and Poland are the most attractive for Ukrainians (Fig. 4).

**Figure 4** Geographical Structure of Ukrainian Emigrants




Source: constructed by the authors according to the data http://www.ukrstat.gov.ua

According to the data of the State Statistics Service of Ukraine, the countries leading in the number of Ukrainian migrants are Russia and Poland, the share of which in the structure of emigration in 2008 was 48% and 8%, in 2012 - 43.5% and 14.4%, in 2017 - 26.3% and 38.9% respectively. During the investigation period, Russia gradually passed the position to Poland, the main reason of which was the beginning of military Ukrainian-Russian conflict (potential migrants see danger), and an increase of the number of work visas to Poland for Ukrainians. Thus, Poland ranked out from the 4th place in 2008 to the 1st in 2017, moving Russia to 2nd place with a difference of 12.6 percentage points. Italy and the Czech Republic, respectively, took the 3rd and 4th places. The shares of Hungary, Portugal, and other countries are almost invisible and tend to decline.

As a result of the PESTEL-analysis of the impact of factors on migration, conducted on the basis of literary resources, a model of five groups of factors (economic, political and legal, socio-cultural, natural and environmental, globalization and integration) was presented. Conducted expert evaluation has shown that economic factors (27.55%), political and legal factors (23.4%) have the greatest impact on migration in comparison with the other groups of factors, that confirms the importance of economic and political stability and the level of safety as the main basic elements of life quality.

In 2008, international money transfers in Ukraine made 3.43% of nominal GDP, in 2017 - 0.31% (https://bank.gov.ua). On the basis of the decrease in remittances, along with the increase of the number of Ukrainian migrants, it is possible to determine the decrease of trust and expediency of Ukrainian emigrants to transfer money through official channels. Thus, the outflow of labour has a negative impact on the financial system and GDP of Ukraine at the same time as the decrease of the number of transfers. For statistical estimation of such influence the Pearson correlation coefficient is calculated according to the formula (Shapochka et al., 2014):

$$r_{xy} = \frac{\sum_{i=1}^{m} (x_i - \underline{x})(y_i - \underline{y})}{\sqrt{\sum_{i=1}^{m} (x_i - \underline{x})^2 \sum_{i=1}^{m} (y_i - \underline{y})^2}} \quad (1)$$

where $r_{xy}$ –value of the coefficient of correlation between GDP and migration balances;

$x_i$ – value of GDP indicator;

$y_i$ –value of the balance of migration;

$\underline{x}$ –arithmetic mean of the GDP indicator;

$\underline{y}$ –arithmetic average of the indicator of the migration balance;

m – number of observations.

The absolute value of the correlation coefficient ranges from -1 to +1. The closer this indicator to 0, the lower is the connection, the closer it is to ±1, the closer the connection is. The sign "+" at the correlation coefficient means a direct connection between the signs x and y, the sign "-" - the inverse.

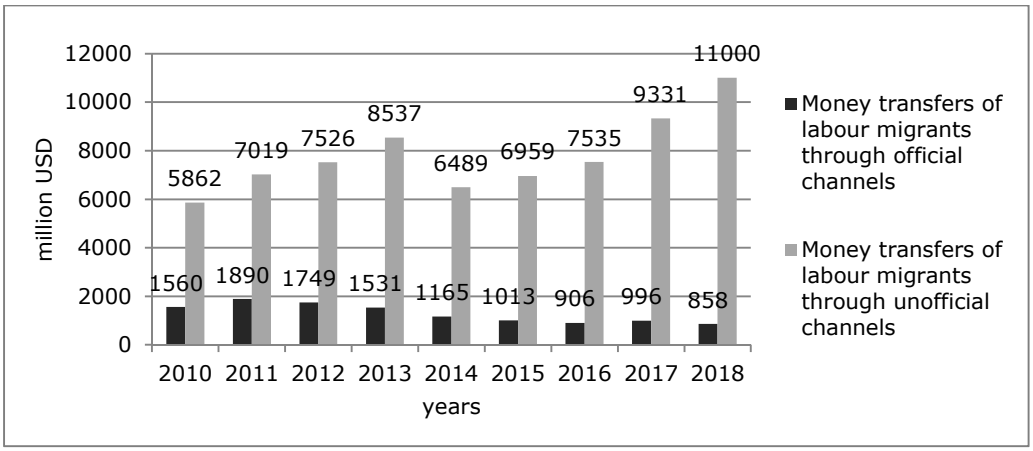
The strength of communication is determined on the Chaddock scale (Shapochka et al., 2014), according to which the value of the correlation coefficient | 0,1 | - | 0,3 | indicates a weak link strength; | 0,3 | - 0,5 | - moderate; | 0,5 | - | 0,7 | - noticeable; 0,7 | - | 0,9 | - high; | 0,9 | - | 1 | - very high.

Based on GDP and migration surplus data for 2008-2017, the correlation coefficient is -0.63. According to the Chaddock scale, the data value (-0.7) - (-0.5) indicates a noticeable inverse nexus between migration processes and GDP.

Based on the dominance of negative effects, it is concluded that the emigration movement of the population has a devastating effect on the financial system and the state of national economy of Ukraine as a result of the reduction of GDP volumes, consumption volumes and taxes. According to this fact, the role of migration policy as an instrument of regulation migration processes is significant.

Based on the data of the National Bank of Ukraine, the impact of migration on the Ukrainian economy was analyzed. The main means of the analysis are money transfers of labour migrants, which, at the same time, are a major negative factor as a result of the delay in the growth of the number of remittances to Ukraine (Fig. 5). The total amount of transfers by official and unofficial channels until 2013 increased. In particular, in 2013, transfers increased by 13.43%. Since 2014, the amount of money transfers has decreased sharply. The growth was much lower from 2014. Since 2017, the amount of transfers has increased, due to the growth of labour migrants and as a result of introduction of a simplified regime of entry into the EU.

**Figure 5** Money Transfers of Labour Migrants




Source: constructed by the authors according to the data https://bank.gov.ua

According to the results of 2017, the largest number of money transfers - more than a third - came to Ukraine from Poland. Russia, which received 14.6% of transfers is in the second place. Third place takes the USA, money transfers of which make up 7.3% (Zanuda, 2018). In comparison with the previous years, the share of transfers has changed. Thus, Russia and Poland reversed places: in 2015, Poland gave 19% of transfers, while Russia - 26.4%. Such a change in the structure of remittances is due to changes of the geographical structure of labour migrants (in 2017 Poland had 38.9% of migrants; Russia had 28.3%). However, if we make official transactions, the United

States and Russia will take the first places, while Poland has the 9th place. This situation shows that labour migrants in Poland prefer informal channels of money transfer (self-commissioning of cash, transfer of funds through chauffeurs who carry out international transportation and others).

The dependence of private money transfers of migrants by official channels as well as unofficial one presented on figure 6.

**Figure 6** Model of Dependence of Money Transfers from Migration Processes

Regression Summary for Dependent Variable: Var1
R= ,66863980 R?= ,44707919 Adjusted R?= ,22591086
F(2,5)=2,0214 p<,22733 Std.Error of estimate: 332,19

| N=8 | b* | Std.Err. of b* | b | Std.Err. of b | t(5) | p-value |
|---|---|---|---|---|---|---|
| Intercept | | | 96,2665 | 10,5437 | 3,201752 | 0,023948 |
| Var3 | 0,649692 | 0,411831 | 10,0110 | 0,0070 | 1,577572 | 0,175492 |
| Var4 | 0,031309 | 0,411831 | 10,0019 | 0,0251 | 0,076024 | 0,942348 |

Regression Summary for Dependent Variable: Var2
R= ,90802249 R?= ,82450484 Adjusted R?= ,80632518
F(1,6)=28,13441 p<,02649 Std.Error of estimate: 11,4

| N=8 | b* | Std.Err. of b* | b | Std.Err. of b | t(6) | p-value |
|---|---|---|---|---|---|---|
| Intercept | | | 76,532 | 10,561 | 7,288676 | 0,000340 |
| Var4 | 0,148022 | 0,403751 | 20,026 | 2,072 | 5,366618 | 0,000649 |

Legend:
Var1 - volumes of money transfers of labor migrants by official channels;
Var2 - volumes of money transfers of labor migrants taking into account informal channels;
Var3 - number of arrived persons;
Var4 - the number of departures.

Source: constructed by the authors

The constructed regression model confirms the hypothesis of low confidence of migrants in the banking system and confirms the need to find ways to increase remittances through official channels. The model of the dependence of remittance volumes on official channels showed that there was no significant effect of the migration indicators (Var3, Var4) on the amount of money transfers (Var1), which is confirmed by the low determination coefficient (0.44), the F-criterion (2.02 at the tabular value of 5.79), the t-criterion (0.08, 1.58 with table 2.57).

In the model of the dependence of money transfers volumes, taking into account informal channels, the influence of the number of departures (Var4) is statistically significant: the value of the ccoefficient of determination is 0.82, the F-criterion of Fisher is 28.13, the student's t-criterion is 5.37. Differences in the statistical significance of the constructed models indicate that the major part of private money transfers is carried out through informal channels.

Thus, private money transfers are an important source of currency inflows into Ukraine, their volumes are equated to the efficiency of direct investment of Ukraine. Effectiveness can be achieved by using official channels, especially through the banking system.

In order to increase the volume of international money transfers through the banking system (official channels), it is necessary to determine on which key aspects the state should pay attention to attract migrant workers to remittance through official channels (banking and other financial institutions). Summarizing theoretical and practical studies, we have identified a list of factors influencing the choice of money transfer channel: (1) accessibility - presence of agents of payment systems in a bank; (2) geography - coverage of countries that represents accessibility to recipients; (3) a set of possible currencies for the money transfers; (4) the reliability of the transfer channel; (5) commission for money transfer; (6) velocity of money transmission; (7) time to transfer money.

In order to assess the impact of these factors, they were ranked, which involves assessment of the impact of each of the factors on the choice of transfer of funds through the bank. The assessment was conducted by expert survey: the groups of factors were estimated in the range from 1 to 7: where "1" is the smallest influence, and "7" - the largest.

The process of forming a group of experts was carried out through self-assessment of

experts (which allowed to determine the level of their abilities); mutual evaluation of experts; expert evaluation by independent experts. The minimum required number of experts was determined by the formula (Litvak, 1996):

$$N_{\min} = 0{,}5 \times \left( \frac{3}{\lambda} + 0{,}5 \right) \tag{2}$$

where λ is a possible error of the examination results (0 < λ < 1).

So, if the marginal sample error equals 0.1, the estimated number of experts will be 16. To determine the consistency of expert opinions, the coefficient of concordation, which was developed by M. Kendall in the middle of the twentieth century, should be used. The coefficient of concordance is a value that characterizes the consistency of expert opinions and the reliability of the results of the polling survey (Litvak, 1996).

$$W = \frac{12 \times S}{m^2 \times (n^3 - n) - m \sum_{i=1}^{m} T_i} \tag{3}$$

where m is the number of experts in the group,

n – number of factors,

S – sum of squares of difference of ranks (deviations from the average).

$T_i$ – intermediate settlement results.

$$S = \sum_{i=1}^{n} \left( \sum_{j=1}^{m} a_{ij} - a \right)^2 \tag{4}$$

where a –average amount of ranks assigned to this factor by all experts.

$$T_i = \sum_{i=1}^{L} (t_l^3 - t_l) \tag{5}$$

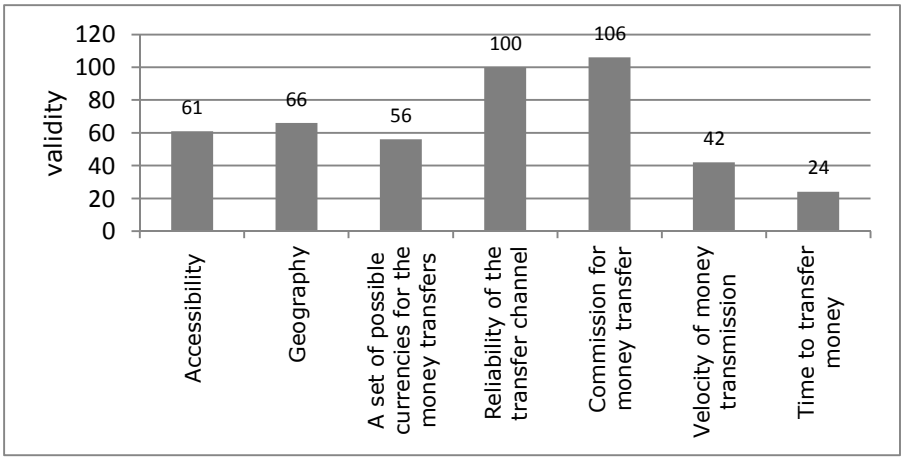
$t_l$ – the number of bound ranks in each group.

Statistical significance of the coefficient of concordation is determined using Pearson's "xi-squared" criterion according to the following formula (for the number of objects n ≥ 7) (6):

$$\chi^2 = m \times (n-1) \times W \tag{6}$$

Based on the calculations (Table 1), it is possible to distinguish the most important factors which influence on the choice of a money transfer channel (Figure 7): the commission factor remains the most important influence and almost the same impact has reliability.

**Figure 7** Distribution of the Factors which Impact on the Choice of the Channel of Money Transfers




Source: calculated by the authors

Therefore, the value of the coefficient of concordance is:

$$W = \frac{12 \times 5214}{\left[16^2 \times (7^3 - 7) - 16 \times 186\right]} = 0{,}7534$$

**Table 1** Estimation of the factors, which impact on the choice of the channel of money transfers

| № | Factors | Experts | | | | | | | | | | | | | | | | $\sum_{j=1}^{m} R_{ij}$ | $\overline{d}$ | $d_j$ | $d_j^2$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | | | | |
| 1 | Accessibility | 3 | 5 | 5 | 3 | 5 | 3 | 5 | 3 | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 5 | 61 | 65 | -4 | 16 |
| 2 | Geography | 4 | 4 | 3 | 3 | 3 | 3 | 3 | 5 | 5 | 5 | 4 | 5 | 5 | 5 | 5 | 4 | 66 | 65 | 1 | 1 |
| 3 | A set of possible currencies for the money transfers | 2 | 3 | 4 | 3 | 3 | 3 | 3 | 3 | 3 | 5 | 4 | 5 | 3 | 5 | 4 | 3 | 56 | 65 | -9 | 81 |
| 4 | Reliability of the transfer channel | 7 | 6 | 6 | 6 | 6 | 6 | 6 | 7 | 6 | 7 | 7 | 7 | 5 | 7 | 5 | 6 | 100 | 65 | 35 | 1225 |
| 5 | Commission for money transfer | 7 | 7 | 6 | 7 | 7 | 7 | 7 | 6 | 7 | 6 | 7 | 6 | 7 | 6 | 6 | 7 | 106 | 65 | 41 | 1681 |
| 6 | Velocity of money transmission | 2 | 1 | 2 | 2 | 4 | 2 | 4 | 1 | 2 | 3 | 4 | 4 | 3 | 3 | 4 | 1 | 42 | 65 | -23 | 529 |
| 7 | Time to transfer money | 1 | 2 | 1 | 2 | 1 | 1 | 1 | 2 | 1 | 1 | 3 | 1 | 1 | 2 | 2 | 2 | 24 | 65 | -41 | 1681 |
| | Number of the same values of ranks ($t_e$) | $(2^3-2)+(2^3-2)$ | - | $(2^3-2)$ | $(3^3-3)+(2^3-2)$ | $(2^3-2)$ | $(3^3-3)$ | $(2^3-2)$ | $(2^3-2)$ | $(2^3-2)$ | $(2^3-2)+(2^3-2)$ | $(3^3-3)+(2^3-2)$ | $(2^3-2)$ | $(2^3-2)+(2^3-2)$ | $(2^3-2)$ | $(3^3-3)$ | - | 455 | | Sum | 5214 |
| | | 12 | | 6 | 30 | 6 | 24 | 6 | 6 | 6 | 12 | 30 | 6 | 12 | 6 | 24 | | 186 | | | |

Source: calculated by the authors

And the value of the significance of the concordation coefficient is determined by the Pearson criterion "xi-square":

$$\chi^2 = 16 \times (7-1) \times 0{,}7534 = 72{,}333$$

In case of confidential interval 99.9% and the number of degrees of freedom df = 7 - 1 = 6 is a rejection limit is 22.457. The reported value is 72,333>24,32. Therefore, the consistency of expert opinions is not accidental.

Second place was shared by geography and accessibility factors. On the third place there is a set of possible currencies for the money transfers, on the fourth is velocity of money transmission and the most significant is the time to transfer money.

In addition to the static analysis, it is important to analyze these factors in the dynamics to determine the possible change of their impact (Table 2).

**Table 2** Estimation of the dynamics of the influence of factors on the choice of money transfer channel

| **Factors** | **Change of influence** | | | **Weighted average** |
|---|---|---|---|---|
| | much stronger – 2 | to intensify – 1 | will not change – 0 | |
| | **number of expert answers** | | | |
| Accessibility | 10 | 3 | 3 | 1,4375 |
| Geography | 6 | 5 | 5 | 1,0625 |
| A set of possible currencies for the money transfers | 1 | 3 | 12 | 0,3125 |
| Reliability of the transfer channel | 2 | 4 | 10 | 0,5 |
| Commission for money transfer | 3 | 2 | 11 | 0,5 |
| Velocity of money transmission | 7 | 5 | 4 | 1,1875 |
| Time to transfer money | 4 | 5 | 7 | 0,8125 |

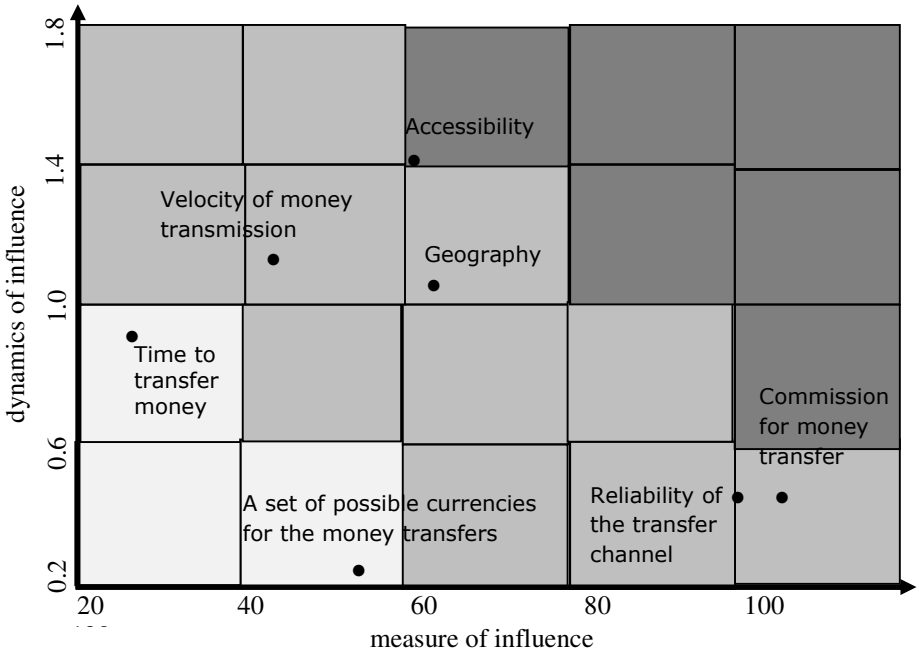
Source: calculated by the authors

In order to obtain a generalized vision, it is expedient to present the calculated results by the degree of influence and dynamics on the matrix (Figure 7).

According to the placement of factors on the matrix, banking institutions need to maintain a high level of transferability and consider possible ways to reduce their own share in the commission for transfers. These factors are most important despite low dynamics. One way is the development of its own money transfer system, such as Welsend (UkrGasBank), PrivatMoney (PJSC CB PrivatBank), IBOX MONEY TRANSFER (PJSC Ai-Box Bank) ) payment system ("TYME"), organized by a non-banking institution, which allows it to manage independently the commission for the money transfer, and to be independent from external agents.

At present, the payment system S.W.I.F.T is more widespread (Society for Worldwide Interbank Financial Telecommunications), which allows to make transfers in foreign currency to any country in the world for the benefit of individuals and legal entities in the following currencies: USD (USD), Euro (EUR), GBP (British Pound) Swiss Franc (CHF), Russian Ruble (RUB).

**Figure 7** Matrix of Distribution of Factors which Influenced the Choice of the Channel of Money Transfers




Characteristics of the quadrants of the matrix:

The factor has the greatest influence on the choice of the money transfer channel and the high dynamics of influence on the choice of the channel of transfer of funds

The factor has an average impact on the choice of a money transfer channel and sufficient dynamics of influence on the choice of a money transfer channel

The factor has a low effect on the choice of the money transfer channel and the dynamics of influence on the choice of the money transfer channel will be almost unchanged.

Source: calculated by the authors

The most important factor is accessibility, because it has the highest level of dynamics, indicating the need of consumers of this service in the maximum possible choice of the existing channels of money transfer presented in the bank, which also allows access to currencies within each channel. The last factor that requires improvement is the need to expand geography, which is due to recent changes in the foreign policy of the state. Taking into account the insufficient level of labour remuneration in Ukraine, the issue of migration of labour resources, remains rather urgent problem, and citizens are trying to find work in different countries of the world, which becomes an objective reason for the need to expand the geography of remittances.

## 3 Conclusions

We analyzed the dynamics of migration processes and structure of Ukrainian migrants. As a result, it is determined that during 2008-2017 Ukraine had a positive migration balance, indicating its potential attractiveness for foreign migrants. The most attractive for Ukrainians is Russia and Poland.

The Pearson correlation coefficient (-0.63) indicated a marked inverse nexus between GDP and migration processes, which shows the negative impact of migration on the level of economic development of the country and the financial system.

The constructed regression model of the relationship between migrants and money transfers proved the hypothesis of low confidence of migrants to the banking system and confirmed the need to find ways to increase remittances through official channels. Differences in the statistical significance of the constructed models indicated that the major part of transfers is carried out through informal channels. This tendency has a negative effect on the accumulation of funds in the financial sector, which could not work for the development of the economy

We aim to expand our research in the future to contain more years and possibly, to investigate instruments for the development of the international money transfer market in Ukraine in conjunction with migration processes, on both macro level (state level) and at micro level (level of financial institution).

## References


Kornienko, O. O. (2017). *Socio-economic aspect of regional asymmetry of migration processes*. (Candidate dissertation). Institute for Demography and Social Studies M.V. Ptuhy of National Academy of Science of Ukraine.

Lanati, M., Thiele, R. (2018). The impact of foreign aid on migration revisited. *World Development*, vol. 111, pp. 59-74.

Lastovetska, R. O. (2015). Mutual influence of the volume of informal money transfers and the level of dollarization of the Ukrainian economy. *Actual problems of the economy*, vol. 6, pp. 255-362.

Litvak, B. G. (1996). *Expert evaluations and decision-making*. Moscow: Patent.

Malynovska, O. A. (2011). Circular migration - a political fashion or a forward-looking model of migration management? *Demography and social economics*, vol. 2(16), pp. 95-104.

Markovski, K. (2008). Economic aspects of migration. *Migration – challenge of XXI century*. Lublin, pp. 35-49.

National Bank of Ukraine (2019). *Statistical data of money transfers*. Retrieved from: https://bank.gov.ua.

Rayp, G., Ruyssen, I., Standaert, S. (2017). Measuring and Explaining Cross-Country Immigration Policies. *World Development*, vol. 95, pp. 141-163.

Shapochka, M. K., Matsenko, O. M. (2014). *Theory statistics.* Sumy: Universitetska knyga.

Stark, O., Byra, L., Casarico, A., Uebelmesser, S. (2017). A critical comparison of migration policies: Entry fee versus quota. *Regional Science and Urban Economics*, vol. 66, pp. 91-107.

State migration Service of Ukraine (2019). *Statistical data of migration*. Retrieved from: https://dmsu.gov.ua/.

State Statistics Service of Ukraine (2019). *Statistical data of migration*. Retrieved from: http://www.ukrstat.gov.ua/.

Zanuda, A. (2018). *Migrants or Investors: Who More Contributes to the Ukrainian Economy?* Retrieved from: https://www.bbc.com/ukrainian/features-45473686.

Zapadnuk, S. O. (2012). Migrations of Ukraine's population: the intra-regional dimension. *Ukrainian Geographic Journal*, vol. 2, pp. 28-33.

# Regional Differences in the Relation of Flat Prices to Net Disposable Income of Households

**Lenka Komárková[1], Libor Votava[2], Jiří Dvořák[3]**

[1] University of Economics, Prague
Faculty of Management, Department of Exact Methods
Jarošovská 1117, CZ-37701 Jindřichův Hradec, Czech Republic
E-mail: lenka.komarkova@vse.cz

[2] University of Economics, Prague
Faculty of Management, Department of Social Sciences
Jarošovská 1117, CZ-37701 Jindřichův Hradec, Czech Republic
E-mail: votaval@fm.vse.cz

[3] University of Economics, Prague
Faculty of Management, Department of Management
Jarošovská 1117, CZ-37701 Jindřichův Hradec, Czech Republic
E-mail: dvorakji@fm.vse.cz

***Abstract:*** *The residential real estate market (especially flats) is currently a very topical issue both from an economic as well as social point of view. Flat and house prices determine the economic burden in family finances and the availability of housing for households in regions. The paper aims to identify differences in the relation between flat prices and net disposable income of households among 14 regions in the Czech Republic based on the publicly available data from the period 2000 - 2017. To deal with the panel (longitudinal) data, a linear mixed model was used for the analysis. Twenty statistically significant differences from a total of 91 were identified. The results show that flat prices grow with increasing household disposable income faster in Prague as compared to other regions, except South Moravia. The results of our study can be helpful in the perspective of the regional economic policy or households' decision makings about their living place or the family real estate investment.*

*Keywords: real estate market, flat prices, household disposable income, panel data, regional analysis*

*JEL codes: D10, G11, R31*

## 1 Introduction

In recent years, the topic of flat prices and, in general, the real estate market has been relatively frequently discussed not only in the Czech Republic (Lux and Sunega, 2010; Hlaváček and Komárek, 2011; Cadil et al., 2014; Votava and Dvořák, 2018), but also in in other European countries (e.g. Huynh-Olesen et al., 2013; Grum and Govekar, 2016). According to the Public Opinion Research Centre (Centrum pro výzkum veřejného mínění, 2018), Czech citizens evaluate the possibility of getting or buying a flat as bad in 72% and 73% of cases, respectively. In this context, it is argued that price developments in the real estate market (especially in housing) may have some undesirable effects in the future. One of them can be (Dewilde and Lancee, 2013) an increase in the unavailability of housing (especially ownership), which affects social tensions in society. There is a risk of household over-indebtedness (as a result of rising housing loans) and increased inequality of wealth between households. Especially, homeowners and real estate owners get richer at the expense of those who do not own the property (Brůha et al., 2017; Filandri and Bertolini, 2016; Filandri and Olagnero, 2014; Lux and Sunega, 2014).

The real estate market (including the housing market) is unique as opposed to other markets. A typical feature of this market is the impossibility of price arbitrage. The property cannot be bought in places with a lower price and resold in places with a higher price (Case and Shiller, 1989; Hassan, 1990). Similarly to other states, special taxes are imposed on real estate in the Czech Republic, namely real estate tax and property

acquisition tax (O'Sullivan and Gibb, 2012; Wieser and Mundt, 2014). It is also a market with special social considerations. Housing is connected with satisfying one of the basic human needs. The construction of new residential properties (especially flats) is strongly influenced by procedural and other constraints, e.g., the need for building permits or land limits for the construction of new real estate as a result of binding land use plans (Hilber and Vermeulen, 2016). From a technical and manufacturing point of view, a typical feature for real estate is the very limited ability to build them in a short time frame. This affects the price elasticity of the supply of new flats and real estate (Meen, 2005), which may be little elastic in the short and medium term (months or years). Therefore, the real estate market is a particular local market. The investigation of the market as a whole (the Czech Republic), e.g., by averaging prices and financial indicators should be burdened with distortion and simplification. Analysis of local linkages and dependencies can yield better results for explaining some phenomena than aggregating and averaging across the Czech market (Mikeszová, 2008; Sunega et al., 2010).

Market prices of real estate (flats) in individual regions are results of the effects of demand and supply determinants (Hlaváček and Komárek, 2010, 2011). Some of them (e.g., real estate taxes, total demographic trends, economic cycle phases) operate on the market across the country, and some (e.g., the attractiveness of the place and local wealth) are mainly regional in nature. In particular, household disposable income (HDI) belongs to essential local demand determinants. It can be expected that there is a link between HDI and housing prices (Bischoff, 2012). Namely, regions with higher average HDI should have, on average, higher prices per square meter of living space (Cadil et al., 2014). With rising HDI, flat prices should also rise (Votava and Dvořák, 2018). However, the sensitivity of the response to HDI is unlikely to be the same in all regions as a result of other demand and supply determinants. Our paper aims, therefore, to answer the following research question:

*RQ: How does the relationship between housing prices and households' income differ in individual regions?*

This study follows the results by Votava and Dvořák (2018). Using data from the 5-year period 2012–2016, they investigated relations between flat prices and selected variables including also HDI, however without examining regional differences in such relations.

## 2 Methodology and Data

Publicly available data of the Czech Statistical Office and the Ministry for Regional Development were used in this study. In particular, housing prices were expressed as mean flat prices related to a square meter in a given year; and HDI as annual households' net disposable income per capita. The indicators were collected separately for all the 14 Czech NUTS 3 regions and measured in thousands of CZK. The 18-year period 2000–2017 was chosen. For the Czech regions, we used abbreviations in Table 1, which also shows regional mean values over the considered period. It can be seen that the largest average ratio of the flat price to HDI is in Prague and the lowest one in the case of the Ústí nad Labem region.

The obtained data were in the form of panel (longitudinal) data, where the panel unit corresponds to the region. With regard to this, statistical methods of modeling panel data, with flat price as a response and households' income as a predictor, were chosen to answer the research question RQ. In addition, Hlaváček and Komárek (2010, 2011) also used a panel regression for investigating the influence of various demand and supply determinants on flat prices on annual data during 1998–2008. For our study, a linear mixed model with a random intercept for the region and an AR(1) process for the error terms was used for each region, see Pinheiro and Bates (2000) for more details about the method. The significance of inter-regional differences was assessed through regression line slopes' comparison using the multiple comparison method of Hothorn et al. (2008). Statistical data analysis, including graphics, was performed in the R 3.5.2 software (R Core Team, 2018).

**Table 1** Regional mean values for flat prices in thousands of CZK per square meter, HDI in thousands of CZK, and price-to-HDI ratios in % over the entire period 2000–2017 and abbreviations for the Czech regions

| Abbrev. | English Name | Original Name | Flat price | HDI | Price-to-HDI |
|---|---|---|---|---|---|
| **PHA** | Prague | Praha | 40.3 | 239.6 | 16.5 |
| **STC** | Central Bohemian | Středočeský | 17.6 | 193.9 | 8.8 |
| **JHC** | South Bohemian | Jihočeský | 12.7 | 173.1 | 7.1 |
| **PLZ** | Plzeň | Plzeňský | 15.2 | 180.8 | 8.1 |
| **KAR** | Karlovy Vary | Karlovarský | 10.7 | 163.5 | 6.4 |
| **UST** | Ústí nad Labem | Ústecký | 6.9 | 158.3 | 4.2 |
| **LIB** | Liberec | Liberecký | 12.1 | 169.3 | 6.9 |
| **KHK** | Hradec Králové | Královéhradecký | 15.7 | 174.8 | 8.7 |
| **PAR** | Pardubice | Pardubický | 15.4 | 168.0 | 8.8 |
| **VYS** | Vysočina | Vysočina | 13.1 | 170.8 | 7.4 |
| **JHM** | South Moravian | Jihomoravský | 20.7 | 175.3 | 11.3 |
| **OLO** | Olomouc | Olomoucký | 13.9 | 163.4 | 8.2 |
| **ZLI** | Zlín | Zlínský | 14.9 | 167.6 | 8.7 |
| **MSK** | Moravian-Silesian | Moravskoslezský | 11.3 | 161.4 | 6.8 |

Source: own processing

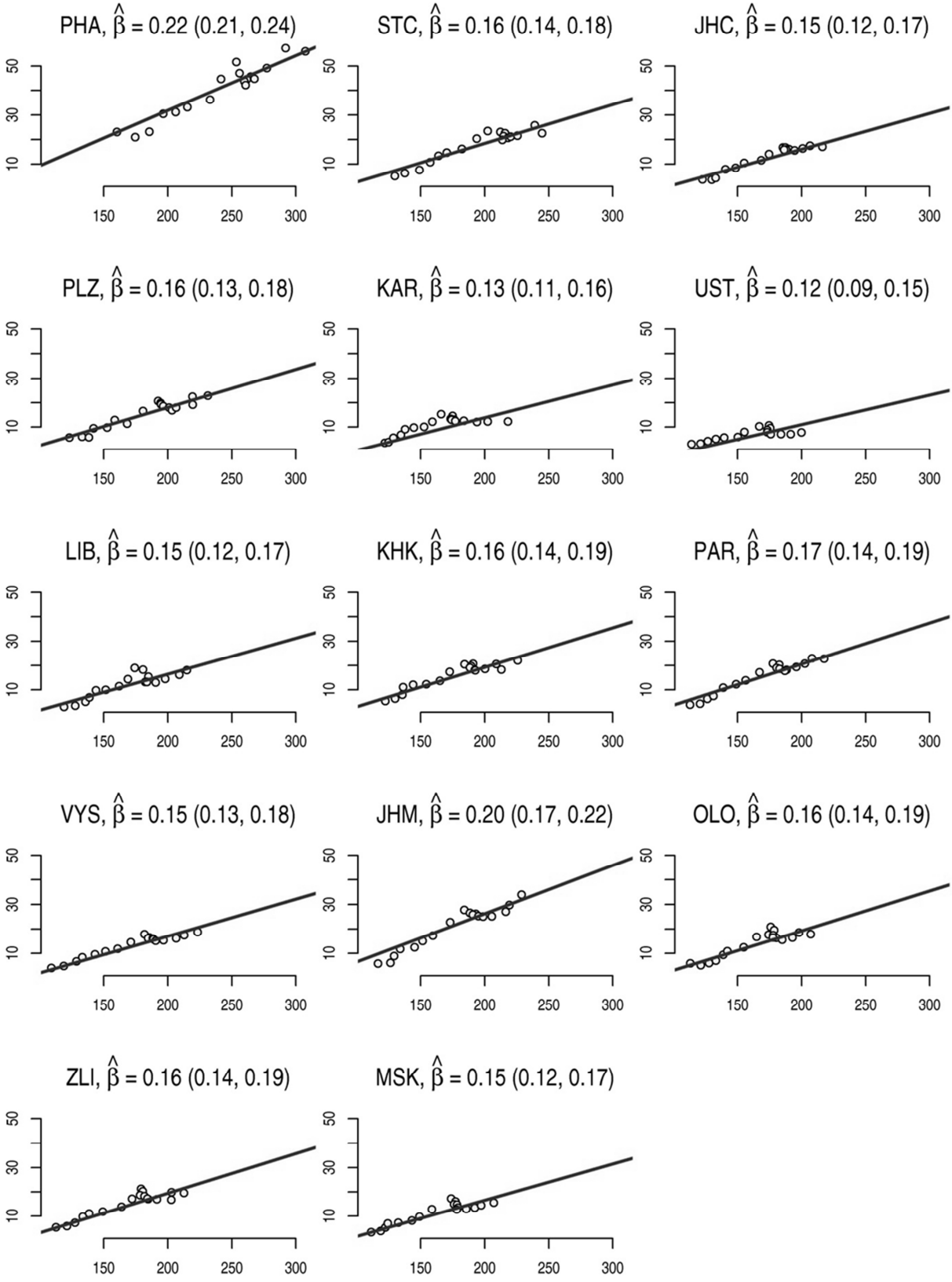
## 3 Results and Discussion

Scatterplots in Figure 1 give an overview of the considered relations between the regional flat price and HDI. Besides individual regional observations, they show regional regression lines with the related point and interval estimates for the regional slopes based on the considered linear mixed model. Figure 1 shows that the greatest slope is for Prague (0.22), and the lowest one is for Ústí nad Labem (0.12). This corresponds to the price-to-HDI ratios in Table 1.

Table 2 presents post-hoc multiple comparison results using the Hothorn et al. (2008)'s approach. In particular, Table 2 shows 20 statistically significant differences between regions from a total of 91 pairwise comparisons. The results demonstrate that flat prices grow with increasing HDI faster in Prague as compared to the other 12 regions. Thus, we confirm a specific position of Prague, which is the largest city and the capital of the Czech Republic. From the point of view of the change of HDI, the flat prices in Prague appear to be the most sensitive and thus the riskiest. Nevertheless, Hlaváček and Komárek (2010, 2011) point out that based on the price-to-income ratios, flat prices in Prague appear to be overvalued. On the contrary, they appear to be undervalued using the residual analysis of multiple panel regression with a number of explanatory variables representing demand and supply factors. It means that investigated relation can be influenced by many other factors.

As compared to Prague, the only exception is the South Moravian region (including the second largest city Brno) with the second greatest slope, where no statistically significant difference in the slopes was detected (JHM: 0.20 vs. PHA: 0.22). The South Moravian region differs in the slope of the linear relationship between HDI and the flat price from 7 regions, namely South Bohemia, Plzeň, Karlovy Vary, Ústí nad Labem, Liberec, Vysočina and the Moravia-Silesian region. Similarly to Prague, the slope of the regression line in the South Moravian region is statistically significantly steeper. The last significant difference in slopes is between the Pardubice (the third greatest slope) and Ústí nad Labem region (the lowest slope). In this region with the long-term higher unemployment and the lowest purchasing power (Cadil et al., 2014) there is the lowest sensitivity of flat prices to the HDI change.

**Figure 1** Scatterplots (x – annual net disposable income in thousands of CZK for household per capita, y – flat price in thousands of CZK per square meter) for Regions with Regression Lines and Related Estimates (95% confidence intervals) for Slopes




Source: own processing

**Table 2** Significant results after multiple comparison for regional difference in slopes of regression lines

| Difference | Estimate | Confidence Interval | P-value |
|---|---|---|---|
| **STC – PHA** | -0.07 | (-0.10, -0.03) | < 0.001 |
| **JHC – PHA** | -0.08 | (-0.12, -0.04) | < 0.001 |
| **PLZ – PHA** | -0.07 | (-0.10, -0.03) | < 0.001 |
| **KAR – PHA** | -0.09 | (-0.13, -0.05) | < 0.001 |
| **UST – PHA** | -0.10 | (-0.14, -0.06) | < 0.001 |
| **LIB – PHA** | -0.08 | (-0.12, -0.04) | < 0.001 |
| **KHK – PHA** | -0.06 | (-0.10, -0.03) | < 0.001 |
| **PAR – PHA** | -0.06 | (-0.09, -0.02) | < 0.001 |
| **VYS – PHA** | -0.07 | (-0.11, -0.04) | < 0.001 |
| **OLO – PHA** | -0.06 | (-0.10, -0.02) | < 0.001 |
| **ZLI – PHA** | -0.06 | (-0.10, -0.02) | < 0.001 |
| **MSK – PHA** | -0.08 | (-0.12, -0.04) | < 0.001 |
| **JHM – JHC** | 0.05 | (0.01, 0.09) | 0.003 |
| **JHM – PLZ** | 0.04 | (0.00, 0.08) | 0.046 |
| **JHM – KAR** | 0.06 | (0.02, 0.10) | < 0.001 |
| **PAR – UST** | 0.05 | (0.00, 0.09) | 0.021 |
| **JHM – UST** | 0.08 | (0.03, 0.12) | < 0.001 |
| **JHM – LIB** | 0.05 | (0.01, 0.09) | 0.007 |
| **JHM – VYS** | 0.05 | (0.00, 0.09) | 0.015 |
| **MSK – JHM** | -0.05 | (-0.09, -0.01) | 0.012 |

Source: own processing

## 4 Conclusions

The share of housing expenditures represents a substantial part of household expenditures. Absolute housing expenditures increase with requirements on the housing quality, which is given by the size and the type of property, and the location attractiveness (Van Ommeren and Koopman, 2011). The demand for a certain type of housing from the perspective of housing quality is, therefore, strongly determined by HDI (Dewilde and Lancee, 2013), both in the case of rental housing and ownership. The amount of HDI is one of the most important factors determining the availability of credit (mortgage loans or building savings loans) intended to acquire ownership of housing. Thus, HDI indirectly determines the lending capacity of an individual (household) and sets limits on many households for a viable demand for intent to buy own property (flat). HDI can affect speculative demand, demand for real estate (housing) as an investment. In regions with a long-term higher average HDI, the financial wealth of households is likely to be higher on average as a result of savings made with unused income in the past. This may affect the size of local demand for investment goods, such as flats or property in general.

Our statistical analysis demonstrated that HDI is an important demand determinant explaining why prices per square meter of a residential area in individual regions gradually increase and at the same time differ considerably among the regions. Richer regions with higher average HDI have on average higher prices for one square meter of a residential area. Furthermore, the analysis showed significant statistical differences in how the price per square meter of housing area responds to HDI. The highest sensitivity was observed in the regions of Prague and South Moravia and the smallest in the Ústí nad Labem region. Differences in sensitivity appear to be due to other local (demand or supply) determinants of the property market. Influences of such determinants were not the subject of this paper, and it is a limitation of our study. Therefore, in future research, we plan to focus on a number of determinants, both on the supply side and on the demand side, including also the non-economic ones. That more extensive future study would help identify in which regions flat prices are the result of the so-called price bubble.

## Acknowledgments

This work was financially supported by the Czech Science Foundation (GAČR) under the grant number 19-00015S.

## References

Bischoff, O. (2012). Explaining regional variation in equilibrium real estate prices and income. *Journal of Housing Economics*, vol. 21(1), pp. 1–15.

Brůha, J., Hlaváček, M., Komárek, L. (2017). House Prices and Household Consumption: The Case of the Czech Republic. *Czech National Bank Working Papers,* vol. 2017(11), pp. 1–40. Retrieved from: https://ideas.repec.org/p/cnb/wpaper/2017-11.html.

Case, K. E., Shiller, R. J. (1989). The Efficiency of the Market for Single-Family Homes. *The American Economic Review*, vol. 79(1), pp. 125–137.

Centrum pro výzkum veřejného mínění (2018). *Hodnocení některých sociálních podmínek – říjen 2018.* Praha: Sociologický ústav Akademie věd ČR. Retrieved from: https://cvvm.soc.cas.cz/media/com_form2content/documents/c2/a4755/f9/eu181120.pdf.

Cadil, J., Mazouch, P., Musil, P., Kramulova, J. (2014). True regional purchasing power: evidence from the Czech Republic. *Post-Communist Economies*, vol. 26(2), pp. 241–256.

Dewilde, C., Lancee, B. (2013). Income inequality and access to housing in Europe. *European sociological review*, vol. 29(6), pp. 1189–1200.

Filandri, M., Bertolini, S. (2016). Young People and Home Ownership in Europe. *International Journal of Housing Policy*, vol. 16(2), pp. 144–164.

Filandri, M., Olagnero, M. (2014). Housing Inequality and Social Class in Europe. *Housing Studies*, vol. 29(7), pp. 977–993.

Grum, B., Govekar, D. K. (2016). Influence of macroeconomic factors on prices of real estate in various cultural environments: case of Slovenia, Greece, France, Poland and Norway. *Procedia Economics and Finance*, vol. 39, pp. 597–604.

Hassan, K. (1990). Real Estate in the Theory of Finance. *Real Estate Appraiser and Analyst*, vol. 56(1), p. 60–67.

Hilber, C. A. L., Vermeulen, W. (2016). The Impact of Supply Constraints on House Prices in England. *Economic Journal*, vol. 126(591), pp. 358–405.

Hlaváček, M., Komárek, L. (2010). Rovnovážnost cen nemovitostí v České republice. *Politická ekonomie*, vol. 58(3), pp. 326–342.

Hlaváček, M., Komárek, L. (2011). Regional Analysis of Housing Price Bubbles and Their Determinants in the Czech Republic. *Czech Journal of Economics and Finance*, vol. 61(1), pp. 67–91.

Hothorn, T., Bretz, F., Westfall, P. (2008). Simultaneous Inference in General Parametric Models. *Biometrical Journal*, vol. 50(3), pp. 346–363.

Huynh-Olesen, D., Steiner, K., Hildebrandt, A., Wagner, K. (2013). Residential Property Prices in Central, Eastern and Southeastern European Countries: The Role of Fundamentals and Transition-Specific Factors. *Focus on European Economic Integration,* vol. Q2/13, pp. 52–76.

Lux, M., Sunega, P. (2010). Udržitelnost vývoje cen bytů v České republice. *Politická ekonomie*, vol. 58(2), pp. 225–252.

Lux, M., Sunega, P. (2014). Public Housing in the Post-socialist States of Central and Eastern Europe: Decline and an Open Future. *Housing Studie*s, vol. 29(4), pp. 501–519.

Meen, G. (2005). On the economics of the Barker Review of housing supply. *Housing Studies*, vol. 20(6), pp. 949–971.

Mikeszová, M. (2008). Regionální disparity ve finanční dostupnosti nájemního bydlení. In: A. Kutscherauer, ed., *Regionální disparity - jejich pojetí, klasifikace a měření*, pp. 78–93. Retrieved from: https://www.soc.cas.cz/publikace/regionalni-disparity-ve-financni-dostupnosti-najemniho-bydleni.

O'Sullivan, A., Gibb, K. (2012). Housing Taxation and the Economic Benefits of Homeownership. *Housing Studies*, vol. 27(2), pp. 267–279.

Pinheiro, J. C., Bates, D. M. (2000). *Mixed-effects Models in S and S-PLUS*. Springer.

R Core Team (2018). *R: A language and environment for statistical computing.* Vienna: R Foundation for Statistical Computing. Retrieved from: https://www.R-project.org/.

Sunega, P., Lux, M., Mikeszová, M. (2010). *Regionální rozdíly ve finanční dostupnosti bydlení jako bariéra pro migraci za prací: analýza a možné nástroje státu*. Praha: Sociologický ústav Akademie věd ČR. Retrieved from: http://www.disparity.cz/data/USR_048_DEFAULT/migrace_2010.pdf.

Van Ommeren, J., Koopman, M. (2011). Public housing and the value of apartment quality to households. *Regional Science and Urban Economics*, vol. 41(3), pp. 207–213.

Votava, L., Dvořák, J. (2018). Ekonomický růst a hospodářská politika jako faktor ovlivňující trh bytů. In: Fiala, R., Závodný Pospíšil, J., ed., *Proceedings of 10th annual international scientific conference Competition*. Jihlava: Vysoká škola polytechnická Jihlava, pp. 415–425.

Wieser, R., Mundt, A. (2014). Housing Subsidies and Taxation in Six EU Countries: Trends, Structures and Recent Measures in the Light of the Global Financial Crisis. *Journal of European Real Estate Research*, vol. 7(3), pp. 248–269.

# Foreign Trade in Central Europe: The Analysis of Openness

**Jaroslav Kovárník[1], Eva Hamplová[2]**

[1] University of Hradec Králové
Faculty of Informatics and Management, Department of Economics
Rokitanského 62, 500 03 Hradec Králové, Czech Republic
E-mail: jaroslav.kovarnik@uhk.cz

[2] University of Hradec Králové
Faculty of Informatics and Management, Department of Economics
Rokitanského 62, 500 03 Hradec Králové, Czech Republic
E-mail: eva.hamplova@uhk.cz

***Abstract:*** *The main topic of this article is the analysis of selected issues of foreign trade in the countries from central Europe, namely the Czech Republic, Poland, Slovakia, Hungary, Germany, and Austria. The Czech Republic, Poland, Slovakia, and Hungary are member states of so-called Visegrad Four, and they can be considered as developing countries, at least in comparison with other two analysed countries. Germany and Austria are not only strong and powerful countries, but they are also important business partners for all V4 countries. This article focuses on selected aspects of foreign trade development, because foreign trade is considered to be very important for successful and sustainable development of almost all countries around the world. The article analyses development of foreign trade with goods and with services, where we have discovered relatively surprising results (the weakest country in terms of services has been Germany, where the country with highest net balance has been Poland). Consequently, the article analyses the dependency of analysed countries on foreign trade. Several indicators can be used for this analysis, where the authors have been used export on GDP ratio, import on GDP ratio, and turnover on GDP ratio. From theoretical point of view, strong and large economies should be less dependent on foreign trade, where weak and small countries should be more dependent. This fact has been proved, but on the other hand, although small and relatively weak countries are more dependent on foreign trade, the final benefit of net balance on GDP is relatively low, which is relatively surprising fact again.*

*Keywords: Central Europe, The Czech Republic, export, foreign trade, import*

*JEL codes: F43, O11*

## 1 Introduction

Foreign trade is very important for every state all around the world because of many reasons. In almost all countries, worldwide, foreign trade helps to solve the proportionality problem, where only few countries have all necessary resources in quantities required for economic development. Foreign trade also has demonstrative effect, where the export program is kind of indicator of the level of economic development, and it also helps create an image of developed country. Foreign trade has also other benefits, such as support of peaceful cooperation among partners, reducing of the risk of conflict, growth of education, and others.

Nevertheless, from economic point of view, foreign trade is a part of macroeconomic Gross Domestic Product (GDP) formula in open economy. In other words, it can either improve the GDP level (in case that export is higher than import) or worsen it (in the opposite case). This basic theory has been explained in many books and articles, for example in Andrews et al. (2011), or Samuelson and Nordhaus (2010), where these authors explain the GDP formula in open economies.

From above mentioned text is clear that foreign trade is very important for every country. The importance of foreign trade has been evaluated in other articles by other authors, for example Baier et al. (2014), Cieslik et al. (2016), Do et al. (2016), Fracasso and Marzetti (2015), Giordano and Zollino (2016), Gladkov (2016), or Vannoorenberghe (2014). Baier et al. (2014) focus on analysis of the influence of agreements on foreign

trade. Cieslik et al. (2016) analyse development in post-socialist countries. Do et al. (2016) write about comparative advantage in different countries. Fracasso and Marzetti (2015) analyse research and development spill-overs in the perspective of the foreign trade. Giordano and Zollino (2016) write about price and non-price competitiveness in large euro-area countries. Gladkov (2016) describes foreign trade in the European Union. Vannoorenberghe (2014) evaluates risk-taking in the perspective of foreign trade. Authors themselves already analysed the topic of foreign trade in the Central Europe several times, for example in Kovárník and Hamplová (2017), Kovárník and Hamplová (2018a), or Kovárník and Hamplová (2018b).

The Czech Republic is a member state of Visegrad Four, and all other member states (namely Poland, Slovakia, and Hungary) are very important business partners for the Czech Republic. Situation in Visegrad Four countries has been also analysed by other authors, for example by Zdražil and Kraftová (2012). However, the most important business partner for the Czech Republic is Germany, where this economy has a very important position as a business partner for all V4 countries. Other developed country from central Europe, which plays significant role in foreign trade of all V4 countries, is Austria.

The aim of this article is to analyse the selected aspects of foreign trade in above-mentioned countries, namely in the Czech Republic, Poland, Hungary, Slovakia, Germany, and Austria. Firstly, this article analyses the development of GDP in selected countries, because of the importance of foreign trade for this indicator. The development of foreign trade in terms of goods and in terms of services in these countries is next topic for analysis. Consequently, the openness of analysed countries is evaluated, where the authors have decided to use export on GDP ratio, import on GDP ratio, and foreign trade turnover on GDP ratio, and compare the results. The aim is to verify theoretical hypothesis that economically strong or large countries are usually less dependent on foreign trade, where weak or small countries are usually more dependent. Finally, the contribution of net balance of foreign trade to GDP creation has been evaluated, with respect to the dependency of every country.

## 2 Methodology and Data

Covered period of time is 2000 – 2018, where data were obtained in general available database Eurostat and calculated by authors (Eurostat, 2018a, Eurostat, 2018b).

Methods of comparison and comparative analysis have been used. Moreover, several different indicators can be used for the verification of above-mentioned hypothesis about openness of economy. Authors have used export on GDP ratio, import on GDP ratio, and turnover on GDP ratio (summary of both export and import). As was already explained, theoretical hypothesis is that large and economically powerful countries are usually less dependent on foreign trade, and therefore less open, where small and economically weak countries are usually more dependent. Based on this theory, Germany, Austria, and Poland should be less dependent, where the Czech Republic, Slovakia, and Hungary should be more open. Germany is both strong and large country; Poland is economically weak, but large, where Austria is relatively small, but economically powerful.

On the other hand, the importance of foreign trade for GDP creation can be evaluated by the size of net balance on GDP, because in the theoretical point of view, only net exports are part of GDP formula in open economy. This analysis is done in the article too.

## 3 Results and Discussion

### The Analysis of GDP Development

Based on the fact that Germany has currently almost 83 billion of inhabitants, Poland almost 38 billion, the Czech Republic more than 10.6 billion, Hungary almost 10 billion, Austria almost 9 billion, and Slovakia almost 5.5 billion of inhabitants, it is quite obvious that the highest GDP is in Germany, and second highest in Poland. However, on the third

position is Austria, despite its small size, where the Czech Republic is on the fourth position, Hungary on the fifth position, and Slovakia on the last position.

However, for mutual comparison is better to use recalculation of GDP per capita. According to this, the highest GDP is already in Austria, where Germany is on the second position. Moreover, the gap between these two countries and the third Czech Republic is relatively huge. On the fourth position is Slovakia, where Hungary is the fifth, and Poland is the last. This means that Austria is extremely developed country, while Poland is very economically weak. In comparison, Slovakia seems to be relatively developed too.

Deep analysis of GDP development shows that before global economic crisis were almost all countries growing. The only exception was in Poland between 2001 and 2003. In all analysed countries was serious decrease in 2009 as a result of global economic crisis, but the after-crisis development is relatively different. Germany, Austria, and Slovakia have been growing since the 2009, without any decrease. In case of the Czech Republic, GDP per capita was decreasing since 2011 to 2014. GDP per capita in Hungary decreased in 2012 and in Poland in 2016. This development suggests that Slovakia behaves similar to advanced economies and it has been developing in economic perspective, as well as advanced economies. However, it is still relatively weak economy, which means that rapid economic growth is not enough for improving of its situation.

**Foreign Trade Development – Trade with Goods**

The analysis of foreign trade with goods shows relatively different results than the GDP development analysis. The development of net balance in terms of goods recalculated per capita is described in following Fig. 1. This recalculation has been done because of a strong position of Germany. This country has had surplus for the whole analysed period, where this surplus is extremely high (more than 64 billion in 2000 and almost 242 billion in 2018). This surplus is so high that the first position of this country remains even after the above-mentioned recalculation.

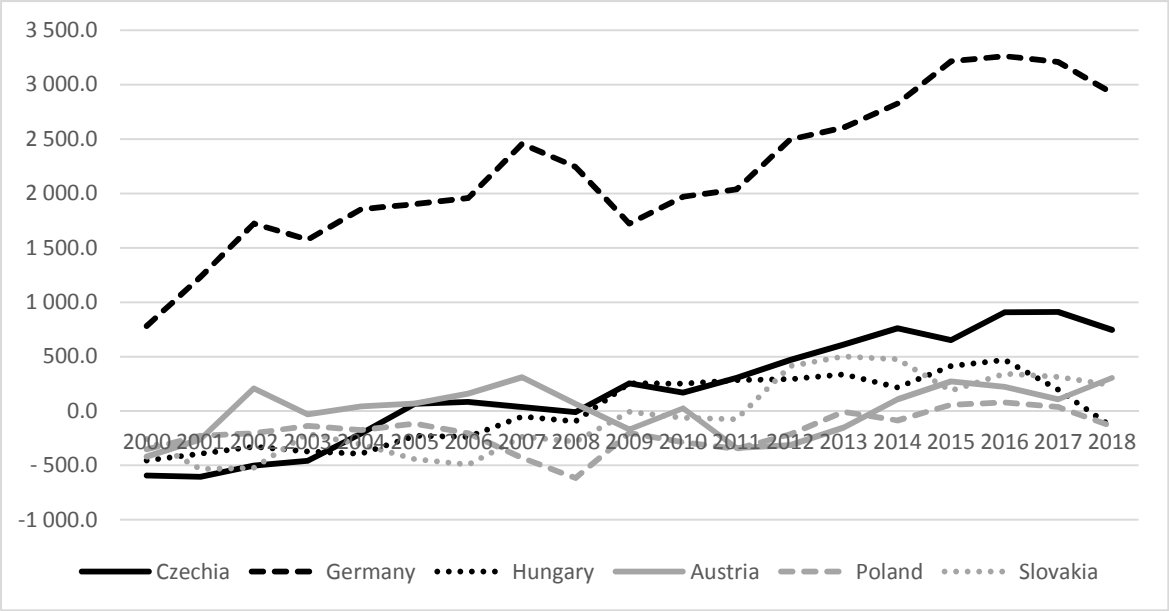
Nevertheless, interesting fact is that Germany was the only country with surplus in 2000, all V4 members, but also Austria had a deficit. Moreover, the highest deficit in absolute amount was in Poland, the Czech Republic was on second position, next was Hungary, Austria, and Slovakia. After the recalculation was the worst the Czech Republic, Hungary was on the second position, Austria was on the third position, next was Poland, and Slovakia. That means that the deficit in Poland was not so high with respect to the number of inhabitants in this country. Surprising fact is that Austria, even if it is the strongest country in terms of GDP, had relatively high deficit.

The development of net balance during the analysed period has been quite irregular. In every country can be found periods of growth and decrease. Interesting development occurred in crisis year 2009. In this year, the net balance in Germany and Austria decreased, similar to GDP, where in other analysed countries occurred increase. Consequently, in 2010 the net balance in Germany and Austria grew again, where it was decreasing in V4 countries. It can be explained in that way that in advanced economies was the development in crisis year similar to GDP development, where in developing countries has occurred some time delay. That means that Slovakia has been developing similar as advanced economies in terms of GDP per capita, it has been developing similar as other V4 countries in terms of trade with goods.

As was already mentioned, the development of net balance was relatively irregular in all analysed countries, some increases and decreases occurred in all of them. However, Germany had the highest balance in 2018 both in absolute value and after the recalculation per capita. On the second position was surprisingly the Czech Republic, also in both values, Austria was on the third place, and Slovakia on the fourth position. Hungary was on the fifth position in absolute values, but it was last after the recalculation per capita. Interesting fact is that between 2017 and 2018 was increasing only Austria, where all other countries (including Germany) decreased, in case of Poland and Hungary from surplus to deficit again.

In spite of irregular development in all analysed countries and also despite the fact that the highest values were not in 2018, all analysed countries have higher values of net balance in 2018 than in 2000.

**Figure 1** Foreign Trade with Goods (Euro per Capita)




Source: own calculations based on Eurostat (2018a), Eurostat (2018b)

**Foreign Trade Development – Trade with Services**

The analysis of foreign trade with services shows completely different results. Surprisingly, the only country with deficit for complete analysed period is Germany. All other analysed countries have been in surplus, with only few exceptions in case of Slovakia. However, the development is again quite irregular in all countries, with several increases and decreases. The development (again recalculated per capita) is described in Fig. 2.

However, the comparison of net balance in 2000 and 2018 shows surprising results too. It increased in case of Germany, Hungary, Austria, and Poland. It decreased a little bit in case of the Czech Republic, and it decreased relatively significantly in case of Slovakia.

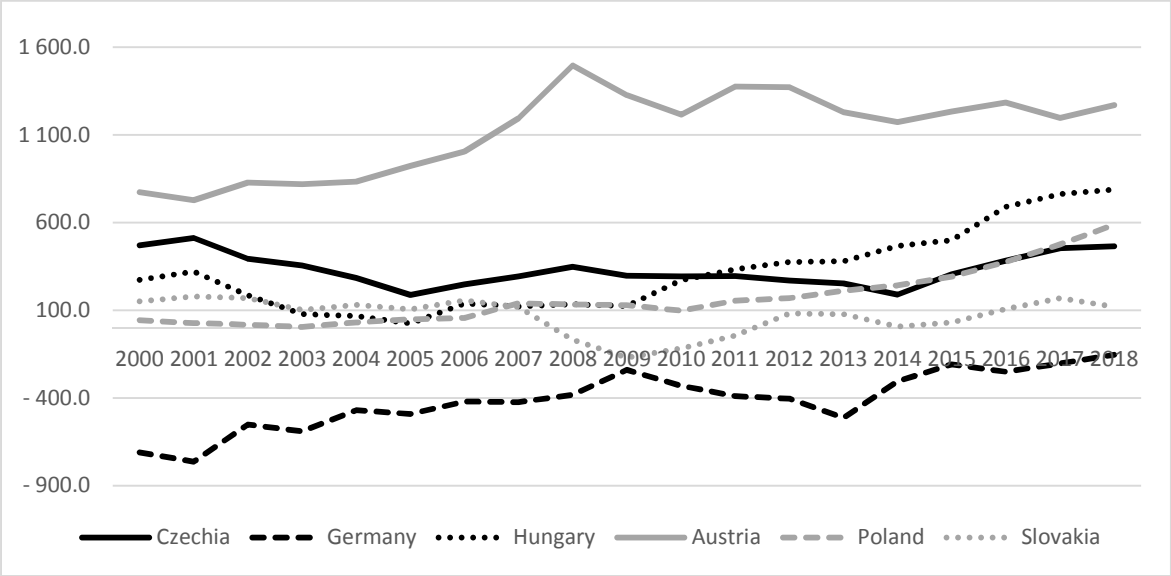
The deep analysis shows even more interesting results. Germany has been the worst both in absolute and recalculated values for the whole analysed period. In 2000, the highest absolute surplus was in Austria, the Czech Republic was on the second position, Hungary was the third, next was Poland, and Slovakia was the last one. However, after the recalculation is Poland the worst and Slovakia improved for one position. In 2018, surprisingly, the highest surplus in absolute value was in Poland, Austria was the second, Hungary the third, the Czech Republic was on the fourth place, and Slovakia was fifth. After the recalculation, Austria was on the first position again, Hungary was the second, Poland the third, next was the Czech Republic, and next was Slovakia. These results suggest rapid development especially in Hungary and Poland.

Interesting fact is that in 2009, where GDP in all analysed countries dropped, net balance with services increased in Germany (it dropped in case of goods), and dropped in all other analysed countries.

It is obvious that there are huge differences in development of trade with goods and trade with services. In case of goods, Germany is the strongest country, where it is the weakest in terms of services. The weakest countries from the trade with goods, namely Hungary and Poland, are relatively powerful in terms of services. On the other hand, there are no significant similarities in the development between different countries.

Germany and Austria are the most powerful in terms of GDP, Germany is the strongest in terms of goods, but the weakest in services, where Austria is relatively strong in terms of goods and the most powerful in case of services. Slovakia is developing in similar way as powerful and developed economies in terms of GDP, but it is relatively weak in goods and in services as well. Relatively similar development can be seen only between Hungary and Poland, where both countries are relatively weak in terms of GDP and trade with goods, and relatively strong in terms of trade with services.

**Figure 2** Foreign Trade with Services (Euro per Capita)




Source: own calculations based on Eurostat (2018a), Eurostat (2018b)

**The Analysis of Openness of Analysed Countries**

The most frequently used indicators for openness evaluation are the share of export on GDP, the share of import on GDP, or the share of turnover on GDP. The authors have decided to use all of these indicators and compare whether there are differences or not, where the order of all analysed countries are in following Tables 1, 2, and 3. The comparison thanks to the order of analysed countries has been chosen because of better visualisation of changes. It is possible to use results in percent, of course, but authors have decided to use ranking. The order of countries remains same, but the percent system is more confusing for understanding of changes in order.

**Table 1** Export on GDP ratio (Rating)

| | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CZ** | 3 | 3 | 4 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **DE** | 5 | 5 | 5 | 6 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 6 | 6 | 6 | 6 | 6 | 6 |
| **HU** | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| **AT** | 4 | 4 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 5 | 5 |
| **PL** | 6 | 6 | 6 | 5 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 5 | 5 | 5 | 5 | 4 | 4 |
| **SK** | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

Source: own calculations based on Eurostat (2018a), Eurostat (2018b)

**Table 2** Import on GDP ratio (Rating)

| | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CZ** | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **DE** | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| **HU** | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| **AT** | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 5 |
| **PL** | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 4 |
| **SK** | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

Source: own calculations based on Eurostat (2018a), Eurostat (2018b)

**Table 3** Foreign Trade Turnover on GDP ratio (Rating)

| | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CZ** | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **DE** | 5 | 5 | 6 | 6 | 6 | 5 | 6 | 6 | 5 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| **HU** | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| **AT** | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 5 | 5 |
| **PL** | 6 | 6 | 5 | 5 | 5 | 6 | 5 | 5 | 6 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 4 | 4 |
| **SK** | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

Source: own calculations based on Eurostat (2018a), Eurostat (2018b)

It is obvious that the hypothesis about bigger openness in small and less developed countries can be verified. Germany is the biggest country, the second in terms of GDP per capita, and it has been less open based on all indicators. Interesting fact is that only import on GDP shows last position in whole analysed period, where in case of export on GDP and turnover on GDP has been Germany on fifth position in few years.

In case that Germany was fifth, Poland was on last position. This country was in few years on fourth place, where the other less open country was Austria. Poland is not economically strong country, but it is large country with a lot of inhabitants. Austria is relatively small country, but the most advanced in terms of GDP per capita.

The most open countries are Slovakia and Hungary, where the Czech Republic is usually on the third position. This fact also supports the hypothesis, because these countries can be considered as small and relatively weak. Tables show that the results of different indicators are not same in every year, but on the other hand, the place is different only for one position.

**The Analysis of Contribution of Foreign Trade on GDP Development**

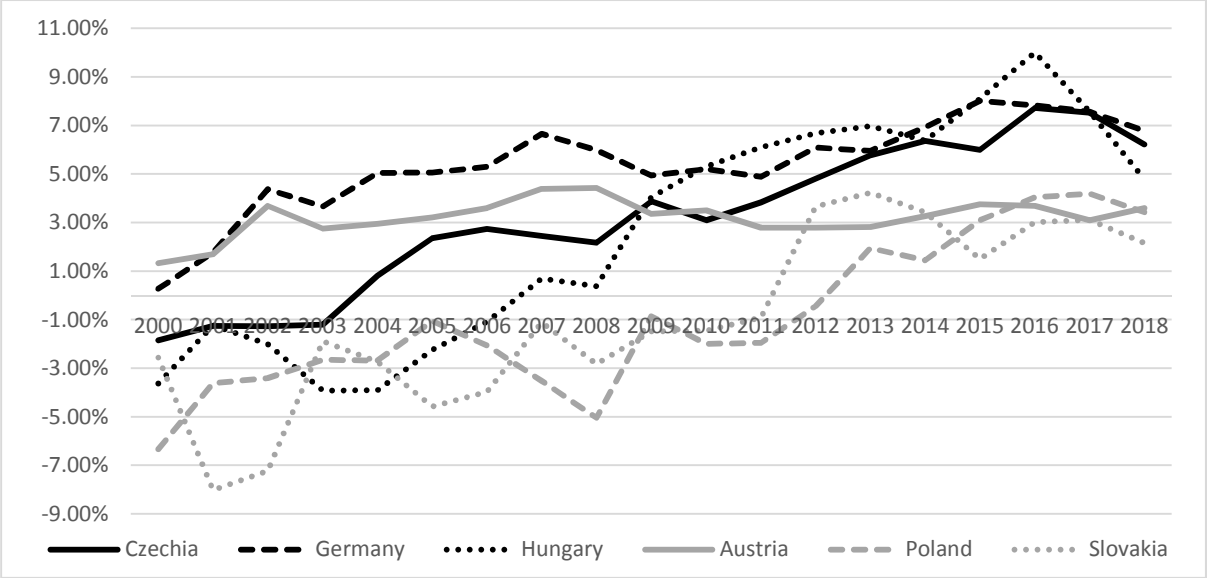
The openness of every analysed country has been evaluated in previous chapter. The Czech Republic, Slovakia, and Hungary, are relatively open countries, which means that these countries are also relatively dependent on foreign trade. Following Figure 3 evaluates contribution of net balance of foreign trade (trade with goods and services together) on GDP development. The assumption is that countries that are more dependent should be able to generate bigger product from foreign trade.

The analysis shows relatively surprising results again. Country with the biggest share of net balance on GDP is Germany, where this country was on first position in more than half analysed years. It can be explained in that way that Germany is the second strongest in terms of GDP, and despite the net deficit of trade with services, its surplus in trade with goods is so high that it can use foreign trade for support of GDP development. However, it is not dependent on this foreign trade, the other (domestic) parts of this economy are more important.

In case of Slovakia, this country is relatively dependent of foreign trade (one of the most open country), but the share of net balance on GDP is low. Although this country is dependent, it cannot generate product from the trade with other countries.

Poland and Austria are countries with low dependency on foreign trade (not so open countries), and therefore contribution of net balance on GDP is also relatively low. This result is relatively surprising in case of Austria. Even if this country is the most powerful in terms of GDP per capita, the contribution of foreign trade is low, which means that domestic parts are more important in this country.

**Figure 3** Contribution of Foreign Trade on GDP Development (Euro per Capita)




Source: own calculations based on Eurostat (2018a), Eurostat (2018b)

## 4 Conclusions

The aim of this article was to analyse the GDP development and foreign trade development in the Czech Republic, Hungary, Slovakia, Poland, Germany, and Austria. The analysis shows that all countries have been growing in terms of GDP per capita, however, the after-crisis development has been quite irregular. Germany and Austria have been growing after crisis, as well as Slovakia, where other countries dealt with some troubles.

In terms of goods, only Germany had surplus in 2000, while currently are in deficit only Hungary and Poland. The development has been irregular again, but interesting point is that in Germany and Austria in the after-crisis year 2009 the net balance decreased (as well as GDP), but in other V4 countries was increase in net balance. However, in 2010 was net balance growing in Germany and Austria again (as well as GDP), where the net balance dropped in V4 countries (in spite of the fact that GDP grew). In terms of services, it is possible to see very surprising results. The weakest country has been Germany, where the net balance has been in deficit for the whole analysed period. V4 countries and Austria have been in surplus (with few exceptions of Slovakia), where the most powerful are Austria, Poland, and Hungary.

The analysis of openness is not surprising, relatively close economies are Germany (both large and economically powerful), Austria (small, but powerful), and Poland (weak, but large), where other countries are relatively open. On the other hand, the contribution of foreign trade on GDP development is surprising, because one of the highest contributions is in Germany, where Austria has the lowest one. Slovakia, even if it is one of the most open countries, has relatively low contribution of net balance, where the Czech Republic has relatively high.

## Acknowledgments

This study is supported by internal research project "Investment within concept Industry 4.0", and by project IGA 2019 "Support of pedagogical work, technical equipment, and communication with experts", both at Faculty of Informatics and Management, University of Hradec Kralove, Czech Republic. It was prepared in cooperation with students of Ph.D. study at Department of Economics, namely with Ing. Vojtěch Tuček and Ing. Martin Král.

## References

Andrews, A. B., Bernake, B., Croushore, D. D., (2011). *Macroeconomics,* 6th ed. Boston: Addison-Wesley.

Baier, S. L., Bergrstrand, J. H., Feng, M. (2014). Economic integration agreements and the margins of international trade. *Journal of International Economics*, vol. 93(2), pp. 339-350.

Cieslik, E., Bieganska, J., Sroda-Murawska, S. (2016). The Intensification of Foreign Trade in Post-Socialist Countries and Their Role in Global Value Chain. *Acta Oeconomica*, vol. 66(3), pp. 465-487.

Do, Q. T., Levchenko, A. A., Raddatz, C. (2016). Comparative advantage, international trade, and fertility. *Journal of Development Economics*, vol. 119(1), pp. 148-166.

Eurostat (2018a). *International Trade of EU, the Euro Area and the Member States by SITC Product Group.* Retrieved from: http://ec.europa.eu/eurostat/web/international-trade/data/database.

Eurostat (2018b). *GDP and Main Components*. Retrieved from: http://ec.europa.eu/eurostat/web/national-accounts/data/database.

Fracasso, A., Marzetti, G. V. (2015). International trade and R&D spill overs. *Journal of International Economics*, vol. 96(1), pp. 138-149.

Giordano, C., Zollino, F. (2016). Shedding Light on Price- and Non-price-competitiveness Determinants of Foreign Trade in the Four Largest Euro-area Countries. *Review of International Economics*, vol. 24(3), pp. 604-634.

Gladkov, I. S. (2016). European Union in Modern International Trade. *Contemporary Europe-Sovremennaya Evropa*, vol. 1(1), pp. 85-94.

Kovárník, J., Hamplová, E. (2017). The Brief Analaysis of Foreign Trade of the Czech Republic in International Comparison. In Nešleha, J., Plíhal, T., Urbanovský, K. (eds.), *Proceedings of the European Financial Systems 2017.* Brno: Masaryk University, pp. 384-393.

Kovárník, J., Hamplová, E. (2018a). Foreign Trade in Globalized World: Comparative Analysis in Selected Countries from Central Europe. In Kliestik, T. (ed.), *Globalization and Its Socio-Economic Consequences 2018.* Žilina, Slovakia: University of Žilina, pp. 2594-2601.

Kovárník, J., Hamplová, E. (2018b). The Selected Aspects of Foreign Trade in Central European Countries. In Nešleha, J., Hampl, F., Svoboda, M. (eds.), *Proceedings of the European Financial Systems 2018.* Brno: Masaryk University, pp. 299-306.

Samuelson, P. A., Nordhaus, W. D. (2010). *Economics,* 19th ed. Boston: McGraw-Hill/Irwin.

Vannoorenberghe, G. (2014). International trade, risk taking and welfare. *Journal of International Economics*, vol. 92(2), pp. 363-374.

Zdražil, P., Kraftová, I. (2012). Konvergují regiony zemí V4? In Klímová,V., Žítek, V. (eds.), *15th International Colloquium on Regional Sciences*. Brno: Masaryk University, pp. 48-58.

# Contextual Non-financial Information Analysis of Annual Reports

**Zuzana Kubaščíková[1], Miloš Tumpach[2], Zuzana Juhászová[3], Bazhan Turebekova[4], Saule Saparbayeva[5]**

[1] University of Economics in Bratislava
Faculty of Business Informatics, Department of Accounting and Auditing
Dolnozemská 1, 852 35 Bratislava, Slovakia
E-mail: zuzana.kubascikova@euba.sk

[2] University of Economics in Bratislava
Faculty of Business Informatics, Department of Accounting and Auditing
Dolnozemská 1, 852 35 Bratislava, Slovakia
E-mail: milos.tumpach@euba.sk

[3] University of Economics in Bratislava
Faculty of Business Informatics, Department of Accounting and Auditing
Dolnozemská 1, 852 35 Bratislava, Slovakia
E-mail: zuzana.juhaszova@euba.sk

[4] L.N. Gumilyov Eurasian National University
Faculty of Economics, Department of Accounting and Analysis
Kazhimukhana 11, 010008 Nur-Sultan, Republic of Kazakhstan
E-mail: turebekova_bo@enu.kz

[5] L.N. Gumilyov Eurasian National University
Faculty of Economics, Department of Accounting and Analysis
Kazhimukhana 11, 010008 Nur-Sultan, Republic of Kazakhstan
E-mail: saparbayeva_ss@enu.kz

***Abstract:*** *When assessing a firm's current and future financial performance, various information sources are available to interested parties. Annual reports, within which companies reveal their activities, results, developments and trends, are one of the most important information sources. Such a report contains, alongside financial data, narrative disclosure of contextual non-financial information providing broader insight into a company´s business and performance. With the increasing average length of narratives in recent years we may also observe the growing interest of investors or analysts in information revealed here as a means of supporting their decisions. The aim of this paper is to accept or reject the claims that non-financial "narrative" data could also be used for the assessment of the financial position and financial performance of a company. Our study confirms the assumption that qualitative data expressed in annual report narratives preceded change in quantitative financial data, and therefore could be used for the prediction of company financial performance. However, as qualitative and quantitative data complement and support each other they should be considered simultaneously by the annual report users, in order for them to be able to make the right decisions. Ergo, we recommend that investors and other annual report users examine narratives alongside individual financial situations and other information sources, in order to get a complete picture of the potential future developments of a company's financial performance. This would consequently contribute to their ability to make the right investment decisions and enable them to appraise the value of their funds.*

*Keywords: sentiment analysis, annual report, narrative data*

*JEL codes: M49*

## 1 Introduction

Some authors (Magnusson, 2005; Hajek et al., 2014) emphasize the importance of annual report narratives in financial performance forecasting. They argue that whilst financial data reflects the current financial situation of the company, the qualitative

data reflects the plans, future trends and expectations of management. Thus, changes in qualitative data might cause changes in financial figures into the future. This paper examines the validity of this argument through the textual analysis of report narratives. The main focus is placed on the forecasting accuracy of sentiment information; however textual complexity and thematic content analysis is also analyzed.

As previously stated, narrative reporting supplements and complements financial statements with prospective and retrospective information concerning various domains, including risk and uncertainties, economic and operating performance, strategy and structure, innovations, supply chain, corporate governance or environmental, social, and ethical performance. Sajjad (2011, p. 3) from ACCA expressed: "Reporting has moved beyond historically focused, number- driven content, [...] annual reports (have moved from their original focus on financial performance to a new emphasis on business performance." This has created new challenges requiring financial professional preparing reports to develop new skills and knowledge necessary to provide a reader the relevant and proportionate narrative information accompanying the financial data.

"Although investors, to a certain extent, make their decision on the basis of factual information such as income statement, cash-flow statements or balance sheet analysis, there is an important part of their decision which is based on a subjective evaluation of events surrounding the activities of a company (Ahmad, 2011, p. 101). Thus, textual information can also influence the decision-making process of corporate stakeholders.

In addition to this, narrative reporting provides important information which needs to be taken into account to fully understand the performance of a given company. According to Beattie et al. (2004, p. 222) quantitative financial information represents only about 20% of all information contained in annual reports.

Also, financial analysts acknowledged the usefulness of narrative reporting, with more than 80% of them identifying management discussion of corporate performance as extremely important or very important when assessing firm value (Balakrishnan et al., 2010, p. 791). Thus, it is imperative to dually consider both the analysis of textual information as it is financial data analysis, in order to be able to correctly assess a firm's financial performance.

## 2 Methodology and Data

Building on theoretical perspectives regarding the predictive power of annual report narratives, we examined whether the tone employed in annual report narratives, as well as textual complexity and structure, could indicate the worsening financial performance of a company in the near future. (Tumpach et al., 2014*)* Based on our findings, we assessed the usefulness of annual report narratives as a tool to support the decision-making process. The result would, therefore, have implications for investors (when making their investment decisions), analysts and other annual report users.

We particularly explored the narrative disclosure in the Management Discussion and Analysis section in the annual report in which managers comment on actual financial performance, and then make statements about future trends, development and challenges. Therefore, the information contained in this section is most likely to indicate potential future financial problems (Pakšiová et al., 2016). Alongside the tone employed by managers in narrative reporting, we examined the textual complexity and impression tactics which the management of the company may use in order to obfuscate bad news. We further analyzed the application of the so-called "Pollyanna hypothesis" which suggests that a company employs more positive and affirmative words in its disclosures, regardless of its financial performance.

We formulated and tested four main hypotheses:

H1: Financially distressed companies use a different tone of language in their annual reports (e.g. less positive, more uncertain) compared to the financially stable companies.

H2: Annual reports of financially distressed companies are more complex and difficult to read compared to those of companies with good financial health.

H3: With approaching bankruptcy, the tone of language employed in the annual report is likely to change (e.g. to become less positive, more uncertain).

H4: With approaching bankruptcy, the annual report text becomes more complex and difficult to read.

H5: With approaching bankruptcy, companies tend to employ various impression management tactics (e.g. using more passive forms) in order to obfuscate bad news.

We analyzed annual reports of companies divided into two groups based on Altman's bankruptcy prediction model: financially distressed companies likely to go bankrupt within the following two years and financially stable companies with a high probability of surviving (Ondrušová, 2016). This model proposed bankruptcy based on financial ratios reflecting current financial results (Blahušiaková, 2017). We examined whether the qualitative information contained in annual report narratives indicated bankruptcy alongside this quantitative information. Thus, we analyzed whether companies likely to go bankrupt employed a different tone of language and had various levels of reading ease difficulty compared to financially stable companies.

For this purpose, we selected 20 companies out of the Fortune 1000 list (Fortune, 2016). We divided them into two equal groups according to Altman's Z-score obtained from the Factiva database portal. This portal provides access to business-critical information including the Z- score calculation. Further, in order to obtain the data, we collected annual reports, 10-K filings, of U.S. companies from the EDGAR database (EDGAR, 2016). In total, we examined 20 Management Discussion and Analysis sections from the fiscal year 2015.

To assess the sentiment used in annual report narratives, we processed and analyzed this data with the LIWC2015 (Linguistic Inquiry and Word Count, Pennebaker et al., 2015) textual analysis program. This program analyzes text on various sentiment categories, including positive emotions, negative emotions, certainty, risk focus and others. To assess the textual complexity expressed by reading ease difficulty, the Flesch Reading Ease Formula, which considers the number of syllables per word and number of words per sentence, was used. The calculation of the Flesch Reading Ease Score and Flesch Kincaid Grade Level was conducted via a computer-assisted program available online (Readability-score.com).

Each company was analyzed individually on sentiment categories and readability, and the results obtained were subsequently synthesized. The results are presented in graphical forms where the aggregated data of financially distressed companies are compared against the aggregated data of financially stable companies. Based on these findings, we assessed the differences between the categories analyzed across both groups of companies. Thus, they indicated to us whether the relationship between sentiment in annual reports and the company's future financial performance exists. If so, we might assume that the sentiment and/or complexity of annual report narratives are able to predict the approaching bankruptcy in a similar way to the quantitative information expressed by Altman's Z-score.

However, Altman's Z-score prediction model does not provide absolute accuracy in bankruptcy prediction (Parajka, 2016). Therefore, in the second section, we selected one particular company which already had experienced bankruptcy. With this company, we analyzed whether the structure of the language used in narrative reporting changed over time alongside the changing financial performance. For these purposes we divided

companies into two groups – companies that belong to sage zone and companies that belong to distress zone.

We analyzed textual complexity through the Flesch Reading Ease Score employing the computer-assisted program (Readability-score.com). We also explored whether impression management tactics had been used to obfuscate adverse information in the annual report from the year preceding the bankruptcy.

We compared the results obtained in this analysis with the previous section results in order to be able to propose more reliable recommendations and conclusions. The actual conclusions regarding the usefulness of annual report narratives in financial performance prediction and, thus, their applicability in the decision-making process of users are further discussed below.

## 3 Results and Discussion

We will examine whether managers of analyzed companies employed methods mentioned above in the MD&A sections of annual reports more intensively prior to bankruptcy in relation to a negative information announcement. We will particularly focus on the parts when managers discuss "Significant Activities and Events and Items Influencing Future Performance" and "Key Risks and Challenges" revealing information about the main challenges companies faced which would have material effects on the results of operations, liquidity and financial condition, as well as initiatives undertaken to handle them. Therefore, if managers already had some knowledge about approaching bankruptcy, the signal about it will be most likely detected by analyzing these particular sections.

a) Reading Ease manipulation

Firstly, we assess the reading ease manipulation used in the text. Our previous findings already confirm that, based on the Flesch Reading Ease score, the text seems to be more complex and therefore more difficult to be read and understood closely before a bankruptcy announcement. By examining the text of this specific section of MD&A from one year before bankruptcy was revealed, we found some very difficult sentences which were in favor of prior findings. For example, MD&A section of EFH includes these main parts: Business Overview and Operational Segments; Key Risks and Challenges; Application of Critical Accounting Policies; Results of Operations; and Financial Condition about substantial leverage, one of the companies expressed their worries about liquidity constraints, through this difficult sentence composed of 73 words:

"While traditional counterparties with physical assets to hedge, as well as financial institutions and other parties, continue to participate in the markets, low natural gas and wholesale electricity prices, continued market and regulatory uncertainty and our liquidity and upcoming debt maturities have limited our hedging and trading activities, particularly for longer- dated transactions, which could impact our ability to hedge our commodity price and interest rate exposure to desired levels at reasonable costs."

Similarly, the sentence composed of 75 words appeared in relation to liquidity constraints, just a few sentences below the previous one.

"Further, a continuation, or further decline, of current forward natural gas prices could result in further declines in the values of TCEH's nuclear and lignite/coal-fueled generation assets and limit or hinder TCEH's ability to hedge its wholesale electricity revenues at sufficient price levels to support its significant interest payments and debt maturities, which could adversely impact TCEH's ability to obtain additional liquidity and refinance and/or extend the maturities of its outstanding debt."

Therefore, it is likely that such complex and difficult sentences may have negatively affected the reader's ability to fully comprehend some passages of the text. As a result, he/she may be inclined to terminate or skip some passages of the report. In this

case, we might suppose that managers would not like the reader to focus on liquidity constraints and substantial company leverage, but rather skip to the other passages which were written in a less complex way. This issue was also examined in a study of Courtis (2004) who suggested that readability variability should be considered alongside the Flesch reading ease score, in order to get the full picture about managers' efforts to deliberately make some information opaque. Thus, we compared the section Key Risk and Challenges with other parts of MD&A, and as a result we found significant differences in reading difficulty. The sections such as Business Overview and Results of Operations ranked comparably better on readability than Key Risks and Challenges (Flesch Reading Ease scores of the former two parts are 30.3 and 37, while the latter scored only 19.8). Results obtained from analysis through the readability computer-assisted program are available online on https://readability-score.com/.

b) Rhetorical manipulation and attribution

Secondly, we analyzed the rhetorical manipulation used within the text. Rhetorical manipulation includes use of linguistic devices such as pronouns and the passive voice in order to conceal negative news. We assumed that passive construction was used more often to deny responsibility for negative performance and that managers would attempt to dissociate themselves from negative news, therefore avoiding the statement of ownership.

Our analysis confirmed that in most of the cases managers employ passive language more often in connection with possible future negative outcomes. They would rather assign the responsibility for this negative news to other forces external to the company or employ techniques of impersonalization. Impersonalisation excludes or obfuscates social agents, thus representing processes in a more abstract manner. Examples of such employment of passive constructions were as follows:

- "...cash flows targeted under the natural gas price hedging program may not be achieved;" instead of expressing "We [EFH] might not achieve the targeted cash flows."

-"...certain amounts of TCEH unsecured debt maturing prior to 2017 are not refinanced;" instead of saying "We [EFH] will not refinance certain amounts of TCEH unsecured debt maturing prior to 2017."

- "Our ability to economically access the capital or credit markets could be restricted at a time when we would like, or need, to access those markets;" instead of expressing "We [EFH] might not be able to economically access the capital …"

- "…the unfavorable impact on pretax earnings is estimated … to be approximately

$1.5 million per day;" rather than "We [EFH] estimate that we will experience an unfavorable impact on pretax earnings."

- "...it is not possible to predict […] the actual gains or losses that will ultimately be realized;" rather than "Based on the information available, we [EFH] are not able to predict […] the actual gains or losses that EFH will ultimately realize."

On the other hand, managers employed active language and assigned possible positive outcomes to the company, and/or their own actions and initiatives. For example, speaking about issues of liquidity concern and the ability to meet obligations in the future:

- "...We expect that TCEH [Texas Competitive Electric Holdings Company LLC] will have sufficient liquidity to meets its obligations until October 2014."

Other examples of where managers associated themselves and their actions with the progress their company made, or the actions they took in order to achieve better performance, are as follows:

- "We implemented a liability management program designed to reduce debt;" rather than "A liability management program designed to reduce debt has been implemented."

- "We secured an extension of the maturity date," and "We secured the extension of the entire $2.05 billion of commitments;" rather than "The extension of the maturity date and entire commitments..." However, they continued with negative news and employed passive language: "Notwithstanding the extension, the maturity could be reset to an earlier date under a "springing maturity" provision if, as of a defined date, certain amounts of TCEH unsecured debt maturing prior to 2017 are not refinanced and TCEH's debt to Adjusted EBITDA ratio exceeds 6.00 to 1.00."

However, despite these findings confirming the application of passive language mainly in the context when managers try to avoid responsibility for negative outcomes, there were certain sentences within the text where this rule did not apply. For example, in the phrase "the natural gas price hedging program is designed to mitigate the effect on earnings oflow wholesale electricity prices." In this sentence the passive formulation was used even though the hedging program was a good initiative taken by the company. Later on, in the MD&A disclosure, the same idea was expressed, however this time it was formulated using an active construction: "We have implemented a natural gas price hedging program to mitigate the risk of lower wholesale electricity prices."

Texas Competitive Electric Holdings Company LLC is an indirect subsidiary of EFH Corp. To this end, it was also interesting to mention how managers started the description of the company's business in the opening sentence of the annual reports MD&A section. In the annual report from fiscal year 2012 (the year before its bankruptcy was announced) the managers expressed:

"EFH Corp., a Texas corporation, is a Dallas-based holding company that conducts its operations principally through its TCEH and Oncor subsidiaries."

Similarly, the same phrase was employed in annual reports from fiscal years 2008, 2011 and 2013. However, the opening sentence of the annual report from 2009 stated: "We are a Dallas-based holding company conducting operations principally through our TCEH and Oncor subsidiaries."

As mentioned above year 2009 was the only year from five years analyzed in which the company reported a net profit. Thus, according to this statement, it seemed that managers sought to associate themselves with the profitable company and its positive performance. However, they remained more neutral and attempted to dissociate themselves from company operations when its financial performance began to worsen.

c) Thematic manipulation

Thematic manipulation means that managers aimed to present financial performance in the best possible way by employing predominantly positive language and emphasizing positive outcomes. Whether companies utilized more positive and affirmative words in their MD&A disclosures was tested. As a result of analysis, the phenomenon called the Pollyanna principle was confirmed. Even though in 2012 the company used fewer positive words compared to other years examined, their volume and frequency within the text still significantly exceeds negative ones (3.06 vs. 1.29 percent).

Even solely within the sections "Significant Activities and Events and Items Influencing Future Performance" and "Key Risks and Challenges" where managers discussed the main challenges and threats to the company's business in the future, positive emotions prevailed over negative ones (2.89 vs. 1.27 percent). This was due to the fact that even though managers mentioned the main risks which threatened the company operations and financial situation, they discussed at the same time the initiatives taken

to address these challenges in the most effective way. Thus, they might place much more emphasis on these actions taken and the good results they could potentially bring, rather than only on the risks themselves. They attempt to reassure the reader of the company's strong performance in the future, despite the fact that some problems may have already threatened its financial situation.

For example:

- "...management continues to focus on the safe, reliable and efficient operations"

- "We believe these risks [that Oncor's credit ratings might have declined which would have affected its access to capital markets and the cost of debt] are substantially mitigated by the significant ring-fencing measures implemented by EFH Corp. and Oncor."

The latter statement was used to reassure the reader that any adverse action with respect to Oncor's credit ratings, which would generally cause borrowing costs to increase, was not likely to happen due to the adopted risk-fencing measures. However, only a few months after that report was filed "Moody's downgraded the senior secured rating of Oncor Electric Delivery Company (Oncor) to BAA2 from BAA1" (Moody´s Investor Service, 2012b).

Therefore, when we assessed the usefulness of annual report narratives in predicting a company's bankruptcy or change in financial performance in the near future, we needed to bear in mind that the positive, affirmative words would always prevail over the negative ones and treat that fact with caution.

In our study we compared the readability of companies which are in danger of bankruptcy and companies with a high probability to survive. To calculate the scores, we employed a computer assisted program available online (Readability-score.com) as processing this data manually would be very difficult and time-consuming. We assumed that companies from the distress zone would have annual reports more difficult to read in accordance with the hypothesis that these companies will be more likely to mislead users or obfuscate bad news compared to the financially healthy companies. Table 1 illustrate the aggregated results for safe and distress company groups.

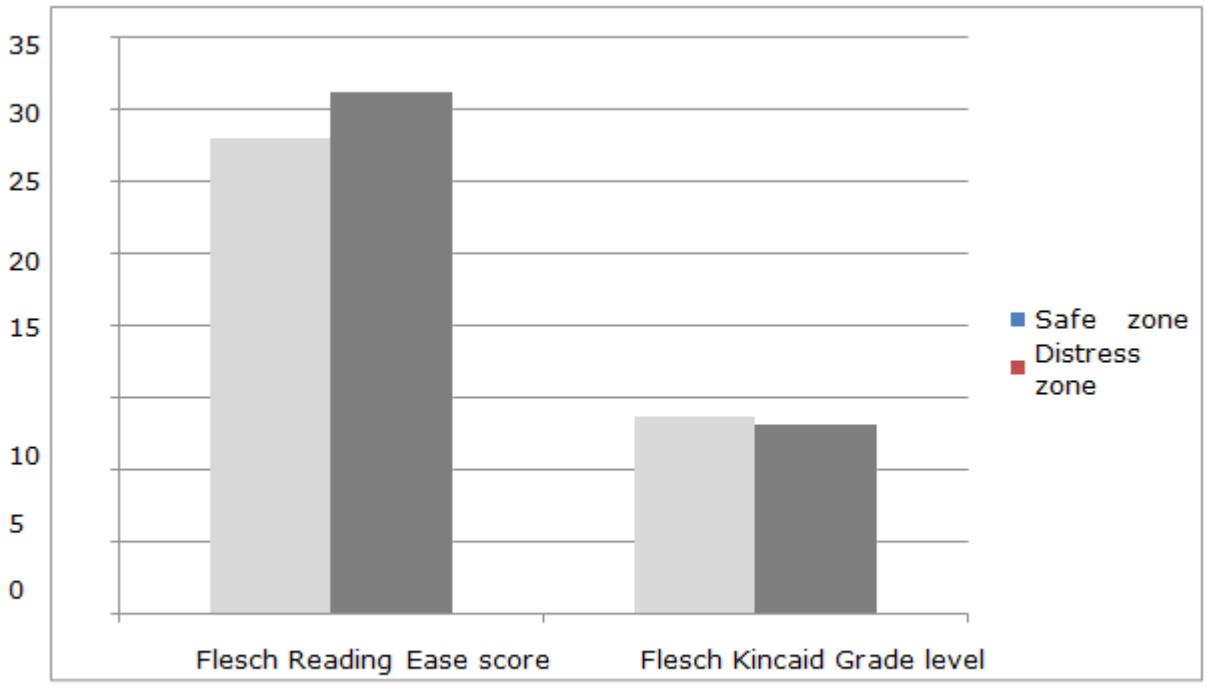
**Table 1** Readability score determinants across safe and distress companies

| | **Safe zone** | **Distress zone** |
|---|---|---|
| **Word count** | 13 328,8 | 14 963,7 |
| **Sentence count** | 676 | 804,1 |
| **Syllable count** | 24 200 | 26 676,5 |
| **Words per sentence** | 20,13 | 19,3 7 |
| **Syllables per word** | 1,82 | 1,78 |
| **Characters per word** | 5,07 | 5,07 |

Source: Data obtained from EDGAR database, processed by www.readability-score.com

Table 1 provides the determinants needed to calculate the average level of readability score for each of two groups. On first sight, it seems that annual reports of safe zone companies will be easier to read as they contain fewer sentences as well as fewer words and syllables in total, but their sentences are composed of many more words and, similarly, the words contain many more syllables. This complexity makes their readability level more difficult.

**Figure 1** Readability Scores Across Safe and Distress Companies




Source: Data obtained from EDGAR database, processed by www.readability-score.com

Figure 1 indicates that the MD&A section of both groups of companies is classified as difficult to read according to the Flesch Reading Ease Score because their score obtained ranges between 30 and 50. This finding is consistent with the general conclusion of other readability studies which classify corporate annual reports as difficult to very difficult to read (Beattie et al., 2004, p. 212).

Interestingly, our finding rejected the hypothesis that companies closer to bankruptcy use a more complex and difficult writing style than companies likely to survive. On the contrary, it indicated that distressed companies' MD&A sections are, in general, easier to read and be understood by the user compared to the other group. Within both groups, there are two companies which are classified as very difficult to read[19] but on average, both distressed and safe companies' MD&A are classified as difficult (distress zone with the score 36.14, and safe zone with the score 33.01).

Previous studies found that firms with lower earnings or less profitable companies tend to file annual reports which are more difficult to read than the firms which are performing well as the managers are more likely to obfuscate information concerning poor performance (Li, 2008). However, our findings are totally inconsistent with this argument as well. When we deeper examined the distressed companies and divided them, according to current earnings, as profitable and unprofitable, we found that companies which reported a loss in fiscal year 2015 ranked actually better on the reading ease score (38.4) than the profitable ones (34.7).

Based on results obtained, we concluded that our analysis does not confirm hypothesis 2. Annual reports of companies with possible financial problems are not found to be more difficult to read compared to companies which perform well. As no relationship between these two variables [financial performance and readability] was found, we would not recommend the readability score as the indicator used to predict the financial performance of the company according to these findings.

## 4 Conclusions

The annual report is not only a compulsory document and communication tool between a company and its shareholders, but also a way for a company to present itself in terms of information openness and transparency. The financial data contained in annual reports are important indicators of current financial performance and may also indicate future financial development via the application of prediction models such as Altman´s Z- score. However, they do not provide us with insight into all of the circumstances that led to these results, nor do they give information about future trends, development and managers' expectations. For this purpose, qualitative data is especially useful.

Narrative reporting supplements and complements financial statements with prospective and retrospective information concerning various domains, including risk and uncertainties, economic and operating performance. With the increasing average length of narratives in recent years, we may also observe the growing interest of investors and other users in this information. For example, financial analysts acknowledged the usefulness of narrative reporting, when as many, or more than 80% of them identified management discussion of corporate performance as extremely important or very important when assessing firm value (Balakrishnan et al., 2010, p. 791).

Although annual report narratives are more subjective than financial data, we suggest they may be indicative of future financial developments, as demonstrated by the language managers use to disclose information. In this study we used a combination of two textual analysis programs in order to accept or reject the claims that non-financial "narrative" data could also be used for the assessment of the financial position and financial performance of a company. Our analysis focused on the Management Discussion and Analysis section (MD&A) of the 10-K reports. Here managers comment on financial performance, but also express predictive statements about future trends, expectations and challenges. Therefore, the information contained in these sections is most likely to indicate future financial performance.

Besides the potential opportunistic behavior of the manager when constructing the language of annual report narratives, the results of our sentiment analysis supported the hypothesis that financially distressed companies use a different tone of language in their annual reports from those of financially stable companies (H1). Similarly, we found that the sentiment employed in annual reports changed when the analyzed company approached bankruptcy (H3). These findings confirmed the relationship between the tone which managers use in constructing annual report narratives, and the financial performance of the company. Thus, we suggest that annual report users pay more attention to this aspect of corporate disclosures, due to the fact it might reflect the future financial developments of the company.

However, concerning the readability analysis, we rejected our original hypothesis that annual reports of financially distressed companies are more complex and difficult to read compared to those with good financial health (H2). Interestingly, the research confirmed that when a company was approaching bankruptcy, the annual report text becomes more complex and difficult to read (H4). These two opposing findings ensured that we could not recognize textual complexity, measured by readability analysis, as a reliable and accurate prediction tool of a company's financial performance.

Our final hypothesis (H5), which suggests that companies tend to employ various impression management tactics in order to construct an inaccurate impression of organizational outcomes, and/or present an accurate but favorable view of organizational outcomes, was confirmed. In general, managers tended to deny responsibility for negative outcomes whilst taking credit for the positive ones. However, for this final hypothesis we examined only one annual report of a company one year prior to its bankruptcy. Therefore, we suggest further research would be appropriate in

this particular area, one means of which would be to examine a larger sample of companies.

In addition, we established the "Pollyanna principle," which suggests that companies tend to use positive, affirmative words more frequently than negative words in their reporting, regardless of corporate financial position. This finding is consistent with the results of previous studies conducted in this domain (Rutherford, 2005). In terms of textual complexity, we found that the MD&A section of most of the companies analyzed is classified as difficult to read according to the Flesch reading ease score. This finding is also consistent with other readability studies, which classify corporate annual reports as 'difficult to very difficult to read' (Beattie et al., 2004, p. 212).

However, the presented research has limitations which could subsequently affect the reliability and accuracy of the results achieved, and on which our recommendations are based. The appropriateness of the sentiment analysis software LIWC2015 as a general textual analysis program, and its applicability in financial and business domain was questioned. Also the Flesch readability formula has been criticized for a number of reasons, mainly due to its exclusive focus on word and sentence length. Other factors which could affect reading ease difficulty and the ability of the user to fully understand the text are ignored. Further, the sample analyzed consisted of a limited number of companies. As the differences between some sentiment categories have been only slightly observable, we remain uncertain if a different sample of twenty companies would deliver the same conclusions. Thus, we recommend examining a larger sample of companies in order to prove the validity of our findings. In spite of these limitations, we conclude that non-financial narrative data could be used for the assessment of financial positions and financial performance of a company.

Our study confirms the assumption that qualitative data expressed in annual report narratives preceded change in quantitative financial data, and therefore could be used for the prediction of company financial performance. However, as qualitative and quantitative data complement and support each other they should be considered simultaneously by the annual report users, in order for them to be able to make the right decisions. Ergo, we recommend that investors and other annual report users examine narratives alongside individual financial situations and other information sources, in order to get a complete picture of the potential future developments of a company's financial performance. This would consequently contribute to their ability to make the right investment decisions and enable them to appraise the value of their funds.

## Acknowledgments

This article is an output of the project APVV no. APVV-16-0602 "Enhancement of the relevance of the accounting data in the SR - from expenses to value"

## References

Ahmad, K. (2011). *Affective computing and sentiment analysis: Emotion, metaphor and terminology*. Vol. 35. Ireland: Springer, 2011. 148 p. ISBN 978-94-007-1756-5.

Balakrishnan, R., Qui, X. Y., Srinivasan, P. (2010). On the predictive ability of narrative disclosures in annual reports. *European Journal of Operational Research*, vol. 202(3), pp. 789-801. ISSN 0377-2217.

Beattie, V., Mcinnes, B., Fearnley, S. (2004). A methodology for analyzing and evaluating narratives in annual reports: a comprehensive descriptive profile and metrics for disclosure quality attributes. *Accounting Forum*, vol. 28(3), pp. 205-236. ISSN 0155-9982.

Blahušiaková, M. (2017). New trends in evaluation of accounting entity's financial performance based on the financial statements. In: *Proceedings of the 22nd International Scientific Conference Strategic Management and Decision Support*

*Systems in Strategic Management.* Subotica: Faculty of Economics in Subotica University of Novi Sad, 2017. ISBN 978-86-7233-362-6, pp. 539-544.

Courtis, J. K. (2004). Corporate report obfuscation: artefact or phenomenon? *The British Accounting Review*, vol. 36(3), pp. 291–312. ISSN 0890-8389.

Edgar (2016). *Edgar Company Filings.* Retrieved from: <https://www.sec.gov/edgar/searchedgar/companysearch.html>. (Accessed on 25. 03. 2019)

Fortune (2016). *Fortune 500.* Retrieved from: <http://fortune.com/fortune500/>. (Accessed on 19. 03. 2019)

Hajek, P., Olej, V., Myskova, R. (2014). Forecasting financial performance using sentiment in annual reports for stakeholders´ decision-making. *Technological and Economic Development of Economy*, vol. 20(4), pp. 721-738. ISSN 2029-4913.

Magnusson, C., Arppe, A., Eklund, T., Back, B., Vanharanta, H., Visa, A. (2005). The language of quarterly reports as an indicator of change in the company´ financial status. *Information & Management*, vol. 42(4), pp. 561-574.

Moody's investor service (2012a). *Moody's changes Energy Future Holdings Corp's rating outlook to negative from stable.* Retrieved from: <https://www.moodys.com/research/Moodys-changes-Energy-Future-Holdings-Corps-rating-outlook-to-negative--PR_236381>. (Accessed on 20. 01. 2019)

Moody's investor service (2012b). *Moody's downgrades Energy Future Holdings and Oncor Electric Delivery; outlooks remain negative.* Retrieved from: <https://www.moodys.com/research/Moodys-downgrades-Energy-Future-Holdings-and-Oncor-Electric-Delivery-outlooks--PR_252879>. (Accessed on 20. 01. 2019)

Ondrušová, L. (2016). Company in crisis form the point of view of accounting. *Journal of East European Science and Research: scientific peer-reviewed journal*. Bratislava: European Institute for Development and Education, vol. 8(1), pp. 338-345.

Pakšiová, R., Tumpach, M., Petera, P., Wagner, J. (2016). Comparative analysis of corporate responsibility reporting of the largest companies in Slovakia and Czech Republic. In: *Aktuálne problémy podnikovej sféry 2016*. Bratislava, 5.-6.5.2016 Bratislava: Vydavateľstvo EKONÓM, 2016. ISBN 978-80-225-4245-6, s. 847-856.

Parajka, B. (2016). Micro accounting entities in the Slovak Republic - a year after an introduction. *Strategic management : international journal of strategic management and decision support systems in strategic management*. Subotica: University of Novi Sad, Faculty of economics in Subotica, vol. 21(3), pp. 43-48. VEGA 1/0486/14. ISSN 1821-3448.

Pennebaker, J. W., Booth, R. J., Boyd, R. L., Francis, M. E. (2015). *Linguistic Inquiry and Word Count: LIWC2015*. Austin, TX: Pennebaker Conglomerates (www.LIWC.net).

Rutherford, B. A. (2005). Genre analysis of corporate annual report narratives: A corpus linguistics-based approach. *Journal of Business Communication*, vol. 42(4), pp. 349-378. ISSN 2329-4884.

Sajjad, A. (2011). *Writing the narrative: The triumphs and tribulations.* Retrieved: <http://www.accaglobal.com/content/dam/acca/global/PDF-technical/narrative-eporting/writing_the_narrative.pdf>. (Accessed on 15. 01. 2019)

SEC (2014). *Annual report*. Retrieved from: <https://www.sec.gov/answers/annrep.htm>. (Accessed on 20. 01. 2019)

Tumpach, M., Užík, J., Juhászová, Z. (2014). Irregularities in accounting for provision in Slovakia. In: *Proceedings of the Managing and Modelling of Financial Risks: 7th International Scientific Conference*. Czech Republic: VŠB – Technical University of Ostrava, 2014. ISBN 978-80-248-3631-7, pp. 824-831.

# Lowered VAT Rate Transfer to the Consumer Prices: Selected Medicaments Case Study

**Gabriela Kukalová, Lukáš Moravec, Dana Bína Filipová, Viktor Janáček, Miroslav Ulrych**

[1] Czech University of Life Sciences in Prague
Faculty of Economics and Management, Department of Trade and Finance
Kamýcká 129, 165 21 Prague, Czech Republic
e-mail: kukalova@pef.czu.cz
e-mail: moravec@pef.czu.cz
e-mail: bina_filipova@pef.czu.cz
e-mail: vita87@centrum.cz
e-mail: mulrych@icloud.com

***Abstract:*** *The contribution focuses on changes in the tax burden on consumers following the introduction of a second reduced rate of value added tax on selected products. The shift in tax burden was assessed on a sample of specific pharmacy products that had been included in the second reduced VAT rate since 1st January 2015. Based on the pharmacy chain recommendations that provided the necessary data, the products were selected as a typical assortment sample, including contraception, high blood pressure medication, vaccine, antibiotics, and baby food. The provided data included mainly sales prices for final consumer for selected products in the months of 2014 and 2015. Data on sales prices were adjusted for inflation. The results show that the impact of the inclusion of selected products in the second reduced VAT rate on the final consumer price was positive. Reducing the VAT rate by including the price change set by the vendor and including inflation reduced the tax burden on the final consumer for all the products examined. The amount of change was highly variable in the individual products, thanks to the entry of other non-tax factors into the price formation process.*

*Keywords: VAT, tax rate, tax burden, price, Czech Republic*

*JEL codes: H20, H21, H30*

## 1 Introduction

Value Added Tax (VAT) is an integral part of EU states tax systems. EU tax systems are often complex and the European Commission (2018) also points out the need for simplification. Taxes, including VAT, are also subject to frequent changes. Changing, introducing or increasing tax leads to a change in relative prices for products or services. Subsequent reaction is the substitution effect, which leads to a non-optimal structure of production and consumption. The loss of consumer or producer surplus is referred as an excessive tax burden or deadweight cost (Maaytová et al., 2015). VAT is one of the leading factors in national fiscal policy. This is confirmed in his study by Cnossen (2015), who argues that extending the VAT base not only increases revenue to the state budget, but also reduces economic distortions and the administrative complexity of most taxes. Hajduchova et al. (2015) assessed the effectiveness of VAT collection in Slovakia. The results show that tax collection can be considered effective because the collection costs are several times lower than the tax revenue. Emami and Maroofi (2018) report that VAT has today an important role in meeting social, economic and budgetary objectives. In 2012, China carried out a major VAT reform and was the first country in the world to impose value added tax on the financial industry (Zhang, 2017).

VAT rates vary across EU countries, with most Member States using two or three rates. Rates may also increase or decrease, or goods and services may be moved to another rate. Hamplova et al. (2018) in their research verified the basic hypothesis that lowering VAT rates would lead to higher VAT collection and vice versa. Based on this research, the hypothesis was not confirmed. Bernal (2018) examined whether a small reduction in the VAT rate from 7% to 5% for food in Poland in 2011 leads to a lower price for consumers. The impacts of changes in VAT rates in the Czech Republic in 2007-2013 were dealt with

in the article by Střílková and Široký (2015), who examined the impact of changes in rates on consumers and the tax burden on households. The Czech Republic has from January 1, 2015 three VAT rates, the basic 21% rate, the first reduced rate of 15% and the second reduced rate of 10% (VAT Point EU taxation, 2018). On that date, the selected goods were moved to the second reduced rate of 10%, such as infant formulas and follow-on formulas and food for small children, some mill products, radiopharmaceuticals, vaccines, medicines, printed books (Ministry of Finance of the Czech Republic, 2018).

The aim of this paper is to evaluate changes in the tax burden on consumers following the introduction of a second reduced VAT rate for selected products based on 2014 and 2015 data. Further research on this issue will focus on changes in the classification of goods and services into the second reduced VAT rate from 1 January 2019 and, where appropriate, in the following period.

## 2 Methodology and Data

Data were provided by one of the pharmacy chains operating in the Czech Republic. The data include the development of sales prices in individual months 2014 to 2015 and information on changes in purchase prices of selected products. Based on the information obtained, the pharmacy chain has long-term supply contracts, thanks to which the purchase price of purchased products did not change in 2014 and 2015. For the purposes of assessing the shift in tax burden, eight specifics most frequently sold pharmacy products were selected, which were included in the second reduced VAT rate from January 1, 2015 (Table 1).

**Table 1** Selected pharmaceutical products

| **Selected Products** | **Product description** |
|---|---|
| Ayreen por. fml. 3x21 | contraception |
| Jeanine drg bal 3m | contraception |
| Lorista 28x50mg | treatment of high blood pressure |
| Lozap 30x50mg | treatment of high blood pressure |
| FSME-IMMUN 0.25ml | vaccine |
| Ospen 1500 30x1500 KU tbl | antibiotic |
| Nutrilon 3 (12 m - 1,5 y), 600g | baby food |
| Sunar complex 3, 600g | baby food |

Source: own work

Ayreen por. fml. 3x21 is a combined oral contraceptive. This product can only be purchased on a prescription and no payment is provided by health insurance companies. The final price for the consumer for the given product in 2014 and 2015 was the same, 660 CZK per package. Jeanine drg. pack. 3m is a combined oral contraceptive that can only be purchased on a prescription and no payment is provided by health insurance companies. The final price for consumers in 2014 was CZK 870 and in 2015 CZK 840 for one package.

The medicament Lorista 28x50mg is indicated for the treatment of high blood pressure. This medicine is on prescription only. Health insurance companies provided a performance of CZK 43.60 per drug package during the period under review. The price for the final consumer for the given drug in 2014 was between CZK 60.10 and CZK 106.70 per package. In 2015, the price was reduced to a constant CZK 49. The medicament Lozap 30x50mg is also indicated for the treatment of high blood pressure. It is a direct substitute for Lorista. This medicine is also on prescription only. During the period under review, health insurance companies provided a performance of CZK 46.70 per package. The final consumer price for the given medicine in 2014 was between CZK 54.90 and CZK 130.70 per package. In 2015, the price was reduced to constant CZK 46.70.

FSME-IMMUN 0.25 ml is a vaccine against tick-borne encephalitis. In 2014, the final consumer price for this vaccine was CZK 737.60. In January 2015, the price decreased to CZK 705.50 and in the following months of 2015 it rose to CZK 737.60.

The medicament Ospen 1500 30x1500 KU tbl is an antibiotic whose main drug substance is based on penicillin. The medicine is available only on prescription. In the period under review, health insurance companies provided performance of CZK 140.90 per package. In 2014, the final consumer price was CZK 268, 80. In the first 7 months of 2015, the price was the same, since the eighth month of 2015 the price has dropped to CZK 239.90.

Nutrilon 3 is a follow-on milk formula for infants from the age of 12 months. In 2014, the price for the final consumer increased from CZK 355 to CZK 375. In 2015, the price of the product for the final consumer was between CZK 355 and CZK 360. One of the direct substitutes is Sunar complex 3600 g. It is also a follow-on milk formula for children from the age of 12 months. In 2014, the price for the final consumer was CZK 240. In 2015, the sales price in January is reduced to CZK 230 and from February the price is increased by CZK 5 to CZK 235.

For the purposes of the analysis, the methodology of David (2012) was chosen, who in his article dealt with the issue of distribution of increased tax burden of selected commodities in the period from the fourth quarter of 2007 to the first quarter of 2008. For calculations in this contribution the formula has been modified to the following form:

$$[(C_1\text{-}C_0) / (T_1\text{-}T_0)] + 1, \quad (1)$$

where $C_1$ is the price without VAT in 2015 (rate 10%), $C_0$ is the price without VAT in 2014 (rate 15%), $T_1$ is calculated VAT at the rate of 10% and $T_0$ is calculated VAT at the rate of 15%.

The provided data were adjusted for inflation on the basis of a change in the consumer price index related to the same time interval of the previous year for which the given price was valid, that is for the entire period under review for all products (Czech Statistical Office, 2018).

## 3 Results and Discussion

The products were selected based on the pharmacy chain recommendation as a typical assortment of products in which contraception, high blood pressure medicines, vaccine, antibiotics and baby food should be represented.

VAT reduction for Ayreen por. flm. 3x21 was reflected in the final consumer price during 2015 only in the amount of 8-13% of the total change in the tax burden on the product (Table 2).

**Table 2** The final consumer's share in VAT reduction for Ayreen por. fml. 3x21 (in % of VAT change)

| 2014/2015 | C1–C0 | T1–T0 | (C1-C0)/(T1-T0) | [(C1-C0)/(T1-T0)]+1 |
|---|---|---|---|---|
| January | 24.27 | -26.25 | -0.92457 | 8% |
| February | 24.27 | -26.25 | -0.92457 | 8% |
| March | 24.27 | -26.25 | -0.92457 | 8% |
| April | 23.67 | -26.31 | -0.89966 | 10% |
| May | 23.67 | -26.31 | -0.89966 | 10% |
| June | 23.07 | -26.37 | -0.87486 | 13% |
| July | 23.07 | -26.37 | -0.87486 | 13% |
| August | 23.67 | -26.31 | -0.89966 | 10% |
| September | 23.67 | -26.31 | -0.89966 | 10% |
| October | 23.67 | -26.31 | -0.89966 | 10% |
| November | 24.27 | -26.25 | -0.92457 | 8% |
| December | 24.27 | -26.25 | -0.92457 | 8% |

Source: own work

VAT rate reduction for product Jeanine drg. bal. 3m was reflected in the final consumer price during 2015 between 87% and 91%, so the transfer of the reduced commodity tax burden on consumers was not 100% for this product (Table 3).

**Table 3** The final consumer's share in VAT reduction for Jeanine drg. bal. 3m (in % of VAT change)

| 2014/2015 | C1–C0 | T1–T0 | (C1-C0)/(T1-T0) | [(C1-C0)/(T1-T0)]+1 |
|---|---|---|---|---|
| January | 4.80 | -37.32 | -0.12862 | 87% |
| February | 4.80 | -37.32 | -0.12862 | 87% |
| March | 4.80 | -37.32 | -0.12862 | 87% |
| April | 4.04 | -37.40 | -0.10802 | 89% |
| May | 4.04 | -37.40 | -0.10802 | 89% |
| June | 3.28 | -37.48 | -0.08751 | 91% |
| July | 3.28 | -37.48 | -0.08751 | 91% |
| August | 4.04 | -37.40 | -0.10802 | 89% |
| September | 4.04 | -37.40 | -0.10802 | 89% |
| October | 4.04 | -37.40 | -0.10802 | 89% |
| November | 4.80 | -37.32 | -0.12862 | 87% |
| December | 4.80 | -37.32 | -0.12862 | 87% |

Source: own work

VAT rate reduction for Lorista 28x50mg between 2014 and 2015 (Table 4) was reflected in the price of the medicament more than sixfold in the period January-March. In the following months the price increased, and the impact of the rate cut was lower for consumers.

**Table 4** The final consumer´s share in VAT reduction for Lorista 28x50mg (in % of VAT change)

| 2014/2015 | C1–C0 | T1–T0 | (C1-C0)/(T1-T0) | [(C1-C0)/(T1-T0)]+1 |
|---|---|---|---|---|
| January | -48.38 | -9.47 | 5.10845 | 611% |
| February | -48.38 | -9.47 | 5.10845 | 611% |
| March | -48.38 | -9.47 | 5.10845 | 611% |
| April | -32.86 | -7.14 | 4.60168 | 560% |
| May | -7.90 | -3.4 | 2.32235 | 332% |
| June | -7.94 | -3.41 | 2.32698 | 333% |
| July | -7.94 | -3.41 | 2.32698 | 333% |
| August | -7.90 | -3.4 | 2.32235 | 332% |
| September | -7.90 | -3.4 | 2.32235 | 332% |
| October | -7.90 | -3.4 | 2.32235 | 332% |
| November | -7.85 | -3.4 | 2.30794 | 331% |
| December | -7.85 | -3.4 | 2.30794 | 331% |

Source: own work

The results for Lozap 33x50 mg showed that a reduction of the VAT rate between 2014 and 2015 resulted in a final consumer price of 285% - 657% (Table 5).

**Table 5** The final consumer´s share in VAT reduction for Lozap 30x50mg (in % of VAT change)

| 2014/2015 | C1–C0 | T1–T0 | (C1-C0)/(T1-T0) | [(C1-C0)/(T1-T0)]+1 |
|---|---|---|---|---|
| January | -71.33 | -12.81 | 5.56831 | 657% |
| February | -71.33 | -12.81 | 5.56831 | 657% |
| March | -71.33 | -12.81 | 5.56831 | 657% |
| April | -71.38 | -12.81 | 5.57196 | 657% |
| May | -71.38 | -12.81 | 5.57196 | 657% |
| June | -71.41 | -12.82 | 5.57048 | 657% |

| | | | | |
|---|---|---|---|---|
| July | -5.49 | -2.94 | 1.86854 | 287% |
| August | -5.46 | -2.93 | 1.86239 | 286% |
| September | -5.46 | -2.93 | 1.86239 | 286% |
| October | -5.46 | -2.93 | 1.86239 | 286% |
| November | -5.41 | -2.93 | 1.84645 | 285% |
| December | -5.41 | -2.93 | 1.84645 | 285% |

Source: own work

The results for FSME-IMMUN (Table 6) show that the reduction of the VAT rate was reflected in the consumer price of 106% in January. This month, the price of the vaccine was reduced. The results in the following months showed an increase in the price for the final consumer.

**Table 6** Final consumer´s share on VAT reduction for FSME-IMMUN 0.25 ml (in % of VAT change)

| 2014/2015 | C1–C0 | T1–T0 | (C1-C0)/(T1-T0) | [(C1-C0)/(T1-T0)]+1 |
|---|---|---|---|---|
| January | -1.98 | -32.24 | 0.06131 | 106% |
| February | 30.11 | -29.03 | -1.03711 | -4% |
| March | 30.11 | -29.03 | -1.03711 | -4% |
| April | 29.44 | -29.10 | -1.01156 | -1% |
| May | 29.44 | -29.10 | -1.01156 | -1% |
| June | 28.77 | -29.17 | -0.98613 | 1% |
| July | 28.77 | -29.17 | -0.98613 | 1% |
| August | 29.44 | -29.10 | -1.01156 | -1% |
| September | 29.44 | -29.10 | -1.01156 | -1% |
| October | 29.44 | -29.10 | -1.01156 | -1% |
| November | 30.11 | -29.03 | -1.03711 | -4% |
| December | 30.11 | -29.03 | -1.03711 | -4% |

Source: own work

On the basis of the year-on-year comparison for Ospen, it is clear that the reduction of the VAT rate was reflected in prices for the final consumer mostly as of August 2015 (Table 7).

**Table 7** Final consumer´s share in VAT reduction for Ospen 1500 30x1500 KU tbl (in % of VAT change)

| 2014/2015 | C1–C0 | T1–T0 | (C1-C0)/(T1-T0) | [(C1-C0)/(T1-T0)] +1 |
|---|---|---|---|---|
| January | 9.88 | -10.69 | -0.92457 | 8% |
| February | 9.88 | -10.69 | -0.92457 | 8% |
| March | 9.88 | -10.69 | -0.92457 | 8% |
| April | 9.63 | -10.71 | -0.89961 | 10% |
| May | 9.63 | -10.71 | -0.89961 | 10% |
| June | 9.40 | -10.74 | -0.87486 | 13% |
| July | 9.40 | -10.74 | -0.87486 | 13% |
| August | -16.53 | -13.33 | 1.24003 | 224% |
| September | -16.53 | -13.33 | 1.24003 | 224% |
| October | -16.53 | -13.33 | 1.24003 | 224% |
| November | -16.31 | -13.31 | 1.22537 | 223% |
| December | -16.31 | -13.31 | 1.22537 | 223% |

Source: own work

As regards Nutrilon 3 (Table 8), there were frequent price changes for the final consumer in 2015. The reduction of the VAT rate in any of the monitored months was not 100 % reflected in the price , in the months of March-June there was such a year-on-year

increase in the price, which indicates that the VAT rate reduction was not reflected in the price at all, on the contrary the tax burden for consumers increased.

**Table 8** Final consumer´s share on VAT reduction for Nutrilon 3 (in % of VAT change)

| 2014/2015 | C1–C0 | T1–T0 | (C1-C0)/(T1-T0) | [(C1-C0)/(T1-T0)]+1 |
|---|---|---|---|---|
| January | 13.06 | -14.12 | -0.92458 | 8% |
| February | 13.06 | -14.12 | -0.92458 | 8% |
| March | 17.58 | -13.66 | -1.28697 | -29% |
| April | 17.26 | -13.70 | -1.25985 | -26% |
| May | 17.26 | -13.70 | -1.25985 | -26% |
| June | 16.93 | -13.73 | -1.23307 | -23% |
| July | 3.89 | -15.69 | -0.24793 | 75% |
| August | 4.22 | -15.66 | -0.26948 | 73% |
| September | 4.22 | -15.66 | -0.26948 | 73% |
| October | 4.22 | -15.66 | -0.26948 | 73% |
| November | 4.54 | -15.62 | -0.29065 | 71% |
| December | 0.19 | -16.27 | -0.01168 | 99% |

Source: own work

For Sunar Complex (Table 9), the price in year-on-year comparison for the final consumer dropped by CZK 10 in January. The reduction of the VAT rate in this month was reflected in the price for consumer of 102%. In the following months, the price increased, and the tax rate reduction was reflected in the price for consumers only in the range of 57 - 61%.

**Table 9** Final consumer´s share in VAT reduction for Sunar complex 3600 g (in % of VAT change)

| 2014/2015 | C1–C0 | T1–T0 | (C1-C0)/(T1-T0) | [(C1-C0)/(T1-T0)]+1 |
|---|---|---|---|---|
| January | -0.23 | -10.46 | 0.02199 | 102% |
| February | 4.29 | -10.00 | -0.42950 | 57% |
| March | 4.29 | -10.00 | -0.42950 | 57% |
| April | 4.08 | -10.02 | -0.40719 | 59% |
| May | 4.08 | -10.02 | -0.40719 | 59% |
| June | 3.88 | -10.05 | -0.38557 | 61% |
| July | 3.88 | -10.05 | -0.38557 | 61% |
| August | 4.08 | -10.02 | -0.40719 | 59% |
| September | 4.08 | -10.02 | -0.40719 | 59% |
| October | 4.08 | -10.02 | -0.40719 | 59% |
| November | 4.29 | -10.00 | -0.42950 | 57% |
| December | 4.29 | -10.00 | -0.42950 | 57% |

Source: own work

The following table (Table 10) shows how the reduction of the VAT rate for selected products was reflected in the price for consumers on average for all months (from January 2014 to December 2015 in year-on-year comparison). The results show that for all the products monitored, the average annual price decreased, and the tax rate reduction was at least partially transmitted to the price for the final consumer. For high-pressure medicines, the reduction of the VAT was reflected in the price for final consumer on average more than fourfold. For all other products, the reduction of the VAT rate was reflected in consumer prices in the range of 7-99%.

**Table 10** Average final consumer´s share in VAT reduction in 2014/2015 (in % of VAT change)

| Selected products | Average share |
|---|---|
| Ayreen por. fml. 3x21 | 9% |
| Jeanine drg bal 3m | 89% |

| | |
|---|---|
| Lorista 28x50mg | 421% |
| Lozap 30x50mg | 471% |
| FSME – IMMUN 0.25ml | 7% |
| Ospen 1500 30x1500 KU tbl | 99% |
| Nutrilon 3 (12 m - 1,5 y), 600g | 31% |
| Sunar complex 3, 600g | 99% |

Source: own work

The impact that can cause the transfer of goods and services between VAT rates has also been addressed by other authors. According to Dušek and Janský (2012), this impact is related to the elasticity of demand, which is determined by the sensitivity of the demanded quantity of a certain product or service on a price change. This statement is fully supported by the results of this paper, where the monitored products have many substitutes. The price for consumers is also related to the retailers' pricing strategy. David (2012) in his study determines the transfer rate of tax burden to the buyers of agricultural products and food consumer in the most recent major change in the reduced rate in VAT reduction in the Czech Republic in late 2007 and 2008. The reduction of VAT rate from 7% to 5% for basic foods in Poland did not lead to lower prices for consumers (Bernal, 2018). The transfer of goods and services to a different VAT rate also affects the amount of tax revenue. Krzikallová and Střílková (2015; 2016) in their studies dealt with the expected impact of a possible transfer of selected high labour intensity services from the basic to the reduced VAT rate. It resulted in the finding that this possible legislative change will lead to a reduction in VAT revenues. A positive aspect could be in particular an increasing investment in business development.

## 4 Conclusions

The aim of the paper was to evaluate changes in tax burden when moving selected products to the second reduced VAT rate. The evaluation concerned the reduction of the VAT rate for 8 specific products, which were a typical sample of the pharmacy chain product range. The data provided by the pharmacy chain operating on the Czech market related to selling prices for final consumers in individual months of 2014 and 2015. For the purpose of calculations, the data were adjusted for inflation.

Based on the analysis, it was found that the tax burden on the final consumer was reduced for all the products under review. Namely it concerned the contraceptives Ayreen and Jaenine, high blood pressure and heart diseases medication Lorista and Lozap, vaccine FSME, antibiotic Ospen and baby food Nutrilon 3 and Sunar 3. The reduction of the VAT rate was reflected in prices for final consumers on average from 7% to 471% of the total change in the tax burden adjusted for inflation. The VAT rate reduction was reflected at minimum in the price of FSME-IMMUN (only 7% on average). Conversely, for medicines to treat high blood pressure, the VAT rate reduction was reflected in the final consumer price fourfold. In this case, it is also necessary to mention other factors that may affect the consumer price, such as the economic and commercial situation of the pharmacy chain, the competitive position of the chain on the domestic and foreign markets, the development of the foreign exchange market, or the development of prices of components and pharmacy products both on the world and domestic market.

The current study solved in this paper is relatively solitary. Nevertheless, the subsequent study based on similar algorithms is pending. The authors have been collecting the data on changes in prices and tax burden being focused on VAT rates changes in 2018 and 2019. The reached fresh results would be compared to the conclusions of the current paper and the future research questions might be formulated subsequently.

## Acknowledgments

This paper is a partial result of the research project No. 2019B0010 - Czech Social System Fraud Rate Estimation and System Optimization Proposals, supported by the Internal Grant Agency (IGA) of Faculty of Economics and Management, CULS Prague.

## References

Bernal, A. (2018). Do Small Value-Added Tax Rate Decreases on Groceries Imply Lower Prices for Consumers? *Eastern European Economics*, vol. 56(1), pp. 81-98.

Cnossen, S. (2015). Mobilizing VAT revenues in African countries. *International Tax and Public Finance*, vol 22(6), pp. 1077-1108.

Czech Statistical Office (2018). *Inflace - druhy, definice, tabulky*. Retrieved from: https://www.czso.cz/csu/czso/mira_inflace.

David, P. (2012). Distribution of the increased tax burden for agricultural products and food in the Czech Republic. *Agricultural Economics*, vol. 58(5), pp. 239-248.

Dušek, L., Janský, P. (2012). The Impact of VAT Changes on the Households Real Incomes. *Politická ekonomie*, vol. 60(3), pp. 303-329.

Emami, A., Maroofi, F. (2018). Strategic VAT Planning as a Sustainable Source of Income for Municipalities During 2017-2021. *Humanidades and Inocacao*, vol. 5(2), pp. 145-153.

European Commission (2018). *Taxation*. Retrieved from: https://europa.eu/european-union/topics/taxation_en.

Hajduchova, I., Sedliacikova, M., Viszlai, I. (2015). Value-added Tax Impact on the State Budget Expenditures and Incomes. In: *International Scientific Conference on Business, Economics, and Management (BEM2015)*. Zvolen: Tech Univ Zvolen. Procedia Economics and Finance, vol. 34, pp. 676-681.

Hamplova, E., Jedlicka, P., Kovarnik, J. (2017). The Price Elasticity of the Demand on Selected Types of Commodities and Its Influence on the Value Added Tax Collection. *Country Experiences in Economic Development, Management and Entrepreneurship*, vol. 5, pp. 187-209.

Krzikallová, K. Střílková, R. (2015). Value Added Tax Applied to Labour-Intensive Services impact of their Changes on the VAT Revenue. In: *Finance and Performace of Firms in Science, Education, and Practice: proceedings of the 7th International Scientific Conference*. Zlín: Tomas Bata University in Zlín, pp. 779-794.

Krzikallová, K., Střílková, R. (2016). Labour-Intensive Services and Changes in Value Added Tax Revenue. *Journal of Competitiveness*, vol. 8(1), pp. 5-18.

Maaytová, A., Ochrana, F., Pavel, J. (2015). *Veřejné finance v teorii a praxi*. Praha: Grada Publishing. ISBN 9788024755618.

Ministry of Finance of the Czech Republic (2018). *Vláda schválila daňový balíček pro rok 2019*. Retrieved from: https://www.mfcr.cz/cs/aktualne/tiskove-zpravy/2018/vlada-schvalila-danovy-balicek-pro-rok-2-32134.

Střílková, R., Široký, J. (2015). Changes in the VAT burden on expenses of selected households in the Czech Republic (2007-2013). In: *Proceedings of the 18th International Conference Enterprise and Competitive Environment*. Brno: Univ Mendel, Fac Business Econom, pp. 842-851.

Vat Point (2018). *Sazby DPH v EU platné k 1. 1. 2018*. Retrieved from: https://www.vatpoint.eu/sazby-dph-v-eu-k-1-1-2018/.

Zhang, C. (2017). Study on Existing Problems and Reform Paths of VAT System in China's Financial Industry. In: *Proceedings of the 2nd International Conference on Contemporary Education, Social Sciences and Humanities (ICCESSH 2017)*, vol. 124, pp. 927-932.

# Do European Investors React to Extreme Oil Prices? Evidence from Granger Causality in Tails Test

**Blanka Łęt**

Poznań University of Economics and Business
Department of Applied Mathematics
Al. Niepodległości 10, 61-875 Poznań, Poland
E-mail: blanka.let@ue.poznan.pl

***Abstract:*** *In this paper we analyze relationship between selected European stock markets and crude oil market. The aim of our analysis is to check whether stock market participants react to extreme changes in oil price. Specifically, we verify whether there is contemporaneous and delayed Granger causality between occurrence of the extreme negative or positive returns on the crude oil market and main European stock markets. We use daily Brent futures prices and stock indices from Belgium, France, Germany, Greece, Italy, Netherlands, Norway, Poland, Spain, Sweden and United Kingdom. We implement Candelon and Tokpavi (2016) testing procedure. Our results show that in the analyzed period in most cases the symmetrical contemporaneous causality was dominant, i.e. extreme negative or positive returns on the oil market and stock markets occurred on the same day and had the same direction. Results of Granger delayed causality test show that more long-lasting reaction occurred as a result to the negative news from the oil market.*

*Keywords: Granger causality in tails, crude oil, stock market, risk, extreme value*

*JEL codes: G15, Q02, C12*

## 1 Introduction

Crude oil is one of the most important commodity, crucial for the world economy and traded internationally. Price of oil is a meaningful factor for most branches of national economy. Importing countries are forced to bear higher costs when the price increases. On the other hand, price of black gold is very sensitive to many factors and can change also as a result of demand shifts. Economic slowdown may lead to a gradual reduction in oil demand and price drops. So there is a linkage between price of oil and condition of many national economics in the long run. But oil price changes can also be triggered as a reaction to extreme movements on the stock markets that reflect condition of the economy. Similarly, levels of stock market indices can change as a result of jumps in oil price, when investors consider this as a signal of a change in the economic situation. If we look at this issue from the importing countries point of view, unexpected and extremely high oil price may be interpreted by investors as a bad news, so one could expect asymmetrical reaction. However in the case of oil exporter it's reasonable to reckon on the symmetrical reaction.

The goal of the paper is to analyze relationships between European stock markets and crude oil market. We verify whether occurrence of the extreme negative or positive returns on the crude oil market preceded the occurrence of similar events on the main European stock markets or occurred on the same day. We implement Candelon and Tokpavi (2016) testing procedure.

Our work contributes to previous research on European stock market – crude oil relation. A number of approaches have been proposed in earlier studies: VAR model (Park and Ratti, 2008; Śmiech and Papież, 2013), multifactor model with GARCH specification (Arouri, 2011), bivariate GARCH model (Arouri et al., 2012), causality in distribution test based on empirical copula (Wanat et al., 2015). To the best of our knowledge Candelon and Tokpavi (2016) test has never been used before for European stock markets – oil relation analysis.

## 2 Methodology and Data

The Candelon and Tokpavi (2016) test is a multivariate extension of the Granger causality test in risk introduced by Hong et al. (2009) and Granger causality test in variance by Cheung and Ng (1996) and Hong (2001). Candelon and Tokpavi test checks existence of Granger causality between the multivariate processes of interquantile event variables for a specific region of the distribution. Specifically one can test existence of the lead-lag relationship in the tails of the return distributions.

### Testing Procedure

Consider two time series $X_t$ and $Y_t$. If $VaR_t^{X\_long}(\alpha)$ denotes a risk measure Value at Risk at a level $\alpha$ for long trading position, then

$$P(X_t < -VaR_t^{X\_long}(\alpha)|\mathcal{F}_{t-1}^X) = \alpha, \tag{1}$$

where $\mathcal{F}_{t-1}^X$is the information set:

$$\mathcal{F}_{t-1}^X = \{X_{t-j}, j = 1, 2, \dots\}. \tag{2}$$

Similarly, $VaR_t^{X\_short}(\alpha)$ denotes Value at Risk for short trading position:

$$P(X_t > VaR_t^{X\_short}(\alpha)|\mathcal{F}_{t-1}^X) = 1 - \alpha, \tag{3}$$

Hong et al. (2009) causality in risk test determines whether Value at Risk violation for $Y_t$ can be considered as a lagged indicator of similar situation for $X_t$. Using the sample cross-correlation function between tail event variables $Z_t^X$ and lagged $Z_t^Y$ defined as

$$Z_t^X = \begin{cases} 1 & \text{if } X_t < -VaR_t^{X\_long}(\alpha) \\ 0 & \text{otherwise,} \end{cases} \tag{4}$$

$$Z_t^Y = \begin{cases} 1 & \text{if } Y_t < -VaR_t^{Y\_long}(\alpha) \\ 0 & \text{otherwise,} \end{cases}$$

they construct a test statistic with a large number of lags and higher-order lags discounted. They suggest to use a kernel weighting function to reflect the fact that recent news have a greater influence on current market trends than older ones.

Candelon and Tokpavi (2016) test is a multivariate extension of the kernel-based Granger causality test in risk. It can be used to detect causality in the whole distribution or to check for Granger causality in specific regions on the distribution supports, such as the center or tails (left or right). Consider a set $A = \{\alpha_1, \dots, \alpha_m\}$ of $m$ VaR risk levels. For the left tail one can choose $A = \{1\%, 5\%, 10\%\}$, for the right tail $A = \{90\%, 95\%, 99\%\}$. We divide tails into $m$ disjoint regions each related to the indicator or event variable.

For the left tail we define following event variables:

$$Z_{t,1}^X = \begin{cases} 1, & \text{if } X_t < -VaR_t^{X\_long}(\alpha_1) \\ 0, & \text{otherwise,} \end{cases}$$

$$Z_{t,2}^X = \begin{cases} 1, & \text{if } -VaR_t^{X\_long}(\alpha_1) \le X_t < -VaR_t^{X\_long}(\alpha_2) \\ 0, & \text{otherwise,} \end{cases} \tag{5}$$

…

$$Z_{t,m}^X = \begin{cases} 1, & \text{if } -VaR_t^{X\_long}(\alpha_{m-1}) \le X_t < -VaR_t^{X\_long}(\alpha_m) \\ 0, & \text{otherwise,} \end{cases}$$

For the right tail we define following event variables:

$$Z_{t,1}^X = \begin{cases} 1, & \text{if } VaR_t^{X\_short}(\alpha_1) < X_t \le VaR_t^{X\_short}(\alpha_2) \\ 0, & \text{otherwise,} \end{cases}$$

…

$$Z_{t,2}^{X} = \begin{cases} 1, & if \quad VaR_t^{X\_short}(\alpha_{m-1}) < X_t \leq VaR_t^{X\_short}(\alpha_m) \\ 0, & otherwise, \end{cases} \tag{6}$$

$$Z_{t,m}^{X} = \begin{cases} 1, & if \quad VaR_t^{X\_short}(\alpha_m) < X_t \\ 0, & otherwise. \end{cases}$$

Let $\boldsymbol{H}_t^X = (Z_{t,1}{}^X, Z_{t,2}{}^X, \dots, Z_{t,m}{}^X)^T$ be a column vector of dimension $m$. Similarly $\boldsymbol{H}_t^Y = (Z_{t,1}{}^Y, Z_{t,2}{}^Y, \dots, Z_{t,m}{}^Y)^T$. The time series $\mathrm{Y_t}$ does not Granger-cause the time series $\mathrm{X_t}$ in tail if the following hypothesis holds:

$$H0: E\left(\boldsymbol{H}_t^X | \mathcal{F}_{t-1}^{X\&Y}\right) = E(\boldsymbol{H}_t^X | \mathcal{F}_{t-1}^{X}), \tag{7}$$

where $\mathcal{F}_{t-1}^{X\&Y} = \{X_{t-j}, Y_{t-j}, j = 1, 2, \dots\}$.

The Candelon and Tokpavi (2016) test statistic is expressed as:

$$V_{Y\to X} = \frac{\hat{\mathcal{J}} - m^2 C(M)}{\sqrt{m^2 D(M)}}, \tag{8}$$

where

$$\hat{\mathcal{J}} = \sum_{j=1}^{T-1} k^2\left(\frac{j}{M}\right) \hat{Q}(j), \tag{9}$$

$$\hat{Q}(j) = T vec(\widehat{\boldsymbol{R}}(j))^T \left(\widehat{\boldsymbol{\Gamma}}_X^{-1} \otimes \widehat{\boldsymbol{\Gamma}}_Y^{-1}\right) vec(\widehat{\boldsymbol{R}}(j)) \tag{10}$$

and $\widehat{\boldsymbol{R}}(j)$ is the sample cross-correlation matrix between $\boldsymbol{H}_t^Y$ (lagged by $j$) and $\boldsymbol{H}_t^X$, $\widehat{\boldsymbol{\Gamma}}_X$ is the sample correlation matrix of $\boldsymbol{H}_t^X$; $k$ is the kernel function, $M$ is the truncation parameter, $T$ is the length of the sample, $C(M)$ and $D(M)$ are location and scale parameters:

$$C(M) = \sum_{j=1}^{T-1}\left(1 - \frac{j}{T}\right) k^2\left(\frac{j}{M}\right), \tag{11}$$

$$D(M) = 2\sum_{j=1}^{T-1}\left(1 - \frac{j}{T}\right)\left(1 - \frac{j+1}{T}\right) k^4\left(\frac{j}{M}\right). \tag{12}$$

Bartlett kernel function is defined as $k(z) = \begin{cases} 1 - |z|, & |z| < 1 \\ 0, & |z| \geq 1 \end{cases}$. Under the null hypothesis of no Granger causality in tails $V_{Y\to X} \xrightarrow{d} N(0,1)$, where $N(0,1)$ denotes standard normal distribution.

To compute Value at Risk estimates we use mean and volatility forecasts obtained from ARMA-GARCH family of models.

**Data**

The data consists of daily prices of eleven major European indices (Belgium: BEL20, France: CAC40, Germany: DAX, Greece: ATH, Italy: FMIB, Netherlands: AEX, Norway: OSEAX, Poland: WIG20, Spain: IBEX, Sweden: OMX30, United Kingdom: FTSE250) and Brent oil futures prices, the most important benchmark for oil prices in Europe.

There are several reasons to analyze investors reaction on oil price movements in the above-mentioned countries. First of all, they are the largest net importers of oil in Europe, with the exception of one net exporter: Norway. Secondly, oil play an important role in primary energy mix in these countries. According to the data in BP Statistical Review of World Energy (2018) analyzed countries have following oil's share in primary energy mix: Greece: 56.16%, Belgium: 51.69%, Netherlands: 47.39%, Sweden: 46.69%, Spain: 41.29%, United Kingdom: 39.88%, Italy: 38.85%, Germany: 35.75%, France: 33.5%, Poland: 30.95%, Norway: 21.26%. The third reason is that stock exchanges in these countries are an important component of the global financial market.

The data cover January 2, 2008 until April 30, 2019. In all calculations we use daily percentage logarithmic returns defined as $r_t = 100 \cdot \ln \frac{P_t}{P_{t-1}}$, where $P_t$ denotes price of an asset at the time $t$.

## 3 Results and Discussion

Table 1 gives calculated basic descriptive statistics of daily percentage logarithmic returns. Mean value in most cases is close to zero. Volatility measured by standard deviation is moderate. In all cases high excess kurtosis suggest non-normal, fat-tailed distribution of returns.

We conducted Candelon and Tokpavi testing procedure in the whole analyzed period. Testing results of Granger causality in tails are reported in Tables 2 and 3. The test is made in two versions. First we check if there exist a contemporaneous and delayed causality in tails, i.e. whether extreme movements, past or current, in oil market may have a significant predictive power for those in the stock market adding in Equation (8) values of $\hat{Q}(j)$ when $j = 0$. Testing results are reported in Table 2.

**Table 13** Descriptive statistics. Full sample: 2.01.2008-30.04.2019

| | Mean | Std. deviation | Skewness | Excess kurtosis |
|---|---|---|---|---|
| AEX | 0.0040 | 1.3493 | -0.2110 | 8.4548 |
| DAX | 0.0059 | 1.6477 | 0.0137 | 7.6631 |
| FMIB | -0.0192 | 1.6847 | -0.2009 | 4.6562 |
| IBEX | -0.0155 | 1.5532 | -0.0854 | 7.1800 |
| CAC40 | 0.0002 | 1.4426 | -0.0076 | 6.5276 |
| FTSE | 0.0217 | 1.1269 | -0.4327 | 5.0284 |
| BEL20 | -0.0033 | 1.2741 | -0.1505 | 6.2049 |
| WIG20 | -0.0135 | 1.4274 | -0.2951 | 3.8824 |
| ATH | -0.0683 | 2.1457 | -0.3028 | 5.3095 |
| OMX30 | 0.0162 | 1.4001 | 0.0110 | 5.3373 |
| OSEAX | 0.0197 | 1.4510 | -0.6182 | 7.1161 |
| Brent | -0.0108 | 2.1343 | 0.0092 | 3.7414 |

Source: Author's own calculations

Next we verify if only delayed causality is significant. Table 3 shows $p$-values of Candelon and Tokpavi (2016) test, with null hypothesis, that extreme oil returns (left or right tail) didn't precede extreme returns on the stock market. In all cases we set truncation parameter $M = 11$. It means that we are testing if Granger causality in tails exists within ten days.

Testing results in Table 2 and 3 suggest that symmetrical instantaneous causality was dominant, i.e. extreme negative or positive returns on the oil market and stock markets occurred on the same day and had the same direction. Investors may perceive oil price jumps as a signal of a changing economic situation. The days when the reaction was asymmetrical also occurred, but less frequently. Only in the case of Greek investors there was dominant asymmetrical response to the extreme positive returns on the oil market. It's worth noting that crude oil is the most important source of primary energy in Greece. It has also the largest share in energy mix among analyzed countries. It means that high oil prices are more troublesome for Greek economy.

In most cases more long-lasting reaction occurred as a result to the negative news from the oil market. In the case of Netherland, Italy, Spain, France and Sweden test results in Table 3 indicate the occurrence of a "rebound effect": after a sharp decline on the day when oil was cheaper, the index probably returned to previous values in the following days.

**Table 14** P-values of Granger contemporaneous and delayed causality in tails test. Full sample: 2.01.2008-30.04.2019

| Country | Type of tails tested | | | |
|---|---|---|---|---|
| | Left→Left | Left→Right | Right→Right | Right→Left |
| Netherlands | ***<0.0001 | ***0.0002 | ***<0.0001 | 0.6258 |
| Germany | ***<0.0001 | ***0.0058 | ***<0.0001 | **0.0485 |
| Italy | ***<0.0001 | ***<0.0001 | ***<0.0001 | 0.4968 |
| Spain | ***<0.0001 | ***<0.0001 | ***<0.0001 | 0.3161 |
| France | ***<0.0001 | **0.0132 | ***<0.0001 | 0.2996 |
| United Kingdom | ***<0.0001 | 0.1157 | ***<0.0001 | 0.5000 |
| Belgium | ***<0.0001 | ***0.0056 | ***0.0001 | ***0.0024 |
| Poland | ***<0.0001 | **0.0431 | ***<0.0001 | 0.5013 |
| Greece | ***<0.0001 | 0.5787 | 0.6988 | *0.0697 |
| Sweden | ***<0.0001 | **0.0251 | ***<0.0001 | 0.9292 |
| Norway | ***<0.0001 | ***0.0010 | ***<0.0001 | **0.0224 |

Note: $P$-values that indicate a significant test result and a dominant response (smaller $p$-value) are bold. Null hypothesis: Oil returns do not Granger-cause in tails stock market returns
Source: Author's own calculations

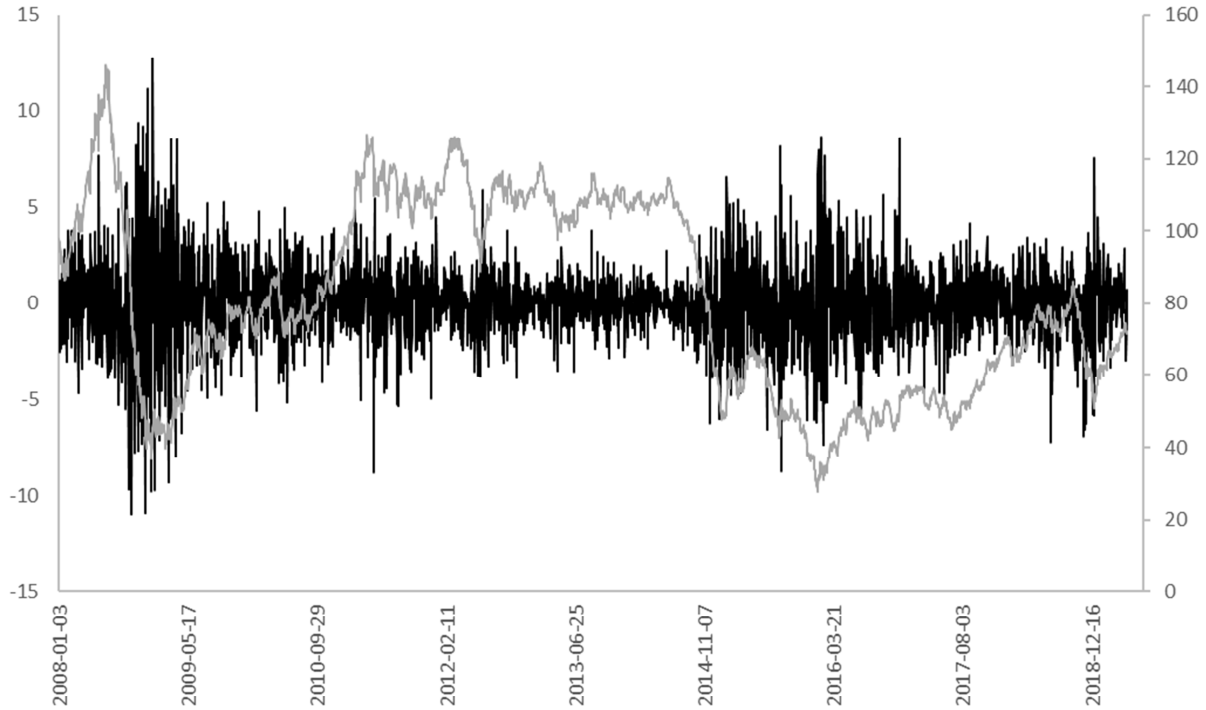
**Table 15** P-values of Granger delayed causality in tails test. Full sample: 2.01.2008-30.04.2019

| Country | Type of tails tested | | | |
|---|---|---|---|---|
| | Left→Left | Left→Right | Right→Right | Right→Left |
| Netherlands | 0.1149 | ***0.0021 | 0.9371 | 0.9420 |
| Germany | ***<0.0001 | **0.0129 | 0.4397 | 0.7441 |
| Italy | ***0.0012 | ***<0.0001 | *0.0816 | 0.8826 |
| Spain | *0.0605 | ***<0.0001 | 0.8256 | 0.6743 |
| France | 0.4383 | *0.0820 | 0.9064 | 0.7431 |
| United Kingdom | 0.2674 | 0.2249 | 0.2712 | 0.9296 |
| Belgium | 0.6569 | 0.1034 | 0.9258 | 0.1925 |
| Poland | ***0.0007 | **0.0125 | 0.9368 | 0.7943 |
| Greece | 0.2679 | 0.8777 | 0.7719 | 0.1111 |
| Sweden | 0.4522 | *0.0745 | 0.8590 | 0.9611 |
| Norway | ***<0.0001 | **0.0420 | 0.8821 | 0.3860 |

Note: $P$-values that indicate a significant test result and a dominant response (smaller $p$-value) are bold. Null hypothesis: Oil returns do not Granger-cause in tails stock market returns
Source: Author's own calculations

Figure 1 shows Brent oil prices and returns throughout the analyzed period. One can see that in the last eleven years crude oil prices and dynamics of returns varied dramatically. We found it necessary to divide it into three subsamples: 2.01.2008-31.12.2010 (great financial crisis, high volatility of oil and stock markets), 2.01.2011-30.06.2014 (high prices and low volatility of oil) and 1.07.2014-30.04.2019 (low prices and high volatility of oil) to verify if it affects testing results.

**Figure 10** Brent Oil Prices (right axis) and Returns (left axis)




Source: author's own elaboration

Tables 4, 6 and 8 presents Granger instantaneous and delayed causality testing results in three subsamples. It can be noticed, that in all sub-periods our results are confirmed in the case of extreme negative oil returns. On the other hand in the last period there is relatively weaker effect in the case of extreme positive oil returns. This may be due to the fact that the price of oil in this period was very low. In this case single extreme increases might be too small to bring some effect.

Results of Granger delayed causality test in Table 5, 7 and 9 show that in most cases more long-lasting reaction occurred as a result to the negative news from the oil market.

Furthermore, our results from Tables 4-9 show that there is one country for which results are confirmed in all sub-periods. It is the case of Norway, the only net exporter of oil in our study. Certainly this result is not surprising: declines and increases in oil prices have a direct impact on the Norwegian economy. Investors in Norway attach great importance to the oil price movements.

**Table 16** P-values of Granger contemporaneous and delayed causality in tails test. Subsample 1: 2.01.2008-31.12.2010

| Country | Type of tails tested | | | |
|---|---|---|---|---|
| | Left→Left | Left→Right | Right→Right | Right→Left |
| Netherlands | ***<0.0001 | 0.1423 | ***<0.0001 | 0.8736 |
| Germany | ***<0.0001 | ***<0.0001 | ***<0.0001 | 0.7936 |
| Italy | ***<0.0001 | ***<0.0001 | ***<0.0001 | 0.5203 |
| Spain | ***<0.0001 | ***<0.0001 | ***<0.0001 | 0.8601 |
| France | ***<0.0001 | **0.0410 | ***<0.0001 | 0.8727 |
| United Kingdom | ***<0.0001 | 0.3792 | ***<0.0001 | 0.6153 |
| Belgium | ***<0.0001 | ***0.0064 | ***0.0002 | *0.0549 |
| Poland | ***<0.0001 | 0.3742 | ***<0.0001 | 0.6567 |
| Greece | ***<0.0001 | 0.1611 | 0.6110 | *0.0641 |

| | | | | |
|---|---|---|---|---|
| Sweden | ***<0.0001 | 0.2473 | ***<0.0001 | 0.9819 |
| Norway | ***<0.0001 | ***0.0069 | ***<0.0001 | 0.9195 |

Note: $P$-values that indicate a significant test result and a dominant response (smaller $p$-value) are bold. Null hypothesis: Oil returns do not Granger-cause in tails stock market returns
Source: Author's own calculations

**Table 17** P-values of Granger delayed causality in tails test.
Subsample 1: 2.01.2008-31.12.2010

| Country | Type of tails tested | | | |
|---|---|---|---|---|
| | Left→Left | Left→Right | Right→Right | Right→Left |
| Netherlands | 0.1274 | *0.0633 | 0.4254 | 0.9770 |
| Germany | ***0.0022 | ***<0.0001 | 0.6344 | 0.9374 |
| Italy | 0.2930 | ***<0.0001 | 0.9274 | 0.6729 |
| Spain | 0.6393 | ***<0.0001 | 0.5583 | 0.9684 |
| France | 0.6947 | ***0.0061 | 0.1650 | 0.7417 |
| United Kingdom | 0.4156 | 0.1155 | 0.2185 | 0.8152 |
| Belgium | 0.8480 | ***0.0012 | 0.7479 | 0.4853 |
| Poland | ***0.0002 | 0.1383 | 0.9481 | 0.8376 |
| Greece | 0.7248 | **0.0465 | 0.9062 | ***0.0064 |
| Sweden | 0.2003 | *0.0751 | 0.6478 | 0.9842 |
| Norway | 0.1090 | ***0.0027 | 0.7704 | 0.9806 |

Note: $P$-values that indicate a significant test result and a dominant response (smaller $p$-value) are bold. Null hypothesis: Oil returns do not Granger-cause in tails stock market returns
Source: Author's own calculations

**Table 18** P-values of Granger contemporaneous and delayed causality in tails test.
Subsample 2: 2.01.2011-30.06.2014

| Country | Type of tails tested | | | |
|---|---|---|---|---|
| | Left→Left | Left→Right | Right→Right | Right→Left |
| Netherlands | ***<0.0001 | 0.1945 | ***<0.0001 | ***0.0075 |
| Germany | ***<0.0001 | 0.9078 | ***<0.0001 | **0.0167 |
| Italy | ***<0.0001 | 0.2548 | ***0.0001 | 0.5159 |
| Spain | ***<0.0001 | *0.0546 | *0.0522 | 0.1857 |
| France | ***<0.0001 | 0.4774 | ***0.0001 | **0.0389 |
| United Kingdom | ***<0.0001 | 0.9109 | ***<0.0001 | ***0.0001 |
| Belgium | ***<0.0001 | 0.4354 | 0.1390 | *0.0892 |
| Poland | ***<0.0001 | 0.8050 | 0.2601 | 0.9334 |
| Greece | ***0.0083 | 0.8105 | 0.5543 | 0.1161 |
| Sweden | ***<0.0001 | 0.7381 | ***<0.0001 | 0.5135 |
| Norway | ***<0.0001 | 0.6760 | ***<0.0001 | 0.3690 |

Note: $P$-values that indicate a significant test result and a dominant response (smaller $p$-value) are bold. Null hypothesis: Oil returns do not Granger-cause in tails stock market returns
Source: Author's own calculations

**Table 19** P-values of Granger delayed causality in tails test.
Subsample 2: 2.01.2011-30.06.2014

| Country | Type of tails tested | | | |
|---|---|---|---|---|
| | Left→Left | Left→Right | Right→Right | Right→Left |
| Netherlands | 0.4431 | 0.1298 | 0.8910 | 0.7911 |
| Germany | ***<0.0001 | 0.8056 | 0.8497 | 0.9560 |
| Italy | 0.7211 | 0.1857 | 0.2099 | 0.9369 |
| Spain | 0.1127 | ***0.0062 | 0.9773 | 0.9091 |
| France | 0.7867 | 0.3417 | 0.7389 | 0.9699 |
| United Kingdom | **0.0223 | 0.8592 | 0.6081 | 0.4630 |

| | | | | |
|---|---|---|---|---|
| Belgium | **0.0425 | 0.3402 | 0.9959 | 0.6388 |
| Poland | ***<0.0001 | 0.5207 | 0.9296 | 0.9651 |
| Greece | *0.0788 | 0.9463 | 0.2845 | 0.6414 |
| Sweden | 0.4488 | 0.6153 | 0.9172 | 0.6613 |
| Norway | ***<0.0001 | 0.5051 | *0.0967 | 0.2759 |

Note: $P$-values that indicate a significant test result and a dominant response (smaller $p$-value) are bold. Null hypothesis: Oil returns do not Granger-cause in tails stock market returns
Source: Author's own calculations

**Table 20** P-values of Granger contemporaneous and delayed causality in tails test. Subsample 3: 1.07.2014-30.04.2019

| Country | Type of tails tested | | | |
|---|---|---|---|---|
| | Left→Left | Left→Right | Right→Right | Right→Left |
| Netherlands | ***<0.0001 | ***0.0001 | 0.7570 | 0.9095 |
| Germany | ***<0.0001 | *0.0522 | 0.7802 | 0.9241 |
| Italy | ***<0.0001 | *0.0996 | 0.1227 | 0.9732 |
| Spain | ***<0.0001 | ***0.0088 | 0.1412 | 0.9678 |
| France | ***<0.0001 | **0.0370 | 0.9681 | 0.8727 |
| United Kingdom | ***<0.0001 | ***0.0017 | ***0.0003 | 0.9980 |
| Belgium | ***<0.0001 | *0.0516 | 0.9815 | 0.9084 |
| Poland | ***<0.0001 | 0.5620 | 0.1703 | 0.9460 |
| Greece | ***0.0012 | 0.4598 | ***0.0001 | 0.8218 |
| Sweden | ***0.0003 | 0.2073 | 0.5499 | 0.6746 |
| Norway | ***<0.0001 | **0.0456 | ***<0.0001 | 0.9155 |

Note: $P$-values that indicate a significant test result and a dominant response (smaller $p$-value) are bold. Null hypothesis: Oil returns do not Granger-cause in tails stock market returns
Source: Author's own calculations

**Table 21** P-values of Granger delayed causality in tails test. Subsample 3: 1.07.2014-30.04.2019

| Country | Type of tails tested | | | |
|---|---|---|---|---|
| | Left→Left | Left→Right | Right→Right | Right→Left |
| Netherlands | **0.0293 | ***<0.0001 | 0.9653 | 0.8813 |
| Germany | ***<0.0001 | ***0.0043 | 0.6940 | 0.9535 |
| Italy | ***<0.0001 | ***0.0056 | 0.3891 | 0.9602 |
| Spain | ***0.0007 | ***0.0002 | *0.0777 | 0.9461 |
| France | ***0.0009 | ***0.0022 | 0.9539 | 0.7417 |
| United Kingdom | ***0.0089 | ***<0.0001 | 0.2281 | 0.9972 |
| Belgium | ***0.0002 | *0.0669 | 0.9750 | 0.8698 |
| Poland | **0.0188 | 0.2299 | 0.4886 | 0.9033 |
| Greece | *0.0842 | 0.1819 | ***0.0005 | 0.7519 |
| Sweden | 0.3940 | *0.0789 | 0.9353 | 0.6932 |
| Norway | ***<0.0001 | **0.0146 | ***0.0034 | 0.9114 |

Note: $P$-values that indicate a significant test result and a dominant response (smaller $p$-value) are bold. Null hypothesis: Oil returns do not Granger-cause in tails stock market returns
Source: Author's own calculations

## 4 Conclusions

In this paper we analyze Granger causality in tails testing results between selected European stock markets and crude oil market. The aim of our analysis is to check whether stock market participants react to extreme changes in oil price. Using daily Brent futures prices and stock indices from Belgium, France, Germany, Greece, Italy, Netherlands, Norway, Poland, Spain, Sweden and United Kingdom and Candelon and Tokpavi (2016) testing procedure we verify whether there is contemporaneous and

delayed Granger causality between occurrence of the extreme negative or positive returns on the crude oil market and main European stock markets.

Testing results show that in the analyzed period in most cases the symmetrical contemporaneous causality was dominant, i.e. extreme negative or positive returns on the oil market and stock markets occurred on the same day and had the same direction. This may be related to the investors' perception of oil and other industrial commodities prices as an indicators of the condition of the global economy. In particular, rapid oil price drops could be interpreted as a signal that market sends before economic slowdown. Results of Granger delayed causality test show that in most cases more long-lasting reaction occurred as a result to the negative news from the oil market. Our results can be used by market analysts and investors because they can help them get better forecasts and confirm the role that crude oil plays in the financial market.

## References


Arouri, M. (2011). Does Crude Oil Move Stock Markets in Europe? A Sector Investigation. *Economic Modelling*, vol. 28, pp. 1716–1725.

Arouri, M., Jouini, J., Nguyen, D. K. (2012). On the Impacts of Oil Price Fluctuations on European Equity Markets: Volatility Spillover and Hedging Effectiveness. *Energy Economics*, vol. 34, pp. 611-617.

BP (2018). *BP Statistical Review of World Energy*. Retrieved from: https://www.bp.com/content/dam/bp/business-sites/en/global/corporate/pdfs/energy-economics/statistical-review/bp-stats-review-2018-full-report.pdf.

Candelon, B., Tokpavi, S. (2016). A Nonparametric Test for Granger Causality in Distribution With Application to Financial Contagion. *Journal of Business and Economic Statistics*, vol. 34(2), pp. 240-253.

Cheung, Y. W., Ng, L. K. (1996). A Causality-in-Variance Test and its Application to Financial Market Prices. *Journal of Econometrics*, vol. 72, pp. 33-48.

Hong, Y. (2001). A Test for Volatility Spillover with Application to Exchange Rates. *Journal of Econometrics*, vol. 103, pp. 183-224.

Hong, Y., Liu, Y., Wang, S. (2009). Granger Causality in Risk and Detection of Extreme Risk Spillover between Financial Markets. *Journal of Econometrics*, vol. 150, pp. 271–287.

Park, J., Ratti, R. A. (2008). Oil Price Shocks and Stock Markets in the U.S. and 13 European Countries. *Energy Economics*, vol. 30, pp. 2587–2608.

Śmiech, S., Papież, M. (2013). Fossil Fuel Prices, Exchange Rate, Stock Market: A Dynamic Causality Analysis on the European Market. *Economics Letters*, vol. 118, pp. 199–202.

Wanat, S., Papież, M., Śmiech, S. (2015). Causality in Distribution between European Stock Markets and Commodity Prices: Using Independence Test Based on the Empirical Copula. In: Jajuga, K., Ronka-Chmielowiec, W., eds., *Financial Investments and Insurance – Global Trends and the Polish Market. Research Papers of Wrocław University of Economics*, vol. 381, pp. 439-454.

# Implementation of IAS/IFRS and Their Impact on Selected Financial Performance Indicators

**Jozef Lukáč**

University of Economics in Bratislava
Faculty of Business Economics with seat in Košice
Department of Corporate Financial Management
Tajovského 13, 04001 Košice, Slovakia
E-mail: jozef.lukac@student.euke.sk

***Abstract:*** *International harmonization is the result of the gradual alignment of the individual accounting principles within the regional representation of states with their own system and habits, while the regional (territorial) groups rank continental, South American, Anglo-Saxon and mixed among these bases. From the point of view of the Slovak Republic, together with the countries of the former Eastern Bloc and the countries of the Visegrad Group (with the exception of the Czech Republic), the Slovak Republic is one of the countries with a mixed accounting system. The European Union countries themselves use more than 25 different accounting systems. The aim of the paper is to point out the research carried out in the area of measuring the financial performance of enterprises in the transition from national accounting legislation to the system of international financial reporting standards. The objective of the paper is also to compare financial indicators in 8 financial statements before and after the adoption of IAS/IFRS.*

*Keywords: International Financial Reporting Standards, IAS, IFRS, financial performance, financial indicators*

*JEL codes: M41, L25*

## 1 Introduction

International Financial Reporting Standards are part of the accounting harmonization, which means an attempt to unify the presentation, measurement and recognition of the various types of assets, liabilities and other accounting items that an entity uses in its activities. The main objective of the long-term accounting harmonization process using International Financial Reporting Standards can be considered to be the gradual elimination of differences in the preparation of financial statements of entities in different countries of the world that form part of the financial statements. (Farkaš, 2014)

The result baselines harmonization of accounting is the process of convergence of accounting information contained in the financial statements. The aim of teamwork of international harmonization standards creators is to achieve a situation where the uniform presentation of accounting information through one accounting system will be the result of uniform accounting rules, accounting statements and accounting principles and thus the gradual creation of international accounting.

Evaluating the financial performance of businesses in the context of IAS/IFRS deal with different groups of authors. The following table gives an overview of the first significant contributions of authors in the impact of IAS/IFRS implementation on selected indicators of business performance in Europe. The most used accounting variables by which the authors analyzed the impact of IAS/IFRS implementation are equity, income and earnings per share, and largely use the regression model. The impact of IAS/IFRS implementation is positive for some researches, but negative for others.

Silva (2007), based on a cluster analysis that trades on the Lisbon Stock Exchange in 2004, accounted for POC - Portugese Accouting Standards, and since 2005 have switched to IFRS. The author creates a clustering on the basis of three indicators, namely earnings per share, net earnings per share, and gearing - the leverage rate that reflects the financing of the shareholder business over creditors. Tanko (2012) focused his research on 220 enterprises in Nigeria, using data from 2007-2010. Using regression and T-testing, he concluded that the adoption of IFRS increases the ratios of the ratios and

reduces the liquidity and income indicators. Similar research was carried out in the same year by Adzis (2012), where, using the same methods, 62 banks in 1995-2009 in Asia-Pacific analyzed the results that after the introduction of IFRS, revenues would increase, but revenue would fall, which would also affect financial indicators. On the contrary, Leuz (2013) argues that the adoption of an IFRS accounting system will not make it easier to compare financial statements because the countries themselves have a different institutional and control mechanism.

Research by Hoque et al. (2013) focuses on the effect of adopting IFRS on the capital market, namely on liquidity, cost, capital and debt. The adoption of IFRS has been shown to affect all indicators in different ways. The research concluded that the overall effect of IFRS implementation was positive, as the implementation of IFRS reduces information asymmetry, leading to improved quality of information for users and increased transparency and comparability of financial information. Finally, the study recommends that the development of an appropriate national enforcement mechanism for IFRS be considered significant, with the cooperation of international and national accounting authorities also needed. The aim of such a mechanism should be to take advantage of international accounting standards. Bahgrava et al. (2014) has developed "IFRS Impact Scorecard", which is the result card of the downside risk assessment of Indian companies' adoption of IFRS. The result card indicates the understatement or overestimation of the share price, provided that the company's financial statements are prepared under IFRS in comparison with the Indian GAAP accounting system. Based on the results, 16 of the 50 most significant companies in Nifty 50 ranked in the low risk area, 17 companies in the low risk zone and the remaining companies are in high risk zones. Research has confirmed that 88% of Nifty 50 Indian companies do not compile IFRS financial statements.

The effect of adopting IFRS on the financial performance of the company examines Kumar (2014), when his research on selected companies follows the differences in the accounting system and I IFRS GAAP (Indian Accounting Standards) financial indicators in achieving equity, liquidity, indebtedness and profitability. Munirudeen (2014) explored the adoption of IFRS on the banking sector in Nigeria. The adoption of IFRS will help national banks in particular, and these banks are expected to expand to other neighboring countries. Uniform standardization of such banks' accounts will make it easier to compare financial statements and performance with other banks operating outside Nigeria.

## 2 Methodology and Data

The methods we use in our analysis are the basis of the financial analysis method - financial ratios. We will compare the obtained values of financial indicators and point out the differences in indicators according to Slovak or Czech accounting legislation and indicators according to IAS/IFRS. The financial indicators used are: liquidity I, liquidity II, liquidity III, return on equity and return on assets.

The aim of the paper is to identify differences arising from different reporting methods based on the application of selected financial indicators. The subject of the survey are companies from the Slovak Republic and the Czech Republic, which use IAS/IFRS as part of their bookkeeping, but also prepare financial statements according to national accounting legislation. The financial statements are presented in the following table.

**Table 1** Analysis objects

| Enterprise no. | Country | The period of the financial statements |
|---|---|---|
| 1 | Slovak Republic | 2010 |
| 2 | Slovak Republic | 2011 |
| 3 | Slovak Republic | 2012 |
| 4 | Slovak Republic | 2014 |
| 5 | Slovak Republic | 2014 |
| 6 | Czech Republic | 2014 |

| | | |
|---|---|---|
| 7 | Czech Republic | 2013 |
| 8 | Czech Republic | 2015 |

Source: own processing

## 3 Results and Discussion

The indicators we will compare are the liquidity indicators of the company - standby, current and total liquidity and indicators of profitability - total capital and assets. Liquidity I., which is also referred to as prompt liquidity and through which it expresses the relationship between current financial assets and liabilities that are due within one year. As we can see the differences at the first level of liquidity, they are, but only at low values.

**Table 2** Differences in Liqudity I.

| Enterprice no. | Indicator | SUL/CUL | IFRS | Difference |
|---|---|---|---|---|
| 1 | L1 | 0,1155 | 0,1066 | 0,0089 |
| 2 | L1 | 0,3742 | 0,3648 | 0,0094 |
| 3 | L1 | 0,2314 | 0,2292 | 0,0023 |
| 4 | L1 | 14,8186 | 14,8329 | -0,0142 |
| 5 | L1 | 1,0174 | 1,0124 | 0,0050 |
| 6 | L1 | 0,0070 | 0,0300 | -0,0230 |
| 7 | L1 | 1,1780 | 1,1388 | 0,0392 |
| 8 | L1 | 0,0561 | 0,0559 | 0,0002 |

Source: own processing

Liqudity II. (current liquidity), where short-term receivables are added to current financial assets. The volume of short-term liabilities should not exceed the sum of financial assets and short-term receivables. In this area, the differences are considerably greater than with prompt liquidity.

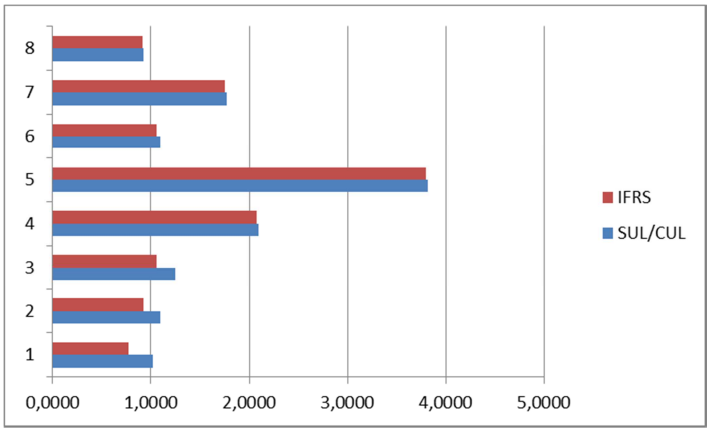
**Table 3** Differences in Liqudity II.

| Enterprice no. | Indicator | SUL/CUL | IFRS | Difference |
|---|---|---|---|---|
| 1 | L2 | 1,0185 | 0,7673 | 0,2512 |
| 2 | L2 | 1,0965 | 0,9235 | 0,1730 |
| 3 | L2 | 1,2509 | 1,0601 | 0,1908 |
| 4 | L2 | 2,0904 | 2,0712 | 0,0192 |
| 5 | L2 | 3,8132 | 3,7938 | 0,0194 |
| 6 | L2 | 1,0922 | 1,0556 | 0,0366 |
| 7 | L2 | 1,7751 | 1,7506 | 0,0246 |
| 8 | L2 | 0,9226 | 0,9189 | 0,0038 |

Source: own processing

Differences in current liquidity are also shown in the chart, where we can see the differences that arose at given values when applying international financial reporting standards and applying Slovak or Czech accounting legislation (SUL/CUL).

**Figure 1** Liqudity I.




Source: own processing

Liquidity III. (total liquidity) expresses the company's ability to settle its liabilities with short-term assets. In our case, when calculating this indicator, significant differences in total liquidity values were achieved for different accounting systems, which is reflected in the following table.

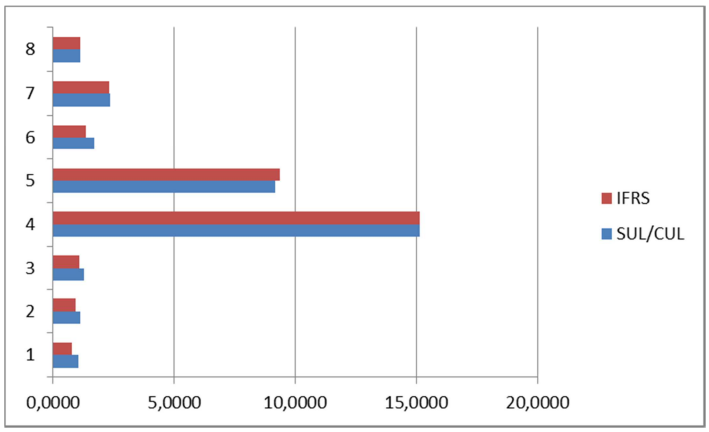
**Table 4** Differences in Liqudity III.

| Enterprice no. | Indicator | SUL/CUL | IFRS | Difference |
|---|---|---|---|---|
| 1 | L3 | 1,0582 | 0,7683 | 0,2899 |
| 2 | L3 | 1,1037 | 0,9276 | 0,1760 |
| 3 | L3 | 1,2563 | 1,0618 | 0,1945 |
| 4 | L3 | 15,1258 | 15,0999 | 0,0259 |
| 5 | L3 | 9,1451 | 9,3577 | -0,2126 |
| 6 | L3 | 1,6950 | 1,3612 | 0,3338 |
| 7 | L3 | 2,3357 | 2,3034 | 0,0323 |
| 8 | L3 | 1,1278 | 1,1136 | 0,0142 |

Source: own processing

Based on the calculations we have obtained, we graphically show how the values of the total liquidity of the companies in different accounting systems change.

**Figure 2** Liqudity II.




Source: own processing

Another group of indicators that we will analyze in this paper is devoted to a group of indicators representing profitability. These indicators are also referred to as profitability

indicators because they characterize the profitability (profitability) of an enterprise as a result of the used part of the asset.

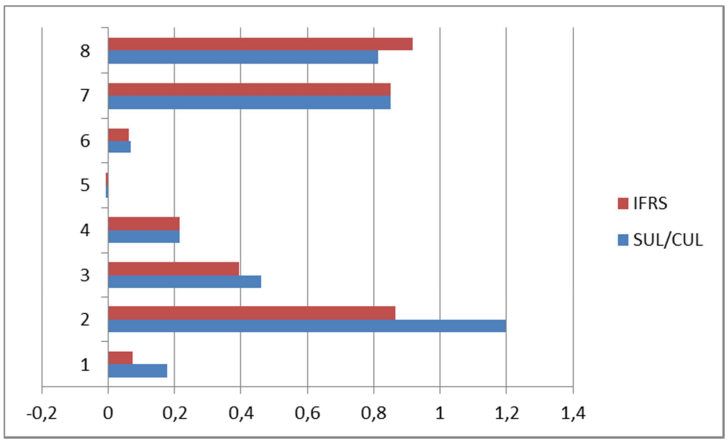
**Table 5** Differences in ROE

| Enterprice no. | Indicator | SUL/CUL | IFRS | Difference |
|---|---|---|---|---|
| 1 | ROE | 0,179024 | 0,07288 | 0,106144076 |
| 2 | ROE | 1,196195 | 0,866522 | 0,329673893 |
| 3 | ROE | 0,459637 | 0,393863 | 0,065774387 |
| 4 | ROE | 0,215694 | 0,215455 | 0,000239239 |
| 5 | ROE | -0,0064 | -0,00634 | -0,0000604 |
| 6 | ROE | 0,069303 | 0,062148 | 0,007154626 |
| 7 | ROE | 0,851488 | 0,85191 | -0,00042170 |
| 8 | ROE | 0,812833 | 0,91599 | -0,10315756 |

Source: own processing

The previous table shows the calculation of the individual indicators of return on total capital ROE, which evaluates the profitability of equity. Owners can use this indicator to find out what revenue they bring to their invested capital.

**Figure 3** ROE




Source: own processing

From the previous figure we can see how the ROE pointer values change in the figure. The smallest recorded change is less than 0.1%, but the highest change from among the analyzed enterprises is more than 32%.

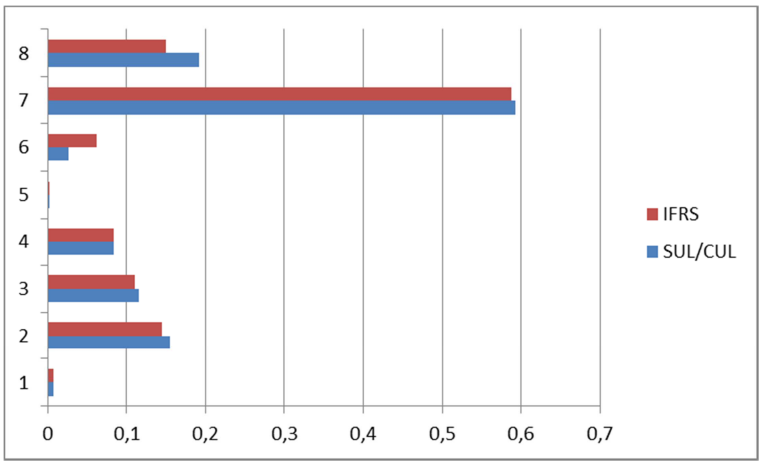
**Table 6** Differences in ROA

| Enterprice no. | Indicator | SUL/CUL | IFRS | Difference |
|---|---|---|---|---|
| 1 | ROA | 0,007422 | 0,007063 | 0,000359 |
| 2 | ROA | 0,154595 | 0,144482 | 0,010113 |
| 3 | ROA | 0,115163 | 0,109812 | 0,005351 |
| 4 | ROA | 0,083741 | 0,083623 | 0,000118 |
| 5 | ROA | 0,002286 | 0,002098 | 0,000188 |
| 6 | ROA | 0,026434 | 0,062148 | -0,03571 |
| 7 | ROA | 0,593475 | 0,587985 | 0,00549 |
| 8 | ROA | 0,191774 | 0,149353 | 0,042421 |

Source: own processing

Table 6 shows the calculations of the return on assets indicator, which aims to show the profitability of the company's total capital in the form of assets. We can also see with this indicator that different values of the ROA indicator occur. These changes are graphically depicted in the following figure.

**Figure 4** ROA




Source: own processing

We found out from the performed analysis that in the case of prompt liquidity there are differences but not significant. Larger differences are seen in current and total liquidity, where the current and total liquidity values are higher in national accounting legislation. In profitability indicators, the change in accounting system in some cases is positive and in some cases negative.

## 4 Conclusions

These financial statements represent the entity's information about the entity, the structure of the asset, the sources of coverage or cash flow. An entity records and presents the enterprise's reproductive process through financial statements, assessing and adopting measures to improve the effectiveness of its business. We can say that the financial statements of an enterprise are inherently important not only to the entity represented by the managers or owners to its assessment, but are an important tool for the external environment of the business represented by business partners, state institutions, creditors and businesses operating in the same industry.

An important question, however, is how the way in which the financial statements are presented can distort the calculations of financial indicators as they have seen in the paper.

The European Union is covering efforts to harmonize accounting with the emergence of a single market with free movement of goods, capital and persons. The reason for the development of harmonization is also to ensure, in the shortest possible time, the comparison of accounting information of businesses across countries caused by the globalization and activity of domestic enterprises beyond the domestic borders and the activities of foreign companies on the domestic market. It is precisely globalization that has given rise to the process of increasing the comparability of accounting information. (Epstein, 2010)

I did similar research in my dissertation. We then applied accounting transactions that have an impact on the change in asset and liability items to the Statement of Financial Position of the Company using the transfer bridge, which resulted in a statement prepared in accordance with IAS / IFRS. The most significant positive changes in the items of the statement were recorded for deferred tax liability (+ 60.92%), retained earnings (+ 30.85%), property, plant and equipment (+ 28.11%). On the other hand, we found negative changes in asset and liability items for inventories (-33.86%), long-term trade and other liabilities (-18.51%) and financial investments (-15.41%). In

addition, new items of investment property, current income tax, the short-term portion of the finance lease payable and finance lease payables were created. Short-term provisions have been canceled.

## Acknowledgments

This contribution is dedicated to the project "Projekt mladých vedeckých pracovníkov a doktorandov, I-19-110-00, 2019: Aspekty finančného riadenia miest a obcí na Slovensku v kontexte finančného zdravia".

## References

Bhargava, V., Shikha, D. (2014). The Impact of International Financial Reporting Standard on Financial Statements and Ratios. *The International Journal of Management*, vol. 2(2). ISSN 1468-2370.

Epstein, B., Jermakowicz, E. K. (2010). *Interpretation and Application of International Financial Reporting standards*. New Yersey: Wiley, 2010. ISBN 978-0470-45322-3.

Farkaš, R. (2014). *Nová účtovná smernica Európskej Únie*. Bratislava: Ekonómia, 2014. ISBN 978-80-8168-089-5.

Hoque, Z., Covaleski, M. A., Gooneratne, T. N. (2013). Theoretical triangulation and pluralism in research methods in organizational and accounting research. *Accounting, Auditing & Accountability Journal*, vol. 26(7), pp. 1170-1198.

Kumar, K. A. (2014). International Financial Reporting Standard (IFRS): Prospects and Challenges. *Journal of Accounting & Marketing,* vol. 3(1). ISSN: 2168-9601.

Leuz, C. (2013). A New Approach to Global Reporting Convergence. *Accounting Business Research*, vol. 40(3), pp. 229-256. ISSN 2159-4260.

Khursid, M., Swain, R. K. (2018). Earnings Management and IFRS Adoption – A Study on Selected UK and Indian Pharmaceuticals Companies. *International Journal of Research in Management, Economics and Commerce*, vol. 8(1), pp. 40-42. ISSN 2250-057X.

Silva, F. (2007). Measuring the Impact of International Financial Reporting Standards (IFRS) in Firm Reporting: The Case of Portugal. *SSRN Electronic Journal*. ISSN: 1556-5068.

Tanko, M. (2012). The Effect of International Financial Reporting Standards (IFRS) Adoption on the Performance of Firms in Nigeria. *Journal of Administrative and Economic Sciences*, vol. 5(2). ISSN 133-157.

# Impact of Brexit on Volatility Connectedness across ASX's Subindices

**Lukáš Marek**

Masaryk University
Faculty of Economics and Administration, Department of Finance
Lipová 41a, 603 00 Brno, Czech Republic
E-mail: lukas.marek@econ.muni.cz

***Abstract:*** *In this paper, we apply* (Diebold and Yilmaz, 2012) *a generalised variance autoregressive framework to measure historical FTSE All-share Index's (hereafter ASX) sector volatility connectedness with a focus on the Brexit era. The main goal of the paper is to examine if Brexit has altered British inter-market connectedness. We analyse six major ASX's sectors provided by Bloomberg, which stands for almost 50 % of ASX's market capitalisation. We use daily prices from May 2006 to the end of May 2019 obtained via Bloomberg Terminal to compute weekly volatility. Then the forecast error variance decomposition is applied to the volatility dataset. The static, as well as the dynamic measurement, is being calculated. We find that the methodology greatly captures volatility shocks, including the shocks primarily caused by Brexit issue. Based on the results, we infer, that the increased volatility connectedness is more of a temporary character than a structural nature.*

*Keywords: Brexit, connectedness, spillover, variance decomposition, VAR*

*JEL codes: G15, G17, C58*

## 1 Introduction

Brexit is the major theme in the European Union in the past years. It is an abbreviation of a British exit, which refers to Britain's exit from the European Union. Historically, it is the first attempt made by the state to quit the European Union. It all started by a referendum which was held on June 23, 2016. The results ruled in favour of leaving the EU. (Arnorsson and Zoega, 2018) evaluate the reasons for the result. However, the whole idea of Brexit was born long before the referendum. We sought for keyword "Brexit" in Bloomberg News ("N" function) and found that the word Brexit started to be used at the beginning of 2015. There is vast literature which contains Brexit's impacts on the financial market or the UK economy, let us note e.g. (Bashir et al., 2019), (Lai and Pan, 2018), (Jackson and Shepotylo, 2018) and (Shahzad et al., 2019).

In our paper, we use the in-sample analysis strictly as we are not trying to forecast or value consequences of various Brexit form. We shift our focus mainly on UK inter-market volatility connectedness and looking for the structural pattern since the Brexit was introduced.

## 2 Methodology

Connectedness measures in our paper are generally based on variance decomposition. (Diebold and Yilmaz, 2009), (Diebold and Yilmaz, 2012) and (Diebold and Yılmaz, 2014) have proposed a complex methodology which exploits the forecast error variances in order to split the impulses into parts related to the various system shocks.

The methodology is based on an *N*-variable VAR (*p*), $x_t = \sum_{i=1}^{p} \Phi_i x_{t-i} + \varepsilon_i$, where $\varepsilon \sim (0, \sum)$ is a vector of independently and identically distributed disturbances. The moving average representation is $x_t = \sum_{i=0}^{\infty} A_i \varepsilon_{t-i}$, where the $N$x$N$ coefficient matrices $A_i$ obey the recursion $A_i = \Phi_1 A_{i-1} + \Phi_2 A_{i-2} + \cdots + \Phi_p A_{i-p}$, with $A_0$ an $N$x$N$ identity matrix and $A_i = 0$ for i<0.

The major issue was that the variance decomposition scheme of (Diebold and Yilmaz, 2009) overcame the orthogonality condition with the usage of the Choleski factorization. However, then the framework highly depends on the ordering of the variables. Therefore we apply the generalised variance decomposition framework of (Koop et al., 1996) and (Pesaran and Shin, 1998), as proposed by (Diebold and Yilmaz, 2012). Since the generalised framework properly accounts for shocks correlation, it does not require orthogonal innovations.

In the paper, we examine three levels of connectedness:

- pairwise directional connectedness,
- total directional connectedness,
- total connectedness.

The pairwise directional connectedness from *j*'s to *i*'s element is measured by $H$-step-ahead generalised forecast error variance:

$$\theta_{ij}^{g}(H) = \frac{\sigma_{jj}^{-1} \sum_{h=0}^{H-1} (e_i' A_h \sum e_j)^2}{\sum_{h=0}^{H-1} (e_i' A_h \sum A_h' e_i)}, \tag{1}$$

where $\sum$ is the covariance matrix of the shock vector in the non-orthogonalized VAR, $\sigma_{jj}$ is the standard deviation of the error term for the $j^{th}$ equation (or $j^{th}$ diagonal element of $\sum$ ) and $e_j$ is a selection vector with $j^{th}$ element unity and zeros elsewhere. As the shocks to each variable are not orthogonalized in the generalised VAR framework, the raw sum of the variance shares for each variable is not necessarily equal to 1. For the total connectedness calculation, it is appropriate to normalise each entry of the variance decomposition matrix by the row sum:

$$\tilde{\theta}_{ij}^{g}(H) = \frac{\theta_{ij}^{g}(H)}{\sum_{j=1}^{N} \theta_{ij}^{g}(H)}. \tag{2}$$

To preserve (Diebold and Yılmaz, 2014) notation, the $\tilde{\theta}_{ij}^{g}(H)$ is hereafter represented by $C_{i \leftarrow j}^{H}$, where $C$ stands for connectedness.

Total directional connectedness of $i^{th}$ variable separately measures connectedness FROM and TO, as $C_{i \leftarrow j}^{H} \neq C_{j \leftarrow i}^{H}$ . Total directional connectedness FROM others to variable *i* is denoted as:

$$C_{i \leftarrow \bullet}^{H} = \frac{\sum_{\substack{j=1 \\ j \neq i}}^{N} \tilde{\theta}_{ij}^{g}(H)}{\sum_{i,j=1}^{N} \tilde{\theta}_{ij}^{g}(H)} \times 100, \tag{3}$$

where the denominator is, due to the normalisation, equal to $N$. In other words, the total FROM directional connectedness is equal to a row sum (except $i^{th}$ element) divided by $N$ variables. Total directional connectedness TO others from variable *i* is similarly (instead of a row sum, a column sum is applied) denoted as:

$$C_{\bullet \leftarrow i}^{H} = \frac{\sum_{\substack{j=1 \\ j \neq i}}^{N} \tilde{\theta}_{ji}^{g}(H)}{\sum_{i,j=1}^{N} \tilde{\theta}_{ji}^{g}(H)} \times 100. \tag{4}$$

It is useful to set net total directional connectedness, which stands for the difference between total TO directional connectedness and total FROM directional connectedness, expressed as:

$$C_{i}^{H} = C_{\bullet \leftarrow i}^{H} - C_{i \leftarrow \bullet}^{H} \tag{5}$$

We measure the total connectedness measures (often referred to in the literature as total spillover index or just spillover index) as:

$$C^H = \frac{\sum_{i,j=1}^{N} \tilde{\theta}_{ij}^{g}(H)}{\sum_{i,j=1}^{N} \tilde{\theta}_{ij}^{g}(H)} \times 100, \quad (6)$$

which represents a sum of all total FROM (or TO) directional connectedness.

**Data**

In our paper, we use daily prices of the FTSE All-share Index's (hereafter ASX) 6 major subsectors, which were obtained via Bloomberg Terminal. The sample period is from May 2006 to May 2019. The developer provides the subindices with tickers FAOILG, FABANK, FAPHRM, FAMNG, FAINVC, FASUPP, which stands for oil and gas producers' sector, banking sector, managerial sector, pharmaceuticals & biotechnology sector, equity investment instruments sector and support services sector. A mean sum of sectors' weights stands for 49,63 % of the total ASX's market capitalisation. We also obtained the number of "Brexit" keyword occurrences in the press via Bloomberg Terminal. We restricted the "Brexit" keyword sample since 2015 because earlier there were almost no keywords occurrences. All calculations were computed using R language (R Core Team, 2018), particularly the packages (Krehlik, 2018), (Ulrich, 2018) and (Qiu, 2015).

**Volatility measure**

In the literature, there are vast approaches to measure volatility. Numerous modern possible methods are captured in (Andersen et al., 2013), e.g. realized variance. Unfortunately, the Bloomberg Terminal does not offer intraday data of given subindices. Hence we follow (Demirer et al., 2018), who uses range-based realized volatility proposed by (Garman and Klass, 1980). We calculate weekly return volatility based on underlying daily data as:

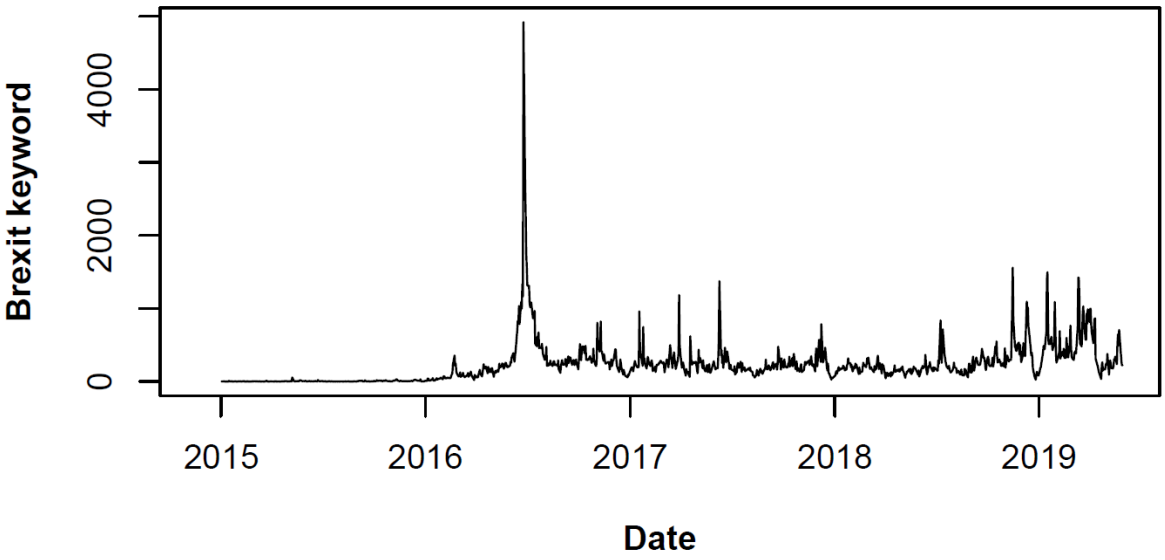
$$\tilde{\sigma}^2 = 0.511(H_t - L_t)^2 - 0.019[(C_t - O_t)(H_t + L_t - 2O_t) - 2(H_t - O_t)(L_t - O_t)] - 0.383(C_t - O_t)^2, \quad (7)$$

where $H$ is the Monday to Friday highest log price, $L$ is the Monday to Friday lowest log price, $O$ is the Monday opening log price, and $C$ is the Friday closing log price.

## 3 Results and Discussion

As an approximating model for our analysis, we use VAR(2) model, which was suggested by both Schwarz criterion and Hannan Quinn criterion. The predicted horizon for variance decompositions and connectedness measures is set to 10 weeks. We test stationarity by Augmented Dickey-Fuller Test and KPSS. Both tests are made under the different null hypothesis, but both suggest stationarity. In the next paragraphs, we analyse the influence of Brexit phenomenon on the UK's sector connectedness. In Figure 1, we show the number of "Brexit" keyword occurrences in the press since 2015.

**Figure 1** "Brexit" Keyword Press Appearances




Source: author's calculations

Firstly, we apply a static approach by calculating two volatility connectedness tables. The first, shown in Table 1, stands for the sample containing weekly volatility data from June 2010 to the end of 2014. Table 2 represents the connectedness table for the sample from the beginning of 2015 to the end of May 2019. The $ij^{th}$ value stands for the percentage of the sector *i*'s 10-day ahead forecast error variance, which is caused by shocks in the sector *j*. E.g., the 5.19 value in the second column of the third row indicates, that shocks in fabank cause only 5.19 % of the 10-day ahead forecast error variance of faphrm. The column FROM (row TO) stands for total FROM (TO) directional connectedness, the row NET for the net total directional connectedness and the bottom right bold value represents total connectedness.

By comparing Table 1 and Table 2, the second sample total connectedness has decreased. It is clear that in the first sample, the faphrm was unambiguously a significant volatility shocks net receiver, and the fainvc was a net donor. In the second period, the net total directional connectedness is evener. Net value for fainvc has notably decreased, and the fabank's net value has inverted from negative to positive values. Based on static measures proposed in Table 1 and 2, any strong pattern is not observable.

**Table 1:** Connectedness table before the Brexit started to occur in the press.

| | **faoilg** | **fabank** | **faphrm** | **famng** | **fainvc** | **fasupp** | **FROM** |
|---|---|---|---|---|---|---|---|
| faoilg | 42.25 | 10.25 | 7.80 | 11.38 | 17.13 | 11.19 | 57.75 |
| fabank | 12.92 | 41.34 | 3.78 | 12.89 | 18.18 | 10.89 | 58.66 |
| faphrm | 12.26 | 5.19 | 51.92 | 4.72 | 17.85 | 8.06 | 48.08 |
| famng | 12.49 | 14.01 | 2.56 | 42.38 | 18.03 | 10.53 | 57.62 |
| fainvc | 13.81 | 14.47 | 7.03 | 11.91 | 37.28 | 15.50 | 62.72 |
| fasupp | 12.50 | 10.85 | 5.66 | 10.37 | 21.47 | 39.15 | 60.85 |
| **TO** | 63.97 | 54.78 | 26.82 | 51.27 | 92.67 | 56.17 | **57.61** |
| NET | 6.21 | -3.88 | -21.26 | -6.35 | 29.95 | -4.68 | |

Source: Author's calculations

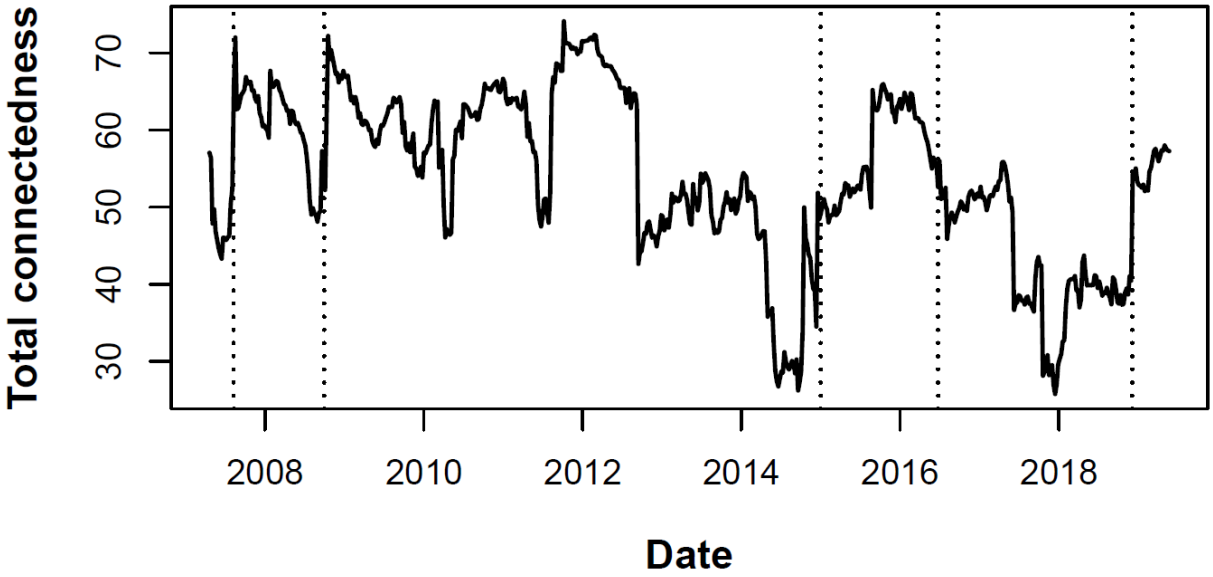
**Table 2:** Connectedness table after the Brexit started to occur in the press.

| | faoilg | fabank | faphrm | famng | fainvc | fasupp | FROM |
|---|---|---|---|---|---|---|---|
| faoilg | 48.81 | 11.19 | 5.72 | 15.23 | 10.96 | 8.09 | 51.19 |
| fabank | 11.88 | 44.67 | 4.82 | 8.88 | 14.03 | 15.72 | 55.33 |
| faphrm | 7.23 | 6.88 | 61.86 | 2.16 | 10.85 | 11.02 | 38.14 |
| famng | 15.03 | 14.99 | 2.92 | 55.18 | 7.71 | 4.17 | 44.82 |
| fainvc | 8.45 | 15.29 | 7.96 | 4.91 | 39.82 | 23.56 | 60.18 |
| fasupp | 6.82 | 18.37 | 6.37 | 2.49 | 22.46 | 43.50 | 56.50 |
| **TO** | 49.40 | 66.72 | 27.79 | 33.68 | 66.01 | 62.56 | **51.03** |
| NET | -1.80 | 11.39 | -10.35 | -11.15 | 5.84 | 6.06 | |

Source: Author's calculations

To capture the dynamics of the ASX's sector connectedness, we apply 30 weeks rolling window measures. The full sample total connectedness dynamics is presented in Figure 2. The first dotted vertical line from the left represents October 9, 2007, when BNP Paribas froze a couple of their hedge funds. It was one of the first signals of the forthcoming crisis. The second vertical line captures the stock market crash as the U.S. House of Representatives rejected a bailout. We show these events only to demonstrate the power of connectedness measurement based on the generalised variance decomposition framework. The third dotted vertical line marks the beginning of 2015 since the keyword "Brexit" has started to occur in the press. The fourth dotted line is on the date when the "Brexit" peaks in the press. Based on the slice between the third and fourth dotted line, it is clear, that the Brexit has a direct impact on total volatility connectedness across ASX's sectors. Moreover, the tail of the figure starts to grow as the tail of the "Brexit" keyword press occurrence, see Figure 1, starts to grow during the most recent Brexit crisis significantly. The fifth dotted line captures the beginning of December, 2018, when the parliamentary vote on approving the European Union Withdrawal Agreement and Political Declaration was postponed. Note that Brexit did not cause structural total connectedness increase as we had expected.

**Figure 2** Full Sample Dynamic Total Connectedness

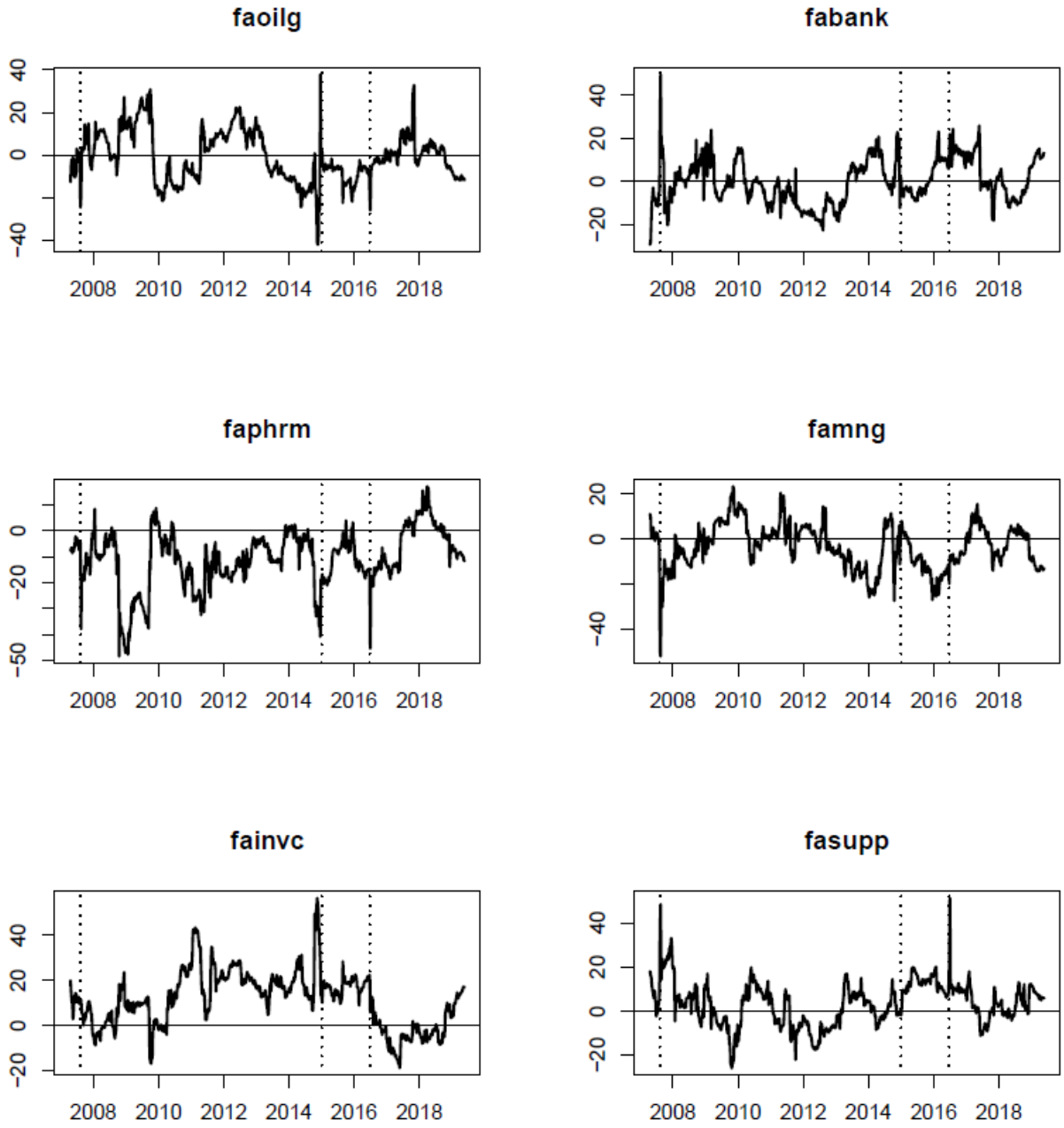



Source: Author's calculations

To preview more details, we present the net total directional connectedness for each examined sector. In Figure 3, we can see the net total directional connectedness reacts to the Brexit phenomenon across all sectors. However, it is rather a temporary state than the structural increase. Furthermore, we can infer that the fainvc is historically a major volatility shock donor, and faphrm is a major receiver. That is in line with our previous

static connectedness calculations. Note, that the fasupp has turned from net receiver to net donor during the sample period. The Brexit might have played an important role, as Brexit may highly influence the support services sector. It is worth mentioning that, unlike other sectors', fabank's and fainvc's net total directional connectedness significantly rose recently. It might be in line with the shifts of the financial centres presented in (Lai and Pan, 2018).

**Figure 3** Net Total Directional Connectedness for Each Sector




Source: Author's calculations

## 4 Conclusions

In this paper, we used the generalised variance decomposition framework to measure different levels of connectedness among ASX's subindices. We found the evidence of increased total connectedness in early 2015, which lasts until early 2017. Recently, the total connectedness has started to increase again, as the Brexit is approaching the verdict. By the net total directional connectedness dynamic measurement, we discovered the pure volatility shocks donors and receivers. We also noted that the net total

directional connectedness of the two financial sectors – fabank and fainvc – is dynamically increasing in the past months.

## Acknowledgements

The support of the Masaryk University internal grant MUNI/A/1102/2018 is gratefully acknowledged.

## References

Andersen, T. G., Bollerslev, T., Christoffersen, P. F., Diebold, F. X. (2013). Financial Risk Measurement for Financial Risk Management. *Handbook of the Economics of Finance*, vol. 2, pp. 1127-1220.

Arnorsson, A., Zoega, G. (2018). On the causes of Brexit. *European Journal of Political Economy*, vol. 55, pp. 301-323.

Bashir, U., Zebende, G., Yu, Y., Hussain, M., Ali, A., Abbas, G. (2019). Differential market reactions to pre and post Brexit referendum. *Physica A: Statistical Mechanics and its Applications*, vol. 515, pp. 151-158.

Demirer, M., Diebold, F. X., Liu, L., Yilmaz, K. (2018). Estimating global bank network connectedness. *Journal of Applied Econometrics*, vol. 33(1), pp. 1-15.

Diebold, F. X., Yilmaz, K. (2009). Measuring Financial Asset Return and Volatility Spillovers, with Application to Global Equity Markets. *The Economic Journal*, vol. 119(534), pp. 158-171.

Diebold, F. X., Yilmaz, K. (2010). Better to Give than to Receive: Predictive Directional Measurement of Volatility Spillovers. *Koç University-TUSIAD Economic Research Forum Working Papers*.

Diebold, F. X., Yilmaz, K. (2012). Better to give than to receive: Predictive directional measurement of volatility spillovers. *International Journal of Forecasting*, vol. 28(1), pp. 57-66.

Diebold, F. X., Yılmaz, K. (2014). On the network topology of variance decompositions: Measuring the connectedness of financial firms. *Journal of Econometrics*, vol. 182(1), pp. 119-134.

Garman, M. B., Klass, M. J. (1980). On the Estimation of Security Price Volatilities from Historical Data. *The Journal of Business*, vol. 53(1), p. 67.

Jackson, K., Shepotylo, O. (2018). Post-Brexit trade survival: Looking beyond the European Union. *Economic Modelling*, vol. 73, pp. 317-328.

Koop, G., Pesaran, M., Potter, S. M. (1996). Impulse response analysis in nonlinear multivariate models. *Journal of Econometrics*, vol. 74(1), pp. 119-147.

Krehlik, T. (2018). frequencyConnectedness: Spectral Decomposition of Connectedness. R package version 0.2.1.

Lai, K. P., Pan, F. (2018). Brexit and shifting geographies of financial centres in Asia. *Geoforum*.

Pesaran, H., Shin, Y. (1998). Generalized impulse response analysis in linear multivariate models. *Economics Letters*, vol. 58(1), pp. 17-29.

Qiu, D. (2015). aTSA: Alternative Time Series Analysis. R package version 3.1.2. https://CRAN.R-project.org/package=aTSA.

R Core Team (2018). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL: https://www.R-project.org/.

Shahzad, K., Rubbaniy, G., Lensvelt, M., Bhatti, T. (2019). UK's stock market reaction to Brexit process: A tale of two halves. *Economic Modelling*, vol. 80, pp. 275-283.

Ulrich, M. J., Ryan, A. J. (2018). quantmod: Quantitative Financial Modelling Framework. R package version 0.4-13. URL: https://CRAN.R-project.org/package=quantmod.

Yilmaz, K. (2009). Return and Volatility Spillovers among the East Asian Equity Markets. *Koç University-TUSIAD Economic Research Forum Working Papers*.

# An Empirical Analysis of the Impact of R&D on Productivity in EU Countries

**[1]O. Mykolenko , [2]S. Strapchuk, [3]O. Kozyrieva**

[1]National University of Pharmacy,
Faculty of Pharmaceutical Technology and Management,
Department of Management and Administration
Pushkinska Str. 53, 61000, Kharkiv, Ukraine
E-mail: mykolenkohelen@gmail.com

[2]National University of Pharmacy,
Faculty of Pharmaceutical Technology and Management,
Department of Management and Administration
Pushkinska Str. 53, 61000, Kharkiv, Ukraine
E-mail: baysvetlana@gmail.com

[3]National University of Pharmacy,
Faculty of Pharmaceutical Technology and Management,
Department of Management and Administration
Pushkinska Str. 53, 61000, Kharkiv, Ukraine
E-mail: yakakos74@gmail.com

***Abstract**: The research investigates the question whether research and development expenditures contribute to productivity growth and depend on the particular countries' capacity and industries' technological level. The paper deals with the analysis of the impact of R&D on the companies' productivity on the industry level in EU countries based on panel data and the stochastic frontier production function approach. We estimate the production function separately for six different sectors and one industry. The results indicate that distribution of production and other relevant factors, such as physical capital per employee, labour force with tertiary education, ICT goods exports etc., vary significantly across industries, reflecting different absorption and diffusion capability of economies and their potential to structural changes. The findings have the practical value for strategic development of Ukrainian economy in the course of integration into EU market, and suggest the design of R&D policy based on the experience of EU countries, structure of the national industries, their technological level and future perspectives.*

*Keywords: R&D; productivity, technological level*

*JEL classification codes: O32; O39*

## 1 Introduction

There is widespread understanding that innovation is a trigger for economic growth, especially in the long run (Fagerberg et al., 2010; Mairesse and Mohnen, 2010). However, the conceptual and empirical links between innovation and growth on different levels are complex. Innovation is not a linear process, and there is no direct impact of investments in innovation on economic development. Moreover, metrics for the analysis suffer from limitations. This makes it difficult to establish new perspectives on future policy on innovation development, and research and development (R&D) spending Thus, strengthening innovation is a fundamental challenge for European countries in their quest for greater prosperity and better lives, including Ukraine with its developing market.

According to the Global Innovation Index Ukraine has ranked highest in the last seven years ($43_{th}$), having improved position mostly due to high coefficient of innovation efficiency – knowledge and technology outputs (GII, 2018). The strengths of the country are knowledge creation, results of scientific research, ratio of patents by origin to GDP, ratio of useful utility models by origin to GDP, computer software spending (% GDP), ICT services export in percent of total trade (GII, 2018). Nevertheless, Ukrainian economy has a weak basis for innovatory technology-based development. The number of enterprises that carried out research into innovation in 2017 decresed by 9 % compared

to 2016. Investments in intangible assets during the last fifteen years have not exceeded 4% of capital investments, and the share of high-tech and medium-tech production amounted to 11.3% of all manufacturing sector (SIA, 2018). In addition, according to statistics, R&D expenditures have not reached 0.5 % of GDP in 2018 that is not comparable with data of EU countries and their targets (SIA, 2018). After EU countries didn't reach 3 % of R&D expenditure in GDP by 2010, the renewed 3 % goal was set as one of the main five targets of the Europe 2020 strategy adopted in 2010 (Liik, 2014). Thus, the strategic development of Ukraine should be based on balanced R&D policy that absorbs best practices and experience of developed EU countries in innovation and R&D activities on different levels.

Thus, the aim of the paper is to analyse the contribution of research and development to the efficiency (productivity) of industries with various technological levels in EU countries. In order to perform the analysis stochastic frontier production function approach was employed. There are plenty of scientific researches that deal with the stochastic frontier analysis as the basis for measuring technical efficiency (Aigner et al., 1977; Coelli et al., 2005; Belotti et al., 2013; Liik, 2014). Aditionally, stophastic frontier analisys allows to estimate a much wider range of time-varying inefficiency based on the inefficiency effects model of Battese and Coelli (1995) and the 'true' fixed and random-effects models developed by Greene (2005). We conduct our analysis in order to investigate whether production efficiency are influenced by various factors of production (physical capital, R&D capital) on the one hand, and the various factors external to the enterprises in order to identify the perspectives on R&D policy in Ukraine. The industry-level data are from OECD STAN (indicators of labour, capital, etc.) and ANBERD (R&D expenditures) databases for 21 EU countries for the period of 2009–2016. In addition, the variables for various external factors are derived from the World Development Indicators database.

Desining the policy goals on R&D one needs to consider the industrial specialization of the economy and the respective technological levels of industries in sectors. For instance, Kumbhakar et al. (2012) linked R&D to higher effeciency primarily in high-tech industries and not in low-tech industries based on data collected from the biggest European R&D performers. Therefore, the targets for R&D expenditures have to be differentiated with regard to the technological level of particular industry. The other research suggests that EU firms are more likely to achieve productivity gains through capital-embodied technological change at least in medium and low-tech sectors (Castellani, 2016). And Ortega-Argilés et al. (2014) point to a lower capacity of European companies to transform R&D investment into productivity gains due to a sort of modern Solow's (1987) paradox. They conclude that there might be an effect due to both level and productivity impact of R&D spending within European firms, irrespective of their sectoral belonging. Since there is a variety of research results, we will focus on sectoral differences in technological capacity of absorbtion and diffusion.

## 2 Methodology and Data

The study is based on industry-level (by International Standard Industrial Classification of All Economic Activities (ISIC) Rev. 4) data from 21 EU countries, over 8-year period from 2009 to 2016, forming an unbalanced panel. Two datasets were combined, OECD STAN (for measures of output, labour input, and capital) and OECD ANBERD (for research and development expenditures). We have used the OECD data as it includes most of the EU countries. The study also includes data from countries like the USA, Japan, and South Korea. Additionally, in order to construct the efficiency frontier we utilized data from countries with the highest levels of productivity in the respective industries.

### Model Specification

Based on econometric theory pre-specified functional form is estimated and inefficiency is modeled as an additional stochastic term. The Stochastic frontier production function model (single Cobb-Douglas form for panel data) is as follows (Coelli et al., 2005):

$$\ln Y_{it} = \beta_0 + \beta_1 \times \ln K_{it} + \beta_2 \times \ln R\&D_{it} + \delta_i \ln z_{ti} + t + v_{it} - u_i \,, \quad (1)$$

where:

$Y_{it}$ – value added per employee;

$K_{it}$ – physical capital per employee;

$R\&D_{it}$ – R&D capital per employee;

$t$ – time trend; .

$z_{ti}$ – efficiency covariates (external factors); .

$v_{it}$ – random variables of i-th unit in year t reflecting effect of statistical noise;

$u_i$ – non-negative time-invariant random variables capturing time-invariant technical inefficiency.

Table 1 presents the description of individual variables.

**Table 1**. Descriptive statistics

| Variable | Description | No. of obser | Mean | SD | Min | Max |
|---|---|---|---|---|---|---|
| **LF** | Labour force with tertiary education (% of total) | 4163 | 29.5 | 6.2 | 15.3 | 41.5 |
| **ICTEx** | ICT goods exports (% of total goods exports) | 4200 | 6.58 | 4.06 | 1.07 | 26 |
| **ICTIm** | ICT goods imports (% total goods imports) | 4200 | 7.8 | 2.73 | 2.75 | 15.69 |
| **Y** | Y = VA/ NEM* | 4200 | 217977 | 590873 | 1533 | 11841500 |
| **K** | Physical capital* / NEM | 4163 | 68622 | 232165 | 110 | 3630000 |
| **R&D** | $R\&D_{capital}$* / NEM | 3453 | 2384 | 6825 | 0.006 | 86348 |

Source: authors' calculations based on ANBERD, OECD STAN, World Development Indicators database

* the currency is euro

The following variables from the Table 1 are used in our model:

- NEM – number of employees;
- GFCF – gross fixed capital formation at current prices; .
- VA – value added at current prices;
- $R\&D_{exp}$ – R&D expenses (at current prices).

According to widely used perpetual inventory method (Hall, Mairesse et al., 2010) $R\&D_{exp}$ and investments into physical capital must be capitalized in order to provide R&D and physical capital stock variables. R&D capital in time period *t* is calculated as follows:

$$R\&D_{capital_t} = R\&D_{capital_{t-1}}(1-\delta) + R\&D_{\exp_t} \,, \quad (2)$$

where $\delta$ is the depreciation rate.

We base our analysis on the following depreciation rates for R&D capital (Kumbhakar et al., 2012): high-tech – 20%; medium-tech – 15%; low-tech – 12%. The depreciation rates for physical capital equal 8%, 6%, and 4% respectively. Different depreciation rates are explained by relevant technological level of the corresponding sector and its life cycle.

In order to produce adequate efficiency estimation a common production frontier is a necessary condition (Koop, 2001). Thus, considered sectors should share a common frontier. To utilize these samples, sectors are grouped into manufacturing (high-tech 21, 26-28, 72; medium-tech 05-25, 29-33, 58-63,69-75, 84-88; and low-tech 15–37); services (45-47,49-53,55-56,58-66,68-75,77-82,84-88,90-99), primary (01–03). A pharmaceutical industry (21) was derived due to its strategic importance for Ukrainian economy. Manufacturing is divided by technological level according to ISIC Rev. 4. Therefore, we estimate the production function separately for six different sectors and one high-tech industry. Also we concern the possible problem of multicollinerity between two types of capital that needs to be reduced. Per capita specification is one of the remedial measures to overcome this problem.

Fixed and random effect models are used for different sectors (test results in Table 2). Since our models don't include time-invariant covariates heterogeneity is not reflected in the fixed-effects SFA model.

## 3 Results

Table 2 presents the results of seven different models: six of them are fitted across sectors, including whole sample, and one is estimated for a pharmaceutical industry. All models are based on Equation (1). The estimates are derived from multiple tests of a number of options, including combinations of external factors (LF, ICTEx, ICTIm). We consider both fixed- and random effect models (the choice is based on the random-effects test).

One industry (21) as a part of the high-tech sector is represented separetly, firstly, to show the differences between sector- and industry-based productivity, secondly, to shed the light on a strategic perspective on innovation development of Ukrainian economy. As a result, mean efficiency of high-tech sector as a whole differs from pharmaceutical industry. Thus, averaging the values over sectors may create significant differeces and result in models' inaccuracy due to indistinguishable heterogeneity.

Table 2 also shows that outlined external factors being significant in sector-based models, are non-significant in the whole sample model. For instance, tertiary education appares to have the capacity for developing new technologies, when the innovation becomes the basis of development (Acemoglu et al., 2006). The factor has a positive influence on productivity in high and medium-tech manufacturing, as well as in services. It has even higher elasticity than R&D capital respectively, in both high and medium-tech sectors. In pharmaceutical industry, the impact of educated labour on productivity is even more stronger than in all other sectors, which points to heterogeneity within sectors. The specified factor are generally under government control, so policy-makers are not restricted in stimulating labour market. The other variables that we consider are ICT goods exports and ICT import. In contrast to ICT goods exports (% of total exports), imports has a positive impact on production efficiency. This could be diffusion effect (spread of technology). However, it is significant only in case of services. In medium-tech manufacturing it has a lowest effect among all factors within this sector.

In addition, production input estimates are also significant, and some general conclusions can be made. Physical capital appares to be statistically significant in all sectors. In manufacturing sectors, the effect of physical capital depends on a technological level of sector. It decreases with a rising technological level. In all sectors, physical capital has a significant influence, being the highest in the primary sector However; the differences in the impact of the variable between sectors' are not so visible. In turn, R&D capital shows the opposite trend. It increases with a rising technological level. And the differences between values are much more visible (0.12 versus 0.05). R&D capital also looks more elastic than the other capital. The R&D effect increases if a particular industry moves closer to the efficiency frontier (Acemoglu et al., 2006). Exactly in that case the innovation becomes an important source of development, while for the industries located out of the efficiency frontier the effect may be lower.

A time trend of technological change is also present mostly due to the high-tech sector and its progress, however, it has a weak effect on effeciency in all industries. Only primary sector shows no progress in technological level on a year-by-year basis. However, built on our analisys the primary sector is the one with time-varying decreasing inefficiency. Therefore, the primary sector is moving closer to the efficiency frontier.

The results are generally in accordance with other studies of a similar type (Kumbhakar et al., 2012; Hall et al., 2010). However, this study is based on stochastic frontier production function approach that includes inefficiency analisys across sectors, but not countries.

The study is not without limitations that are mostly connected with the outlined factors. For instance, R&D capital as a part of innovation process is not a comprehensive variable, but it is easily available. As a result, we base our investigation on the assumption that technological level relates to R&D intensity, which is not always the case. There may be indistinguishable heterogeneity across industry. And the last but not the least, additional efficiency covariates (external factors) should be considered. For instance, Jaumotte and Pain (2005) show that the availability of scientists and engineers, industry-academia knowledge exchange and others would increase the R&D activities of entreprises.

**Table 2.** Models' parameters for different sectors

| Variable | Whole sample | High-tech | Pharmaceutical industry | Medium-tech | Low-tech | Primary sector | Services |
|---|---|---|---|---|---|---|---|
| **lnK** | 0.248*** | 0.189*** | 0.718*** | 0.311*** | 0.526*** | 0.823*** | 0.496*** |
| **lnR&D** | 0.101** | 0.121** | 0.242*** | 0.111** | 0.056*** | - | 0.038* |
| **Time** | 0.004*** | 0.018*** | - | 0.078*** | 0.013*** | - | 0.043*** |
| **lnLF** | - | 0.181** | 0.426** | 0.214** | - | - | 0.143** |
| **lnICTEx** | - | - | - | - | - | - | - |
| **lnICTIm** | - | - | - | 0.058* | - | - | 0.112* |
| **constant** | -91.12*** | -37.89*** | 1.14* | -103.28*** | -148.15*** | 9.41** | -94.56*** |
| **RE test** | $F(4.321)=24.3$ | $F(4,349)=3.89$ | - | $F(6.318)=0.98$ | $F(3.428)=9.12$ | $F(4.412)=1.46$ | $F(2.389)=0.85$ |
| **p-value** | 0.0000 | 0.0563 | - | 0.3258 | 0.0008 | 0.4112 | 0.0000 |
| **Hetero-skedasticity** | $\chi^2(8) = 139.55$ | $\chi^2(1) = 18.94$ | - | $\chi^2(6) = 76.93$ | $\chi^2(3) = 64.45$ | $\chi^2(3) = 8.75$ | $\chi^2(3) = 108.4$ |
| **p-value** | .0000 | .0004 | .0000 | .0000 | .0031 | .3698 | .0058 |
| **Mean effeciency** | 0.19 | 0.42 | 0.71 | 0.39 | 0.39 | 0.56 | 0.35 |

Source: authors' calculations

## 4 Conclusions

The analysis contributes to the literature by the developing the ideas of Kumbhakar et al. (2012) with industry-level data on a wider set of countries. Based on the previous literature and the analysis the importance of R&D is highlighted. It is concluded that the growth of R&D capital prominently contributes to enhancing effect more in high-tech industries, such as pharmaceutical and ICT. Both industries are of strategic importance to Ukrainian economy. Therefore, R&D investments in the development of these industries will contribute to the increased level of value added according to our results. And the experience of EU countries proves our assumption.

A contribution to economic productivity may also result from technological progress embodied in physical capital. We identified that physical capital is the only one variable that positively influences productivity in all industries. Investment in more advanced machinery or in new computers are beneficial for any industry. According to our analysis, it has a strong effect on pharmaceutical and primary sector. What is more important is that primary sector includes agriculture that also will benefit in Ukraine from investing in a new technology and machinery after the land market becomes opened for sale.

We also contribute by investigating how the link between production efficiency and R&D is influenced by various external factors like ICT good exports or imports (% of total).

## References


Acemoglu, D., Aghion, P., Zilibotti, F. (2006). Distance to frontier, selection, and economic growth. *Journal of European Economic Association*, vol. 4, pp. 37-74.

Aigner, D. J., Lovell, C. A. K., Schmidt, P. (1977). Formulation and estimation of stochastic frontier production function models. *Journal of Econometrics*, vol. 6, pp. 21-37.

Battese, G. E., Coelli, T. J. (1995). A model for technical inefficiency effects in a stochastic frontier production function for panel data. *Empirical Economics*, vol. 20, pp. 325–332.

Castellani, D., Piva, M., Schubert, T., Vivarelli, M. (2016). The Productivity Impact of R&D Investment: A Comparison between the EU and the US. *Discussion Paper,* No. 9937, 27 p.

Coelli, T. J., Rao, D. S. P., O'Donnell, C. J., Battese, G. E. (2005). *An introduction to efficiency and productivity analysis* (2nd ed.). New York: Springer, pp. 209-310.

Fagerberg, J., Srholec, M., Verspagen, B. (2010). Innovation and economic development. In: B. H. Hall and N. Rosenberg (Eds.), *Handbook of the economics of innovation*. Amsterdam: Elsevier, pp. 833-873.

GII (2018). *The Global Innovation Index 2018: Energizing the World with Innovation*. Retrieved from: https://www.wipo.int/edocs/pubdocs/en/wipo_pub_gii_2018.pdf.

Greene, W. (2005). Reconsidering heterogeneity in panel data estimators of the stochastic frontier model. *Journal of Econometrics*, vol. 126, pp. 269-303.

Hall, B. H., Mairesse, J., Mohnen, P. (2010). Measuring the returns to R&D. In: B. H. Hall and N. Rosenberg (Eds.), *Handbook of the economics of innovation*. Amsterdam: Elsevier, pp. 1033-1082.

Jaumotte, F., Pain, N. (2005). From ideas to development: The determinants of R&D and patenting. *OECD Economics Department Working Papers*, No. 44, 59 p.

SIA (2018). *Scientific and innovation activity of Ukraine 2017*. Retrieved from: http://www.ukrstat.gov.ua/.

Koop, G. (2001). Cross-sectoral patterns of efficiency and technical change in manufacturing. *International Economic Review*, vol. 42(1), pp. 73-103.

Kumbhakar, S. C., Ortega-Argilés, R., Potters, L., Vivarelli, M., Voigt, P. (2012). Corporate R&D and firm efficiency: Evidence from Europe's top R&D investors. *Journal of Productivity Analysis*, vol. 37, pp. 125-140.

Mairesse, J., Mohnen, P. (2010). Using innovation surveys for econometric analysis. In: B. H. Hall and N. Rosenberg. (Eds.), *Handbook of the economics of innovation*. Amsterdam: Elsevier, pp. 1130–1155.

Liik, M., Masso, J., Ukrainski, K. (2014). The contribution of R&D to production efficiency in OECD countries: econometric analysis of industry-level panel data. *Baltic Journal of Economics*, vol. 14(1-2), pp. 78-100.

Ortega-Argilés, R., Piva, M., and Vivarelli, M. (2014), The Transatlantic Productivity Gap: Is R&D the Main Culprit? *Canadian Journal of Economics*, vol. 47, pp. 1342-1371.

# Milestones in the Development of the Modern Insurance Market in the Czech Republic

**Svatopluk Nečas[1], Eva Vávrová[2]**

[1] Masaryk University
Faculty of Economics and Administration, Department of Finance
Lipová 41a, 602 00 Brno, Czech Republic
E-mail: necas@econ.muni.cz

[2] Masaryk University
Faculty of Economics and Administration, Department of Finance
Lipová 41a, 602 00 Brno, Czech Republic
E-mail: eva.vavrova@econ.muni.cz

***Abstract:*** *The main goal of the paper is to define the fundamental milestones of the modern insurance market in the Czech Republic. The article will deeply analyze the transformation of the insurance market in the Czech Republic, launched in 1991. The accession of the Czech Republic to the European Union will not be forgotten either. These milestones will be supported by selected indicators specifically used to describe the insurance industry that can be used to document the event and learn more about it. The methods of description, analysis and comparison will be used in the paper. Regarding results, the number of commercial insurance companies stabilized over the time at around fifty, with the largest insurer's share now reaching just over 20%, as measured by premiums written. The impact of the Czech Republic's accession to the EU is also traced in the paper. We can distinguish domestic insurance companies and branches of insurance companies from the EU and third countries. There is a significant increase in the number of branches after the Czech Republic's accession to the EU; in the first years after entry it roughly doubles, after ten years from entry it rises roughly three times compared to the number of branches before entry.*

*Keywords: insurance market, commercial insurance company, market structure, market leader, demonopolization, transformation*

*JEL codes: G22*

## 1 Introduction

The insurance market plays an irreplaceable role in the functioning of every economy. It can absorb the consequences of negative events and contribute to the stabilization of the country's economy. However, the insurance industry does not have the same meaning and identity in all economies. Significant differences can be seen in the position of the insurance industry within a centrally planned economy and a market economy. Changing the system logically also entails a change in the approach to insurance, which is not always easy given the importance of this sector. A new economic environment, however, brings a unique experience of the transformation and thus encourages a deeper analysis, but it needs to be done after a sufficient period. The Czech insurance market has met this condition as more than a quarter of a century has passed since its transformation brought about by the transition from a centrally planned to a market economy.

The main goal of the paper is to define the fundamental milestones of the modern insurance market in the Czech Republic. The article will analyze the transformation of the insurance market in the Czech Republic, launched in 1991. The accession of the Czech Republic to the European Union will not be forgotten either.

A monopoly of one insurance company (the State Insurance Company) was typical of the insurance industry in the former Czechoslovakia after 1948, and this situation lasted until 1969. In the year 1969, this entity was divided into the Czech State Insurance Company and the Slovak State Insurance Company, and these monopolies were active in the respective territories (Čejková and Nečas, 2006, p. 22-23). The Act which abolished the

monopoly position of Česká státní pojišťovna (later Česká pojišťovna, a.s.) was Act of the Czech National Council No. 185/1991 Coll., on insurance. Its main task was to define the basic rules for private insurance business in the Czech Republic and thereby remove the state monopoly in this area of business. It set out the general principles of operating the insurance business: a business license based on an approved application, the definition of legal forms of insurance companies, rules for controlling their business, and the creation of a state supervision body in the insurance sector, which was the Ministry of Finance of the Czech Republic. An insurance company could be established as a state-owned enterprise, joint-stock company, cooperative, or cooperative enterprise. The protective period of one year after the Act came into force was an interesting thing; during that time foreign subjects could only participate in assets, equity or registered capital up to 45%. For the Slovak Republic, the role of demonopolization was fulfilled by Act of Slovak National Council No. 24/1991 Coll., on insurance. However, the conditions set were not entirely identical to the Czech legislation. It is worth mentioning, for example, that only entities established as a state-owned company, a joint-stock company or an insurance syndicate could do business in the Slovak Republic. Also, the restrictions on the business of subjects from abroad were set in a different way. The share of foreign shareholders in an insurance company founded as a joint stock company by Czech/Slovak legal entities or individuals was not allowed to exceed 25% of the registered capital. However, this article will not pursue further developments within the Slovak Republic as they are beyond its scope.

Another major public regulation in the insurance sector was Act No. 277/2009 Coll., on insurance. Přikryl and Čechová (2009, p. 46) mentioned that "since 1991 this new act has been already the third insurance act in-line governing activities of home insurance and reinsurance undertakings as well as insurance and reinsurance undertakings from another Member State and from a third country. A considerable part of Act No. 277/2009 Coll. represents transposition of the EU insurance and reinsurance Directives, in particular Directive 2005/68/EC on reinsurance. Thus in the new insurance act there are provisions including conditions for granting authorisation to pursue life and non-life reinsurance, requirements as to registered capital and guarantee fund, provisions on relocated and transferred activities of the insurance and reinsurance undertakings, provisions on special purpose reinsurance vehicles and finite reinsurance, provisions containing requirements as to system of governance to cover all activities of insurance and reinsurance undertakings including outsourcing, equalisation provision." The new insurance act is complemented by Act No. 278/2009 Coll. including amendments to several other acts that had to be made due to the adoption of the new insurance act, for example Act on Insurance Contract No. 37/2004 Coll., Act for Determination of the Income Tax Base No. 593/1992 Coll., Act No. 38/2004 Coll., on Insurance Intermediaries and Independent Loss Adjusters and the MTPL Act No. 168/1999 Coll., as amended, etc. (Přikryl and Čechová, 2009, p. 46). This act had two follow-up decrees, namely Decree No. 433/2009 Coll., on reporting of insurance and reinsurance companies, and Decree No. 434/2009 Coll., implementing certain provisions of the Insurance Act.

Act No. 277/2009 Coll. has undergone many amendments, most notably Act No. 304/2016 Coll., implementing the Solvency II regulatory framework into Czech law. Following this step, three implementing regulations were issued, namely Decree No. 305/2016 Coll., on reporting by insurance undertakings and reinsurance undertakings to the Czech National Bank, Decree No. 306/2016 Coll., implementing certain provisions of the Insurance Act, and Decree No. 307/2016 Coll., on applications under the Insurance Act.

## 2 Methodology and Data

The methods of description, analysis and comparison will be used in the paper. The analysis will be supported by selected indicators specifically used to describe the insurance industry that help to document the event. The data sources for the analyses made are the annual reports of the Czech Insurance Association and the data of the Czech National Bank, before all.

## 3 Results and Discussion

Although the development of the insurance market itself is primarily determined by legislation, this is not always the case. Some fundamental changes result from the activity of market players themselves, who operate within the boundaries defined by law. Others will be caused by "force majeure", effects of which the insurance industry already has to work with, or external influences on the insurance market. The following text defines the milestones of the Czech insurance market which mostly fall into the above categories. This will further analyze the aforementioned transformation of the insurance market, launched in 1991. The accession of the Czech Republic to the European Union in the year 2004 will not be omitted either. The above-mentioned milestones will be supported by selected indicators that can be used to document the event or get to know it more deeply. To a certain extent, the results achieved can be confronted with the publications that the insurance market development have previously dealt with. These include e.g. Čejková (2002).

**Launching the insurance market transformation**

Although fundamental social changes began in the former Czechoslovakia at the end of 1989, the insurance sector did not change until 1991, namely by the above-mentioned Act of the Czech National Council No. 185/1991 Coll., on insurance (or Act of Slovak National Council No. 24/1991 Coll. in the Slovak part of the former Czechoslovak Republic). As a result of demonopolization, new players could emerge, thus creating a competitive environment. Two indicators of the insurance market level, namely the number of commercial insurers and the concentration of the insurance market, can well serve to substantiate this development. The number of commercial insurance companies can be assessed by origin, capital or the insurance branch. In this chapter, however, we will limit ourselves to the total number of entities on the market. The mentioned categorization will be only used in the chapter devoted to the Czech Republic's accession to the EU. There are basically two ways to define the insurance market concentration indicator. The first one addresses the market share of a number of entities. Typically, it is the market leader or the first five or ten insurance companies. The second, more sophisticated approach is based on the Herfindahl-Hirschman index (for details see Ducháčková et al., 2009). However, this article will only take into account the first approach, namely the share of the largest insurance company.

After the demonopolization of the insurance market, Česká pojišťovna's original 100% market share started to decline rapidly, which was associated with the entry of new entities in the market. This process is illustrated by Tables 1 and 2, which show the share of the largest insurer and the number of entities in the insurance market from the beginning of the market transformation in 1991 until 2017.

**Table 1** Share of the market leader on the Czech insurance market (1991–2017, in %)

| | **1991** | **1992** | **1993** | **1994** | **1995** | **1996** | **1997** | **1998** | **1999** |
|---|---|---|---|---|---|---|---|---|---|
| **Share of the market leader** | N.A. | 94,45 | 87,15 | 76,15 | 69,64 | 64,44 | 59,94 | 59,01 | 52,43 |
| **Year** | **2000** | **2001** | **2002** | **2003** | **2004** | **2005** | **2006** | **2007** | **2008** |
| **Share of the market leader** | 38,12 | 38,12 | 36,60 | 35,75 | 36,39 | 35,46 | 32,80 | 30,17 | 28,88 |
| **Year** | **2009** | **2010** | **2011** | **2012** | **2013** | **2014** | **2015** | **2016** | **2017** |
| **Share of the market leader** | 26,36 | 24,62 | 26,67 | 26,24 | 25,23 | 23,81 | 23,03 | 22,46 | 21,94 |

Source: authors' own processing based on Czech Insurance Association (1996, 1997, 1998, 1999, 2000, 2001, 2005, 2007, 2009, 2011, 2017, 2018)

Two methodological notes need to be made on the data in Table 1. Market share data are always provided according to the latest available sources. It is common practice that the subsequent annual reports and similar documents, which include time series, specify the data in the coming years. The second remark concerns the change in the methodology for reporting premiums written by the Czech Insurance Association since 2011. The change in methodology is based on the following: "Figures do not include cross-border business via branches or under FOS unless otherwise provided. Single premiums in life insurance are recalculated on the basis of 10 years (only one tenth of premiums written is included). The recalculation also applies to sums. Total premiums in non-life insurance are reduced by premiums ceded to other CIA members. Contractual premiums do not include ex-lege workers' compensation (Czech Insurance Association, 2015, p. 62)." This, of course, was reflected in the value of the total premiums written, which decreased by several tens of billions of CZK due to the new methodological approach. Given that the changes in methodology did not have the same effect on all insurance companies, there were also some changes in market shares, which is also reflected in the share of the largest insurance company. However, this does not change the trend visible within the time series. Moreover, in 2019 for the first time in the modern history of the Czech insurance market, most likely a change in the market leader position will occur. Most probably, it will be the Kooperativa pojišťovna, a.s., due to the merger with Pojišťovna České spořitelny, which has for many years belonged to the same financial group, Vienna Insurance Group.

Table 2 shows the development of the number of commercial insurance companies in the Czech insurance market. The data shows a steep increase in the first years of market transformation, which stopped in 1997. From this year until the Czech Republic's accession to the EU in 2004, only minimal changes in this indicator could be observed. The other chapter of the article will discuss the consequences of joining the EU.

**Table 2** Number of insurance companies operating on the Czech insurance market (1991–2017)

| | **1991** | **1992** | **1993** | **1994** | **1995** | **1996** | **1997** | **1998** | **1999** |
|---|---|---|---|---|---|---|---|---|---|
| **Number of insurance companies** | 3 | 12 | 20 | 27 | 35 | 35 | 40 | 41 | 42 |
| **Year** | **2000** | **2001** | **2002** | **2003** | **2004** | **2005** | **2006** | **2007** | **2008** |
| **Number of insurance companies** | 41 | 43 | 42 | 42 | 40 | 45 | 49 | 52 | 53 |
| **Year** | **2009** | **2010** | **2011** | **2012** | **2013** | **2014** | **2015** | **2016** | **2017** |
| **Number of insurance companies** | 53 | 53 | 54 | 53 | 52 | 53 | 55 | 54 | 50 |

Source: authors' own processing based on Czech Insurance Association (2001, 2018)

**The Czech Republic's accession to the European Union**

An essential moment in the history of the Czech insurance market was the accession of the Czech Republic to the European Union, which took place on 1 May 2004. Since that date, the Czech insurance market has become part of the Single EU Insurance Market and has therefore started to operate under the so-called single license which allows the insurance undertaking to carry on insurance business in another EU Member State on the basis of an authorization granted in its country of residence, under the right to establish branches or under the freedom to provide services on a temporary basis (see Act No. 39/2004 Coll., an amendment to the Insurance Act).

These two options for an insurance company activity in another EU country will be addressed in the following text. Let's start from Table 2, which discussed the number of commercial insurance companies in the Czech insurance market, and try to focus on the

origins of commercial insurance companies. We can distinguish domestic insurance companies and branches of insurance companies from the EU and third countries. While the above-mentioned single license advantage applies only to branches of insurance companies from the EU, branches of third-country insurance companies need permission from the supervisory authority to operate on the Czech insurance market. However, available data do not allow differentiation. Even so, the impact of the Czech Republic's accession to the EU can be largely traced. In Table 3, which presents the development of the number of domestic insurance companies and branches of insurance companies in the years 2000 to 2017, there is a significant increase in the number of branches after the Czech Republic's accession to the EU; in the first years after entry it roughly doubles, after ten years from entry it rises roughly three times compared to the number of branches before entry.

**Table 3** Number of domestic insurers and branches of insurers from the EU and third countries on the Czech insurance market (2000–2017)

| | **2000** | **2001** | **2002** | **2003** | **2004** | **2005** | **2006** | **2007** | **2008** |
|---|---|---|---|---|---|---|---|---|---|
| **Domestic insurers** | 35 | 35 | 35 | 34 | 33 | 33 | 33 | 34 | 35 |
| **Insurers from the EU/third countries** | 6 | 8 | 7 | 8 | 7 | 12 | 16 | 18 | 18 |
| | **2009** | **2010** | **2011** | **2012** | **2013** | **2014** | **2015** | **2016** | **2017** |
| **Domestic insurers** | 36 | 36 | 36 | 35 | 34 | 33 | 32 | 30 | 28 |
| **Insurers from the EU/third countries** | 17 | 17 | 18 | 18 | 18 | 20 | 23 | 24 | 22 |

Source: authors' own processing based on Czech Insurance Association (2018)

Another possibility of operating insurance in another EU Member State is provided by the freedom to temporarily provide services. Table 4 shows that this form of activity has been of great interest to foreign insurance companies since the beginning, and the number of such reported entities almost tripled between 2005 and 2018 – it is close to 1,000. At the same time, it should be noted that this form of insurance business usually generates only relatively low insurance premiums and is therefore not essential in the European market. This is evidenced by the Insurance Europe data, as only a few countries record data associated with the freedom to provide services, i.e., FOS. Usually this is annual premiums written of hundreds of millions EUR, the only exception being the insurance market in Italy, which in this way generates about 10% of its total premiums written (Insurance Europe, 2019).

**Table 4** Number of foreign insurance companies and branches of foreign insurance companies providing cross-border services on the Czech insurance market (2005–2018)

| | **2005** | **2006** | **2007** | **2008** | **2009** | **2010** | **2011** |
|---|---|---|---|---|---|---|---|
| **Number of companies** | 328 | 401 | 478 | 554 | 621 | 665 | 695 |
| | **2012** | **2013** | **2014** | **2015** | **2016** | **2017** | **2018** |
| **Number of companies** | 714 | 743 | 789 | 824 | 864 | 890 | 965 |

Source: authors' own processing based on Czech National Bank (2003-2019), Czech Insurance Association (2006, 2007, 2008, 2009)

## 4 Conclusions

The Czech insurance market has gone a long way in more than 25 years since its transformation. In the process, it has been transformed into a standard economic industry with a competitive environment. When the transformation began in 1991, new entities started to emerge. Their number stabilized over the time at around fifty, with the largest insurer's share now reaching just over 20%, as measured by premiums written. In 2004, the Czech insurance market became an integral part of the Single European Insurance Market and got integrated into international structures. That's why the impact of the Czech Republic's accession to the EU was traced in the paper. Domestic insurance companies and branches of insurance companies from the EU and third countries are distinguished. There is a significant increase in the number of branches after the Czech Republic's accession to the EU; in the first years after entry it roughly doubles, after ten years from entry it rises roughly three times compared to the number of branches before entry. Another possibility of operating insurance in another EU Member State is provided by the freedom to temporarily provide services. The number of such reported entities almost tripled between 2005 and 2018 – it is close to 1,000.

This was also related to the need to harmonize the Czech legal environment with European Union regulations. In addition to joining the EU, this need was most evident in the areas of MTPL insurance, insurance and reinsurance brokerage/distribution and in particular the Solvency II regulatory framework. However, the changes in the insurance market have not only been triggered by the need to harmonize the regulatory environment, although they might be related.

## References


Act of Czech National Council No. 185/1991 Coll., on insurance. Retrieved from: ASPI.

Act of Slovak National Council No. 24/1991 Coll., on insurance. Retrieved from: ASPI.

Act No. 39/2004 Coll., on insurance. Retrieved from: ASPI.

Act No. 277/2009 Coll., on insurance. Retrieved from: ASPI.

Act No. 304/2016 Coll., amending Act No. 277/2009 Coll., on insurance, as amended, and other related acts. Retrieved from: ASPI.

Czech Insurance Association (1996). *Annual Report 1995*.

Czech Insurance Association (1997). *Annual Report 1996*.

Czech Insurance Association (1998). *Annual Report 1997*.

Czech Insurance Association (1999). *Annual Report 1998*.

Czech Insurance Association (2000). *Annual Report 1999*. Retrieved from: http://www.cap.cz/images/aj-web/Annual-reports/Annual_Report_1999_EN.pdf.

Czech Insurance Association (2001). *Annual Report 2000*. Retrieved from: http://www.cap.cz/images/aj-web/Annual-reports/Annual_Report_2000_EN.pdf.

Czech Insurance Association (2005). *Annual Report 2004*. Retrieved from: http://www.cap.cz/images/aj-web/Annual-reports/Annual_Report_2004_EN.pdf.

Czech Insurance Association (2006). *Annual Report 2005*. Retrieved from: http://www.cap.cz/images/aj-web/Annual-reports/Annual_Report_2005_EN.pdf.

Czech Insurance Association (2007). *Annual Report 2006*. Retrieved from: http://www.cap.cz/images/aj-web/Annual-reports/Annual_Report_2006_EN.pdf.

Czech Insurance Association (2008). *Annual Report 2007*. Retrieved from: http://www.cap.cz/images/aj-web/Annual-reports/Annual_Report_2007_EN.pdf.

Czech Insurance Association (2009). *Annual Report 2008*. Retrieved from: http://www.cap.cz/images/aj-web/Annual-reports/Annual_Report_2008_EN.pdf.

Czech Insurance Association (2011). *Annual Report 2010*. Retrieved from: http://www.cap.cz/images/aj-web/Annual-reports/Annual_Report_2010_EN.pdf.

Czech Insurance Association (2015). *Annual Report 2014*. Retrieved from: http://www.cap.cz/images/o-nas/vyrocni-zpravy/2014.pdf.

Czech Insurance Association (2017). *Annual Report 2016*. Retrieved from: http://www.cap.cz/images/o-nas/vyrocni-zpravy/2016.pdf.

Czech Insurance Association (2018). *Annual Report 2017*. Retrieved from: http://www.cap.cz/images/o-nas/vyrocni-zpravy/2017_vyrocni.pdf.

Czech National Bank (2003-2019). *Lists and registers published by the Czech National Bank*. Retrieved from: http://www.cnb.cz/en/supervision_financial_market/lists_registers/index.html.

Čejková, V. (2002). *Pojistný trh.* 1st ed. Prague: GRADA Publishing.

Čejková, V., Nečas, S. (2006). *Pojišťovnictví*. 2nd, recast, ed. Brno: ESF MU.

Decree No. 433/2009 Coll., on reporting of insurance and reinsurance companies. Retrieved from: ASPI.

Decree No. 434/2009 Sb., implementing certain provisions of the Insurance Act. Retrieved from: ASPI.

Decree No. 305/2016 Coll., on reporting by insurance undertakings and reinsurance undertakings to the Czech National Bank. Retrieved from: ASPI.

Decree No. 306/2016 Coll., implementing certain provisions of the Insurance Act. Retrieved from: ASPI.

Decree No. 307/2016 Coll., on applications under the Insurance Act. Retrieved from: ASPI.

Ducháčková, E., Lejková, Z., Kafková, A., Majtánová, A., Meheš, M., Szkarlat, A., Vološinová, D. (2009). *Vývoj poistného trhu krajín Vyšehradskej štvorky v období 1995-2007.* 1st ed. Bratislava: Vydavateľstvo Ekonóm.

Insurance Europe (2019). *Total Insurance*. Retrieved from: https://insuranceeurope.eu/insurancedata.

Přikryl, V., Čechová, J. (2009). Některé změny, které přinesl zákon o pojišťovnictví, a zákon o změně zákonů v souvislosti s přijetím zákona o pojišťovnictví. *Pojistné rozpravy*, No. 25. Czech Insurance Association, pp. 32-46.

# Transaction Costs in the Czech and Slovak E-procurement: Selected Issues

**Juraj Nemec[1], Matúš Grega[2], Marta Orviská[3], Markéta Šumpíková[4]**

[1] Masaryk University
Faculty of Economics and Administration, Department of Public Economics
Lipová 41a, 60200 Brno, Czech Republic
E-mail: 29310@econ.muni.cz

[2] Matej Bel University
Faculty of Economics, Department of Finance and Accounting
Tajovského 10, 97411 Banská Bystrica, Slovakia
E-mail: matus.grega@umb.sk

[3] Matej Bel University
Faculty of Economics, Department of Finance and Accounting
Tajovského 10, 97411 Banská Bystrica, Slovakia
E-mail: marta.orviska@umb.sk

[4] The College of Regional Development and Banking Institute - AMBIS, a. s.
Department of Economics and Management
Lindnerova 575/1, 18000 Prague, Czech Republic
E-mail: marketa.sumpikova@ambis.cz

***Abstract:*** *Experts and public procurement offices state that e-procurement increases the competition in public procurement and thank to this saves an important sum of public money. However, the real picture is not so simple. First, their calculations use the difference between estimated and final price to calculate savings, which is very problematic indicator. Second, there is the issue of transaction costs – and some studies suggest that transaction costs can be higher than above indicated formal savings. The goal of this paper was to calculate selected types of transaction costs of e-solutions in the public procurement in the Czech Republic and in the Slovak Republic. The first part of the analysis presented the estimates of the transaction costs of the Slovak e-market system, which is functional from 2012 and its current software available from 2014. The second part of the analysis presented similar calculations for the Czech national e-procurement tool – NEN. The calculated data have important methodological limitations and should not be used to say in definite way that e-procurement is very effective, or – opposite – too costly. However these data seem to suggest that electronisation of procurement has important potential, especially in situations when new electronic solutions are implemented for reasonable costs (no corruption) and serve to large number of purchasing operation (economies of scale).*

*Keywords: public procurement, electronisation, transaction costs, Czech Republic, Slovakia*

*JEL codes: H57, D24*

## 1 Introduction

Experts and public procurement offices almost everywhere state that competition in public procurement saves an important sum of public money. If e-procurement is used, the outcomes from competition are even more positive: according to our calculations, the electronic marketplace in Slovakia achieved savings roughly about 18 % of the total estimated value of the contracts (Table 1).

However, the real picture is not so simple. First, to use the difference between estimated and final price to calculate savings is very problematic indicator, as discussed in many works, for example Pavel (2013). Second, there is the issue of transaction costs – and some studies suggest that transaction costs can be higher than above indicated formal savings.

The issue of **competitiveness** is probably the most frequently investigated aspect of procurement in the academic environment. One of most frequently cited studies is Gupta (2002). He found that the best results can be achieved with 6 to 8 bidders, after this point the number of bidders does not impact the price (analysing highway constructions in Florida in 1981–1986 with sample of 1937 tenders). Gupta also speaks about competitive and collusive procurement markets (higher number of bids serves as possible prevention of collusive cartels).

**Table 1** E-market in Slovakia as of 30. 9. 2017

| Indicator | Value |
|---|---|
| Procurements started between 1. 10. 2014 and 1. 10. 2017 | 93 431 |
| Procurements finished between 1. 10. 2014 and 1. 10. 2017 | 77 911 |
| Cases only with one bidder | 17 756 |
| Average number of bids | 3,54 |
| Value of finished procurements | 786 202 190 € |
| Savings (absolute) | 140 730 192 € |
| Savings (%) | 17,90 % |

Source: own calculations, based on e-market data

Brannman et al. (1987) analysed areas of sale of wood, oil areas and obligations and confirmed the impact of competition on the final result. Kuhlman and Johnson (1983) analysed highway constructions in USA in the period 1975-1980 and also confirmed the positive impact of competition on the final price. The authors also found that if the estimated price is not published, the probability of better final price increases.

For developing countries Iimi (2006) analysed data from 26 developing countries from the period 1999-2005. He confirmed that competition decreased the final price up to eight bids (after this point the effect disappears).

Gineitiene and Šerpytis (2011) analysed the situation in Latvia and their results are also similar (standardised good), but more positive from the point of the level of impact of competition on the final price (for some commodities they found that extra bidder can decrease the price for more than 10%).

Ilke et al. (2012) analysed the situation in Turkey 2004-2006 with data from 90 089 tenders. According to their results, every extra bidder "decreases" the price by 3.9%. Large financial volume tenders attract more bidders, the participation of foreign companies increases the effect of competition (however, the average number of bids for the sample was 3.09).

In our conditions there exist more studies on the impact of competitiveness on the final price. Soudek and Skuhrovec (2013) analysed electric energy and gas supply area (where comparisons with real market price are simple, as both are homogeneous commodities – stoke exchange prices serve as „solid bottom-line benchmark"). Their findings were very interesting – for example they found that the expected price in tender documentation is normally over-estimated (to show savings? or to be safe?). The core conclusion from their study is that the core factor determining price was the selection method (open tenders delivered 7% price decrease compared to other forms) and that every extra bidder "decreased" the price in case of electric energy by 1 % (the impact of number of bidders for gas was insignificant). E-auctions decreased the price by extra 6%. The average number of bidders was four for electricity and 3.3 for gas.

Pavel (2010) analysed the area of road and railway infrastructure. According to his results every extra bidders "decreased" the price by 3.27% (because of low average number of bidders, he was not able to define up to which point) and that the use of restricted tender increases the price by 11.56%.

Sičáková-Beblavá et al. (2013) analysed 725 procurement actions in 32 organisations during 2008-2010. Also this study confirms positive effects connected with the use of e-auctions and of competition (first extra offer decreases the price by 4% and additional

extra offer by 84% of previous change – similarly to Pavel, they did not find "break point", behind which the price does not decrease anymore).

The theory of **transaction costs** is connected with Coase (1937, 1960) and later on with works of Williamson (1985) or Brown and Potoski (2003). The level of transactions costs has direct impact on final results of public procurement (and also on decision to contract/outsource - „make or buy" decision).

Pavel (2007) tried to define main types of transaction cost connected with the public procurement (**Table 22**).

**Table 22:** Transaction costs in public procurement

| Sector/Time | Ex-ante | On-going | Ex-post |
|---|---|---|---|
| **Public sector** | Preparing tender documentation<br>Administering tender preparation<br>Fees to involved external experts<br>Legal expertise costs | Administration of running tender | Re-start of cancelled procedure<br>Costs connected with contract amendments<br>Costs of cancellation or delay<br>Costs connected to control/remedy procedures<br>Legal costs |
| **Private sector** | Preparing bid<br>Costs to fulfil qualification criteria<br>Guarantees | Communication with tenderer | Costs connected with contract amendments<br>Costs connected with delays and cancellation<br>Legal costs |

Source: authors, based on Pavel (2007)

The calculation of transaction costs in public procurement were delivered for example by Strand et al. (2011). In our conditions for example by Pavel (2013), Švejda (2010), Nemec et al. (2016), Grega and Nemec (2015). Švejda estimated that in the Slovak conditions the transaction costs vary between 0.25-5.6 percent of the contract value. Pavel (2013) estimates for the Czech Republic that median transaction costs 0.4% of contract value per each participant. By adding the probability of success he argues that for one wined contract the firm may have transactions costs on the level of 4.6% of the contract value.

According to Plaček et al. (2017) the core factors determining the level of transaction costs in public procurement are the quality of legislative and regulatory framework, the type and method of procurement, expected volume, management experience especially on procurer´s side, post-award behaviour of participants and attitudes of participants.

Many authors argue that electronising procurement serves as perfect tool to decrease transaction costs. Sičáková-Beblavá et al. (2011) even argue that e-tendering decreases transaction cost, increases transparency and improves results. The following text shows our calculations in the Slovak and Czech conditions.

## 2 Methodology and Data

The goal of this paper is to calculate selected types of transaction costs of e-solutions in the public procurement in the Czech Republic and in the Slovak Republic. The first part of the analysis presents the estimates of the transaction costs of the Slovak e-market system, which is functional from 2012 and its current software available from 2014. The second part of the analysis present similar calculations for the Czech national e-procurement tool – NEN.

The main method used is the processing of existing (secondary) data about the Slovak and Czech e-procurement solutions available from different public sources. The core

methodological problem of this paper is the calculation of savings from e-market in Slovakia. The difference between estimated and final price is used, which may not be the real efficiency indicator (see above). Another methodological problem is the fact that we are able to calculate only direct costs, full costs should be significantly higher.

## 3 Results and Discussion

### Selected transaction cost of the Slovak e-market

In this part we calculate two types of transaction costs of the Slovak e-market. The first calculations estimate the direct costs of a supplier to participate; the second part estimates yearly costs of the system.

The relatively high transaction **costs to participate** for the supplier are connected with excessive bureaucracy connected with the participation. The elementary requirements are as follows (2017):

1. Registration in the e-market (by post or by e-signature)
2. Registration in the list of economic subjects of the Office for Public Procurement.
3. Registration in the list of partners of the public sector of the Ministry of Justice (compulsory for all bidders in tenders with value over 100 000 EUR for one tender, or 250 000 EUR of total value of yearly participation).

We estimated the time and complexity of requirements needed for all three registrations (with the use of information from interviews) and the estimated costs for the registration at e-market are close to zero. The costs to register in the list of economic subjects are 87,90 EUR (as of today, central state registers are not interconnected, and all required certificates must be submitted for this registration in paper form – like penalty registry, business registry certificates) and this part of the process requires 2-4 weeks' time. Very expensive is the registration in the list of partners of the public sector (recent anticorruption measure of the Slovak government, with the aim to prevent participation of firm with unknown owners in procurement) – as minimum 500 EUR. All above means that the direct costs of a supplier to participate are as minimum 600 EUR. With 6500 registered suppliers, direct "participation costs" are app. 3.9 mil. EUR.

**Table 3:** The overview of the Ministry of Interior costs to run the e-market (estimate for 36 months from the start of the use of the current e-solution to 30. 9. 2017, only direct costs)

| Item | EUR without VAT |
|---|---|
| **Lump sum to create the system** | 3 514 201 € |
| **Lump sum to administer the system** | 5 994 036 € |
| **Fixed fee paid for finished procurements** | 2 676 366 € |
| **Fixed fee paid for cancelled procurements** | 226 314 € |
| **Volume fee paid for finished procurements** | 846 490 € |
| **Volume fee paid for cancelled procurements** | 552 130 € |
| **Total** | **13 809 538 €** |
| **Average monthly costs** | 383 598 € |
| **Average costs per tender** | 177,25 € |
| **Average % of value of the tender** | 1,76 % |

Source: own calculations

The yearly **costs to run the e-market system** are covered by the Ministry of Interior. Table 3 provides the overview of this form of transaction costs (official data used as inputs only). If we recalculate monthly direct costs of running e-market for four years, the sum of this type of transaction costs is app. 18.4 mil. EUR.

The sums calculated above (direct participation cost 3.9 mil. EUR and direct system costs 18.4 mil. EUR) with the estimated savings, the final picture seems to be very positive.

However, the reality may be a bit different – the savings are over-estimated and the transaction costs underestimated, because we were able to calculate only selected direct transaction costs. With this, the real level of efficiency of the Slovak e-market depends especially on the real level of savings (according to the existing studies, public bodies prefer to over-estimate the final price, to be sure that savings will be achieved, see for example Pavel (2007).

**Selected transaction cost of the NEN**

The MMR accepted NEN and transferred it to its ownership on 31 March 2014. Two phases of pilot testing were completed by the end of 2014. Between April and August 2014, the MMR, the Ministry of Labour and Social Affairs, and the Ministry of Agriculture participated in closed pilot testing. Altogether, more than 150 public contractors participated in the subsequent open pilot testing. However, public contractors were not able to test all of the NEN functionalities throughout the open pilot testing period, because the functionalities were made accessible in a sequence. Testing of NEN had been underway until August 2015, when NEN was officially launched as fully operational. NEN is a crucial module of the national e-procurement infrastructure (NIPEZ) and a fully autonomous information system that offers complex functionalities for public procurement that can be used by all types of contractors. The e-market is only one from more functions of NEN. From its start NEN realised 45 111 procurements.

The core problem of NEN is the fact that in terms of economy NEN is an expensive solution (see also Supreme Audit Office findings – NKÚ, 2016). For our estimates, the total direct costs of NEN include:

1. Costs to prepare and implement the system (NEN development costs).
2. Costs to run and maintain the system at a central level (NEN operation and maintenance costs).

Both types of costs are specified below. At the end we provide some comparisons of the costs of NEN and previous individual solutions used by Czech public administration bodies.

According to the MMR, the **costs of developing NEN** were app. 6.1 million EUR. However, this is only the sum invoiced within one specific tender. In reality the total costs to acquire the system were much higher - from existing data (list of tenders connected with NEN) we estimate that these costs were app. 18 mil. EUR. Because the NEN was not perfectly developed, extra investments to make it fully functional were necessary – our estimate from existing information about extra tenders suggest that the costs to finalise NEN were app. 10 mil. EUR. In total the "construction" costs of NEN should be app. 28 mil. EUR. According to expert opinions, this sum is rather beyond the standard level of expenditures for such a system.

The calculation of the main set of **direct operating and maintenance costs** of NEN is based on the data from the contract on the operation of NEN that was concluded between the MMR and the current operator. All sums are lump sum payments and do not depend on the number of users and frequency of usage. According to these data, the yearly direct costs to run the system on its central level are about 1.6 million EUR and do not depend on volume. This would be app. three times less compared to the Slovak e-market solution (such high difference would need more investigations, not possible for this paper).

The NEN direct operating transaction costs per tender are much higher compared to the Slovak situation (Table 4). The explanation is rather simple – too small volume of realised tenders by NEN. In such situation NEN opponents claim that the total NEN operating costs are much higher than the total costs paid by users of all previously existing individual solutions (IENs) used by public bodies. Such a statement is rather difficult to prove or disprove, especially because the total (direct) costs of contractors using IENs are not known (also due to a lack of statistical data on actual IENs usage) and we can only roughly estimate them.

**Table 4:** NEN costs

| Item | EUR without VAT |
|---|---|
| **Lump sum to create and finalise NEN** | 28 000 000 € |
| **Average monthly direct operating costs** | 133 333 € |
| **Average costs per tender** | 744,89 € |

Source: own calculations

The Table 5 provides estimates of IENs based on official data from the central level and from our findings (the data validity may be debatable):

**Table 5** Costs for IEN solutions for selected central bodies

| Ministry | Purchasing costs EUR | Operating costs EUR | | |
|---|---|---|---|---|
| | | 2012 | 2013 | 2014 |
| **Transport** | 81 537 | 0 | 0 | 0 |
| **Finance** | 15 406 | 4277 | 8 788 | 12 770 |
| **Culture** | 0 | 807 | 9 680 | 8 560 |
| **Labour and Social Affairs** | 0 | 0 | 37 | 37 |
| **MMR** | 8 639 | 18 935 | 20 655 | 10 502 |
| **Industry and Trade** | 0 | 8 889 | 10 600 | 11 652 |
| **Justice** | 0 | 5 333 | 5 378 | 5 378 |
| **Education** | 15 338 | 3 037 | 3 037 | 2 667 |
| **Interior** | 44 178 (estimate) | 8 533 | 8 533 | 8 551 |
| **Agriculture** | 16 133 | 4 033 | 0 | 0 |
| **Environment** | 1 120 | 0 | 0 | 7 667 |

Source: MMR (2015)

The Table 5 includes only a very small sample from all of the purchasing authorities in the Czech Republic, but it documents the situation somehow. In the Table 6 we tried to calculate the breakeven point for NEN with the assumption that the yearly NEN costs are 7 million EUR (and we worked with different estimates of average costs for IENs). The sum of 7 million EUR yearly (only direct costs) is derived from the previous tables and includes costs to develop NEN, costs to update NEN, and operational costs. The sum of costs to develop and update NEN is divided by five (five years of planned NEN operation under the current contract). A breakeven point is reached when NEN costs paid by the state equal the total costs of IENs paid by individual purchasers.

Concerning IENs, we decided to use the following minimum and maximum average levels of individual IEN costs per year to be able to calculate the breakeven point (IEN purchasing costs are also divided by five, as for NEN):

1. Minimum average IEN costs: 2,000 EUR purchase costs (10:5) per year and 1,000 EUR operational costs;
2. Maximum average IEN costs: 4,000 EUR purchase costs per year (20:5) and 4,000 EUR operational costs.

The Table 6 shows that if the average yearly costs to use IENs in the Czech Republic are 8,000 EUR, NEN can be cost effective if there are fewer than 1000 users. It also shows that if the average IEN costs are about 3,000 EUR, NEN can be cost effective when it has approximately 2,500 users. These calculations may favour NEN, but they do not include many related direct and indirect costs, calculations are also based on the full and perfect functionality of NEN and zero transfer costs from IENs to NEN. These calculations also explain, why the Ministry of Regional Development, responsible for NEN, has done as much as possible to make the use of NEN compulsory, with the aim to reach necessary minimum number of registered bodies and operations.

**Table 6** Estimates of breakeven points for NEN

| Scenario | NEN total yearly costs (EUR) | IEN individual yearly costs (EUR) | Number of purchasers using NEN to achieve breakpoint |
|---|---|---|---|
| **Minimum average IEN costs** | 7 000 000 | 3 000 | 2 333 |
| **Maximum average IEN costs** | 7 000 000 | 8 000 | 875 |

Source: own calculations

## 4 Conclusions

The goal of this paper was to calculate selected types of transaction costs of e-solutions in the public procurement in the Czech Republic and in the Slovak Republic. The authors are fully aware that calculations are not perfect and they can be used only as demonstrative figures to document that transaction costs play important role in determining the final efficiency of the use of e-solutions in public procurement. Our data cannot be used to say in definite way that e-procurement is very effective, or – opposite – too costly, however these data seem to suggest that electronisation of procurement has important potential, especially in situations when new electronic solutions are implemented for reasonable costs (no corruption) and serve to large number of purchasing operation (economies of scale).

## Acknowledgments

The preparation of this paper was supported by the Slovak Grant Agency APVV, project APVV-17-0360 (Multidimenzionálna analýza signifikantných determinantov efektívnosti verejného obstarávania s dôrazom na aplikáciu Health Technology Assessment v procese prípravy obstarávania) and by the Czech Grant Agency, project No. 19-06020S.

## References

Brannman, L., Klein, J. D., Weiss, L. W. (1987). The Price E□ects of Increased Competition in Auction Markets. *The Review of Economics and Statistics* vol. 69(1), pp. 24–32.

Brown, T. L., Potoski, M. (2003). Transaction Costs and Institutional Explanations for Government Service Production Decisions. *Journal of Public Administration Research and Theory,* vol. 13(4), pp. 441–468.

Coase, R. H. (1937). The Nature of the Firm: USA. *Economica,* vol. 4(16), pp. 386–405.

Coase, R. H. (1960). The Problem of Social Cost*. Journal of Law and Economics,* vol. 3(October), pp. 1–44.

Gineitiene, Z., Šerpytis, K. (2011). The Impact of Competition and Purchase Volume on the Price in Public Procurement Tenders. *Socialinin mokslu studijos,* vol. 3(2), pp. 473–485.

Grega, M., Nemec, J. (2015). Factors Influencing Final Price of Public Procurement: Evidence from Slovakia. *Procedia Economics and Finance*, vol. 25, pp. 543–551.

Gupta, S. (2002). Competition and Collusion in a Government Procurement Auction Market. *Atlantic Economic Journal,* vol. 30(1), pp. 13–25.

Iimi, A. (2006). Auction Reforms for E□ective Official Development Assistance. *Review of Industrial Organization,* vol. 28(2), pp. 109–128.

Ilke, O., Rasim, O., Bedri, K. (2012). Public Procurement Auctions and Competition in Turkey. *Review of Industrial Organization,* vol. 40(3), pp. 207–223.

Kuhlman, J., Johnson, S. (1983). The Number of Competitors and Bid Prices. *Southern Economic Journal, vol*. 50(1), pp. 213–224.

MMR (2015). *Strategie elektronizace zadávání veřejných zakázek pro období let 2016 až 2020*. Praha: MMR.

NKÚ (2016). *Kontrolní závěr z kontrolní akce 15/10 Peněžní prostředky vynakládané na Národní infrastrukturu pro elektronické zadávání veřejných zakázek (NIPEZ) a nákup komodit jeho prostřednictvím*. Praha: NKÚ.

Nemec, J., Bušina, J., Grega, M., Orviská, M., Šumpíková, M. (2016). Transaction Costs in Czech and Slovak Public Procurement. In: Sedmihradská, L., ed., *Theoretical and Practical Aspects of Public Finance 2016: Proceedings of the 21*st *International Conference*. Prague: University of Economics, pp. 282–286.

Pavel, J. (2007). *Ekonomické aspekty veřejných zakázek*. Brno: Masarykova Univerzita.

Pavel, J. (2010). Analýza vlivu míry konkurence na cenu rozsáhlých staveb v dopravní infrastruktury. *Politická ekonomie,* vol. 14(3), pp. 343–356.

Pavel, J. (2013). *Veřejné zákazky a efektivnost.* Ekopress: Praha.

Plaček, M., Schmidt, M., Ochrana, F., Půček, M. (2017). Do the Selected Characteristics of Public Tenders A□ect the Likelihood of Filing Petitions with the Regulators of Public Tenders? *Prague Economic Papers,* vol. 26(3), pp. 317–329.

Sičáková-Beblavá, E., Klátik, P., Beblavý, M. (2013). Ekonomické efekty elektronických aukcií na Slovensku. *Ekonomický časopis,* vol. 61(10), pp. 1067–1078.

Sičáková-Beblavá, E., Šatníková, S., Klátik, P. (2011). *Elektronické aukcie vo verejnom obstarávaní: teória a prax na Slovensku*. Bratislava: Transparency International.

Soudek, J., Skuhrovec, J. (2013). Public Procurement of Homogeneous Goods: the Czech Republic Case Study. *Econpapers*. Prague: Charles University, 1–23.

Strand, I., Ramada, P., Canton, E. (2011). *Public Procurement in Europe: Cost and E□ectiveness*. Brussels: European Commission.

Švejda, J. (2010). *Transaction Costs in Slovak Public Procurement*. Prague: University of Economics.

Williamson, O. (1985). Reflections on the New Institutional Economics. *Journal of Institutional and Theoretical Economics,* vol. 141(1), pp. 187–195.

# Tax Haven Ties and the Profitability of Foreign Owned Companies

**Danuše Nerudová, Veronika Solilová, Marian Dobranschi, Marek Litzman**

Mendel University of Brno
Faculty of Business and Economics,
Department of Accounting and Taxation
Zemědělská 1, 61300, Brno, Czech Republic
E-mail:danuse.nerudova@mendelu.cz;
veronika.solilova@mendelu.cz;
marian.dobranschi@mendelu.cz
marek.litzman@mendelu.cz

***Abstract:*** *Tax haven countries are the prevalent territories chosen by the Multinational Enterprises to place their income in order to avoid tax burden. By exploiting tax differences and preferential tax regimes, the Multinational Enterprises can engage in profit shifting in order to decrease the corporate income tax. This paper aims to analyze the impact of links with tax haven countries on the profitability of foreign owned companies based in the Czech Republic. The objective of this research is to investigate whether Czech subsidiaries that have sister companies based in tax haven countries report less profit before taxation. We adopt the stochastic frontier model to estimate the effect of links with tax haven on the output inefficiency reported by the Czech companies. We focus our empirical analysis on the firm-level data and their ties with 50 world tax haven countries. The links with tax havens are expected to have a negative impact of company efficiency, proxied by profit before taxation. This negative effect represents an indirect evidence of profit shifting from the Czech Republic to tax haven countries.*

*Keywords: profit shifting, corporate income tax, stochastic frontier model, tax havens*

*JEL codes: H25, H26, H32*

## 1 Introduction

The Multinational Enterprises (MNE's) can exploit different tax rules and tax policies regarding corporate income in order to avoid taxation. OECD (2015) underlines that base erosion and profit shifting (BEPS) causes overall tax losses that are between 4-10% of corporate income tax revenues or between 100 up to 240 billion USD on annual basis. The literature points that tax havens play a major role in profit shifting, where these jurisdictions are used as parking places for international wealth. The aim of this paper is to analyze the impact of large tax differences between high-tax and low or no-tax countries on the profits before tax. The empirical analysis is based on firm-level data from the Czech Republic. Even if the corporate income tax (hereinafter as CIT) is relatively low, it is important to research whether profit shifting is enhanced by large tax differences between a non-tax haven such as the Czech Republic and companies from the same MNE group placed in world tax havens.

We adopt an innovative approach in order to investigate the occurrence of profit shifting, namely the stochastic frontier model (hereinafter as SFM). The basis of our approach is the model proposed by Battese and Coelli (1995) time-varying inefficiency model. We depart from the already established model of Hines and Rice (1994), where we aim to determine if pre-tax profits reported by foreign owned companies in the Czech Republic are sensitive to tax differences to onshore and offshore tax havens. Our paper contributes to the scarce literature regarding profit shifting Central European countries towards tax havens. To our knowledge this is the first attempt to analyze the occurrence of profit shifting using the stochastic frontier approach. Moreover, our empirical analysis provides insights regarding profit shifting in two distinct sectors, namely manufacturing and services sector.

The paper is organized as follows. In the first section we review the theoretical and empirical literature regarding the concept of profit shifting and tax havens. In the second section we describe the data used for empirical methodology. In the third section of this

paper we present the methodology. In the fourth section we present the results obtained. In the last section concluding remarks are presented.

## 2 Profit shifting – theoretical background

The concept of profit shifting is defined by Dyreng (2015) and Markle (2015) as the strategic actions taken by the Multination Enterprises to report less profit in high-tax countries and more income in low or no-tax jurisdictions. According to Dyreng (2015) the most common practices to shift profit are transfer pricing, intra-company debt and the movement of production plant to another country with comparable tax advantages. Dyreng (2015) considers that the main factors or drivers of profit shifting are the loop-holes in tax laws from different countries accompanied by the great difficulty to establish the true value of intellectual property. Tax differentials between world countries play also an important role in shifting profits by the MNE's as long as there are different corporate income tax rate in different jurisdictions.

OECD (2013) underlines that tax base erosion poses a risk towards tax revenue, tax sovereignty and tax fairness across the OECD countries and non-OECD countries alike. Profit shifting plays an important role in base erosion. Base erosion and profit shifting (hereinafter as BEPS) is seen by the OECD (2013) as a result of active and aggressive tax planning and tax strategies aimed to avoid taxation in high-tax rate countries and shift profits towards low or no-tax countries. Profit shifting is affecting tax revenues collected by the state, undermines competition between companies and harms the overall voluntary tax compliance if there is a broad perception that MNE's can legally avoid taxation.

With respect to the empirical research regarding the profit shifting behavior, Dharmapala (2014) points that the dominant approach to empirically analyze the profit shifting practices is the "Hines-Rice" approach. Another influential paper of profit shifting analysis is done by Grubert and Mutti (1991). Hines and Rice (1994) assume that the size of shifted income is determined by the tax incentives in different jurisdictions. The basic tax incentive taken into account by the authors is the tax difference faced by the parent company based in one country and the tax rates faced by the foreign subsidiary. The model proposed by Hines and Rice (1994) to analyze profit shifting using tax differentials was adopted and further improved by works of Devereaux and Maffini (2007), Huizinga and Laeven (2008), Clausing (2009), Weichenrieder (2009), Dischinger and Riedel (2011), Buettner and Wamser (2013), Beer and Loeprick (2015), Markle (2016) and Heckemeyer and Overesch (2017).

The concept of tax havens is defined by OECD (1998) as those countries that have zero or low taxes, countries that lack the effective exchange of information, lack of transparency and do not require any substantial economic activities for foreign subsidiaries. OECD (1998) underlines three main channels through which tax havens contribute to base erosion and profit shifting: tax haven represent an ideal location to hold passive investments or "money boxes"; a location to book "paper profits" and enable the bank accounts to be protected from the control of tax authorities from other countries.

The literature also uses other labels for tax havens such as preferential tax regimes. Harmful preferential tax regimes are oriented in attracting mobile capital and other service activities, especially those economic activities that can be easily shifted in response to tax differentials. Dharmapala and Hines (2006) underline that low tax rates are not the exclusive condition for a country to become tax haven and attract foreign investment. Dharmapala and Hines (2006) found that tax havens are small and affluent countries with high-quality governance institutions. Tobin and Walsh (2013) notes that the wide concept of tax haven country refers to those jurisdictions that offer favorable tax regimes to foreign investors. Murphy (2008) proposes another concept as an appropriate replacement for tax haven term – secrecy jurisdiction. This concept refers to the favorable terms granted to nonresident financial and economic activities, by offering high level of secrecy and thus protect them from the reach of tax authorities from other

countries. Cobham et al. (2015) argue that tax havens are traditionally associated with low or no tax jurisdictions. However, the authors use the lack of transparency to analyze the ability of tax havens to attract income and profits that arise from economic activities that take place elsewhere (e.g., usually in high-tax countries) and hide relevant financial information from the source countries. The authors construct 15 indicators to measure the level of financial secrecy of tax havens. Cobham et al. (2015) found top 10 countries with highest Financial Secrecy Score, such as: Switzerland, Luxembourg, Hong Kong, Cayman Islands, Singapore, USA, Lebanon, Germany, Jersey and Japan.

There is an extensive literature concerned with analyzing the influence of tax havens on profit shifting. Empirical analysis of Jansky and Prats (2015), Jansky and Kokes (2016), Gumpert et al. (2016), Laffite and Toubal (2018) and Nerudova et al. (2018) found that those MNE's that have links with tax havens tend to report less profits before taxation and pay less corporate income tax.

The Stochastic Frontier Model was firstly proposed by Aigner et al. (1977). In comparison with the traditional regression estimation and SFM is the decomposition of error term in two distinct terms $v_i$ and $u_i$. $v_i$ represents the white noise or those factors that are outside of country's control and influence tax revenues collection. The second component of the composed error term $\epsilon_i$, the $u_i$ which is the core element to be predicted by the SFM, and it represents the inefficiency or the "failure" to achieve the maximum amount of output. The inefficiency $u_i$ is a non-positive term which determines the frontier function. Battese and Coelli (1995) improved the stochastic frontier model, where the technical inefficiency can be modeled as a function of external factors which are not included into the inputs set of variables.

## 3 Data and Methodology

### Data

We use firm-level data derived from Orbis database regarding the Czech subsidiaries owned by foreign MNE's. We collect the data only for those Czech subsidiaries that reported profits before taxation at least one year across analyzed period, have at least one sister company based in tax haven countries and are 51% owned by a foreign parent company. Taking into consideration these restrictions imposed for our empirical analysis, we were able to build a panel which contains financial data for 4,163 Czech subsidiaries.

In order to analyze the impact of tax differentials on the inefficiency of profits before taxation we select a list of 50 tax havens suggested by Gravelle (2013). We take into consideration two criteria in order to build our group of tax Havens. The first group of tax havens is constructed using the OECD (1998) criteria, namely we select those countries with low or no corporate income tax rate. In this first group we include: Anguilla, Antigua and Barbuda, Aruba, Bahamas, Barbados, British Virgin, Cayman Islands, Dominica, Grenada, Montserrat, Netherlands Antilles, St. Kitts and Nevis, St. Lucia, St. Vincent and Grenadines, Turks and Caicos, U.S. Virgin Islands, Belize, Costa Rica, Panama, Hong Kong, Macau, Singapore, Andorra, Channel Islands (Guernsey and Jersey), Cyprus, Gibraltar, Isle of Ireland, Liechtenstein, San Marino, Maldives, Mauritius, Seychelles, Bahrain, Jordan, Lebanon, Bermuda, Cook Islands, Marshall Islands, Samoa, Nauru, Niue, Tonga, Vanuatu and Liberia.

The second group of tax havens or countries that bear some of the tax havens features includes adopts the Financial Secrecy Score criteria proposed by Cobham et al. (2015): Luxembourg, Malta, Monaco and Switzerland. These four countries are mentioned in several important studies (Dharmapala and Hines, 2006; Zucman, 2014; Gravelle, 2013) due to their high financial secrecy index and also the complex network of tax treaties that these countries offer to foreign investors. The period on which observations are available is between 2009-2017.

**Methodology**

The production function describes a transformation relationship as a "black box", which transforms inputs in outputs. The difference between the stochastic production function and other empirical methods is concerned with the error term which is divided in two parts. The estimation of frontier equations is interesting due to its concept of maximality which puts a bond on the dependent variable. According to Brun and Diakite (2016) there are two ways to estimate a stochastic frontier models – firstly by maximum likelihood method (ML) to panel data and corrected ordinary least squares for cross section data. The model estimated in this paper, follows the inefficiency model proposed by Battese and Coelli (1995). This model assumes that the inefficiency term $u_i$ is a linear function of a set of exogenous explanatory variables and time. This model is innovative because it takes into consideration the issue of heteroscedasticity. Tackling the issue of heteroscedasticity takes into consideration the random parts of SFM where shifts of inefficiency are explained by external factors which are not included neither into the output or input variables. The inputs are assumed to directly affect the subsidiaries output (i.e., profit before taxation) while the environmental factors (i.e., tax differentials) affect the inefficiency.

The dependent variable used in our model is profit before taxation (Pbt) and the core independent variable is: and the tax differential (taxdiff). Consequently we use the fixed assets as a representative of capital and number of employees for labor costs. The tax differential is constructed as the difference between corporate income tax rate of the subsidiary (i.e., CIT rate in the Czech Republic) and the unweighted average corporate income tax rate of affiliates from the same MNE group (i.e., the average corporate income tax rate of "sister" companies based in tax havens across the world). We build the tax differential using the statutory corporate income tax rates.

The inefficiency stochastic frontier model equation is:

$$lnPbt_{i,t} = \beta_0 + \beta_1(lnfixedassets_{i,t}) + \beta_2\,(lncostwithemployees_{i,t}) + v_{i,t} - u_{i,t} \qquad (1)$$

$lnPbt_{i,t}$ represents the profits before taxation reported by the Czech subsidiaries in natural logarithm; *t*=1,2…T for each *i*-th company, where *i*=1,2, … N.

$lnfixedassets_{i,t}$ represents the fixed assets as proxy for capital in natural logarithm associated with *i*-th subsidiary at *t*-th observation, expressed in EUR:

$lncostwithemployees_{i,t}$ represents the cost with employees as proxy for labor in natural logarithm associated with *i*-th subsidiary at *t*-th observation, expressed in EUR:

β is an unknown set of parameters to be estimated using SFM approach based on Battese and Coelli (1995) model.

$v_{i,t}$ is the random statistical error with i.i.d. $v_{i,t} \sim N(0, \sigma_v^2)$ and $u_{i,t}$ is the non-negative random variables associated with technical inefficiency of profit performance, with the distribution assumed to be truncated-normal where $u_{i,t}$ is i.i.d. and $u_{i,t} \sim N^+(\mu, \sigma_u^2)$, with mean $Z_{i,t}\delta$ and a variance of $\sigma^2$.

Once the inefficiency $u_{i,t}$ is obtained we can assume that this inefficiency is a function of explanatory variables $Z_{i,t}$ specified as:

$$u_{i,t} = Z_{i,t}\delta + W_{i,t} \quad (2)$$

This procedure is explaining the structure of technical inefficiency in terms of other variables. *TE* – technical efficiency (or inefficiency) of i-th state in t-th time is defined as $\exp(-u_{i,t})$.

$Z_{i,t}\delta$ refers to exogenous variables that affect the inefficiency of profits before taxation reported by the Czech subsidiaries. In our model we include tax differential as the exogenous variable. $W_{i,t}$ is a set of random variable to be estimated, which is defined by truncation of normal distribution of $u_{i,t}$ with zero mean and a variance of $\sigma_u^2$.

The SFM allows us also to calculate the optimal frontier or the maximum amount of profit before taxation that a company can obtain given a set of inputs. Therefore $\beta' x + v_{i,t}$ represents the optimal frontier; $\beta' x$ represent the deterministic part of the STFM and $v_{i,t} \sim N(0, \sigma_v^2)$ represents the stochastic part of STFM. The sum of $\beta' x + v_{i,t}$ is the stochastic tax frontier. The $u_{i,t}$ or the inefficiency is the amount by which companies fail to reach the optimum frontier of profitability. The selected external factor (i.e. $Z$ variable) is used to estimate the impact of tax differentials between the Czech subsidiaries and their sister companies owned by the same MNE and based in tax haven countries on the reported profits before taxation. The tax differential is expected to increase the inefficiency term $u_{i,t}$, or as the tax differential increases which translates in larger difference of corporate income taxation between the Czech Republic and tax havens, the profits before taxation will decrease. We estimate the SFM separately for Czech subsidiaries that are involved in manufacturing and service sector.

## 4 Results

In this section we show the results from the SFM using the approach of Battese and Coelli (1995) time-varying inefficiency model. This model assumes that the distribution of the inefficiency term is affected also by external factors other than only by the inputs of the Stochastic Frontier Model. This model combines both estimation – the STFM and inefficiency model in one step using maximum likelihood method. The distribution of $u_{i,t}$ is assumed to be truncated-normal, where $u_{i,t} \sim N^+(\mu, \sigma_u^2)$, with mean $Z_{i,t}\delta$ and a variance of $\sigma^2$. The distribution of the inefficiency term is assumed to be a linear function of tax differential. In this model we choose to parametrize the sigma_u ($\sigma_u^2$) or the variance of the inefficiency term $u_{i,t}$, leaving aside the (Mu) or the pre-truncated mean of the inefficiency distribution.

**Table 1** Estimation results using time-decay inefficiency stochastic frontier model

| **Dep. Var. LnPbt** | | **Manufacturing Sector** | | **Service sector** | |
|---|---|---|---|---|---|
| | | Coef. | Std. Err. | Coef. | Std. Err. |
| **Frontier** | Lnfixedassets | **0.297**$^{***}$ | 0.0163 | **0.300**$^{***}$ | 0.0056 |
| | Lnemployees | **0.627**$^{***}$ | 0.0263 | **0.437**$^{***}$ | 0.0072 |
| | _cons | 1.084 | 0.2509 | 3.742 | 0.0970 |
| **Mu** | _cons | -51.34 | 17.7392 | -41.932 | 10.4543 |
| **U_sigma** | taxdiff | **3.372**$^{***}$ | 0.6691 | **2.867**$^{***}$ | 0.2704 |
| | _cons | 4.189$^{***}$ | 0.3335 | 4.069$^{***}$ | 0.2306 |
| **V_sigma** | _cons | -0.412$^{***}$ | 0.0649 | 0.092$^{***}$ | 0.0302 |
| | sigma_u ($\sigma_u^2$) | **6.953** | 0.9336 | **7.146** | 0.1362 |
| | sigma_v ($\sigma_v^2$) | 0.813 | 0.0264 | 1.047 | 0.0158 |
| | lambda (λ) | **8.552** | | **6.825** | |
| **Log likelihood** | | -1.86E+04 | | -3.50E+03 | |
| **Wald chi2(2)** | | 4697.69 | | 11361.86 | |
| **Prob > chi2** | | 0.000 | | 0.000 | |
| **N** | | 2233 | | 10279 | |

Source: Own calculation; * p < 0.05, ** p < 0.01, *** p < 0.001.

Table 1 shows the results obtained after estimating the stochastic frontier model proposed by Battese and Coelli (1995). The model adopted is an output oriented production frontier model. The output in this case is the dependent variable profit before taxation (LlnPbt) and the input variables are fixed assets (Lnfixedassets) and cost with employees (Lnemployees). Both of the inputs, proxies for capital and labor are statistically significant and have a positive impact on the output, as expected. The second

part of the table presents the results regarding the inefficiency model. Since the estimation of Battese and Coelli (1995) model is a single step procedure, after the estimates of technical inefficiency is obtained the impact of Z variable on inefficiency is estimated. sigma_u ($\sigma_u^2$) represents the variance of the inefficiency term $u_{i,t}$, sigma_v ($\sigma_v^2$) the variance of the statistical noise $v_{i,t}$ and lambda (λ) shows the relative contribution of $u_{i,t}$ to the variation of the total error term, where lambda equals to: $\lambda = \sigma_u/\sigma_v$ .

The second part of Table 1 shows that tax differential has a statistically significant impact on the inefficiency term estimated by our stochastic production frontier model. This shows that the differences in corporate income taxation between the Czech Republic and the tax havens have a negative impact on profits before taxation declared by foreign owned Czech subsidiaries. Tax differential has a positive impact on inefficiency term in both cases, namely on subsidiaries which activate in manufacturing and service sector.

We also perform a robustness check regarding our estimates obtained from the SFM. In order to check whether our results are robust we choose to replace the dependent variable, profits before taxation reported by foreign owned Czech subsidiaries with earnings before taxation and interest (hereinafter as EBIT).

**Table 2** Robustness check for the stochastic frontier model

| **Dep. Var. LnEBIT** | | **Manufacturing Sector** | | **Service sector** | |
|---|---|---|---|---|---|
| | | Coef. | Std. Err. | Coef. | Std. Err. |
| **Frontier** | Lnfixedassets | **0.283**$^{***}$ | 0.0149 | **0.285**$^{***}$ | 0.0052 |
| | Lnemployees | **0.621**$^{***}$ | 0.0235 | **0.438**$^{***}$ | 0.0067 |
| | _cons | 1.331 | 0.2297 | 3.808 | 0.0905 |
| **Mu** | _cons | -38.806 | 15.4399 | -37.048 | 10.4399 |
| **U_sigma** | taxdiff | **3.483**$^{***}$ | 0.7026 | **2.912**$^{***}$ | 0.2998 |
| | _cons | 3.758$^{***}$ | 0.3790 | 3.700$^{***}$ | 0.0292 |
| **V_sigma** | _cons | -0.416$^{***}$ | 0.0613 | 0.065$^{***}$ | 0.0286 |
| | sigma_u ($\sigma_u^2$) | **5.584** | 0.5672 | **5.934** | 0.9264 |
| | sigma_v ($\sigma_v^2$) | 0.812 | 0.0249 | 1.033 | 0.0148 |
| | lambda (λ) | **6.876** | | **5.744** | |
| **Log likelihood** | | -3416.34 | | -1.77E+04 | |
| **Wald chi2(2)** | | 5027.54 | | 12558.96 | |
| **Prob. > chi2** | | 0.000 | | 0.000 | |
| **N** | | 2281 | | 10364 | |

Source: Own calculation; * p < 0.05, ** p < 0.01, *** p < 0.001.

The results obtained from robustness check show that there are no large differences in terms of our inefficiency model. The impact of tax differential on inefficiency term is positive and statistically significant even if we change de dependent variable. This means that tax differences between the Czech Republic and the tax havens will increase the inefficiency and consequently reduce the earnings before taxation and interest payments reported by Czech subsidiaries. The input variables, namely fixed assets and cost with employees have a statistically significant and positive impact on the output.

## 5 Conclusions

The aim of this paper was to analyze the occurrence of profit shifting due to tax differential using an innovative approach. We investigate the occurrence of profit shifting by estimating an output-oriented stochastic frontier model. We adopt the time-varying

inefficiency model proposed by Battese and Coelli (1995), where the inefficiency of profit before taxation is also a function of external factors such as tax differential. The empirical analysis used firm-level data for Czech subsidiaries owned by a foreign parent that activate in manufacturing and service sector and which have a sister company in tax havens countries. The main objective of the stochastic frontier model was to estimate the impact of tax differential on the inefficiency of profits before taxation reported by the Czech subsidiaries. Our results show that in both cases, manufacturing and service sector companies, the tax differential plays an important role in affecting the profitability before tax declared by analyzed subsidiaries. We found that tax differential tends to increase the inefficiency of profits before taxation reported by Czech subsidiaries, which indicates in an indirect manner the occurrence of profit shifting. The tax differential between Czech Republic and tax havens has a negative impact on the output of our stochastic frontier model. This result can be interpreted as the tax differential increases, or sister companies face a lower CIT rate than the subsidiaries based in the Czech Republic, the reported profit before taxation will decrease.

## Acknowledgments

This paper was funded by the Czech Science Foundation (GACR) grant [no.18-14082S] entitled: "Fair corporate taxation: Measurement of the impact of the corporate profit shifting on the budget of the Czech Republic".

## References

Aigner, D., Lovell, C. K., Schmidt, P. (1977). Formulation and estimation of stochastic frontier production function models. *Journal of Econometrics*, vol. 6(1), pp. 21-37.

Battese, G. E., Coelli, T. J. (1995). A model for technical inefficiency effects in a stochastic frontier production function for panel data. *Empirical economics*, vol. 20(2), pp. 325-332.

Beer, S., Loeprick, J. (2015). Profit shifting: drivers of transfer (mis) pricing and the potential of countermeasures. *International Tax and Public Finance*, vol. 22(3), pp. 426-451.

Buettner, T., Wamser, G. (2013). Internal debt and multinational profit shifting: Empirical evidence from firm-level panel data. *National Tax Journal*, vol. 66(1), pp. 63-96.

Clausing, K. A. (2009). Multinational firm tax avoidance and tax policy. *National Tax Journal*, vol. 1, pp. 703-725.

Cobham, A., Janský, P., Meinzer, M. (2015). The financial secrecy index: Shedding new light on the geography of secrecy. *Economic geography*, vol. 91(3), pp. 281-303.

Crivelli, E., De Mooij, R., Keen, M. (2016). Base erosion, profit shifting and developing countries. *FinanzArchiv: Public Finance Analysis*, vol. 72(3), pp. 268-301.

Devereux, M., Maffini, G. (2007). The Impact of Taxation on the Location of Capital, Firms and Profit: a Survey of Empirical Evidence. *Oxford University Centre for Business Taxation Working Paper* no. 07/02.

Dharmapala, D. (2014). What do we know about base erosion and profit shifting? A review of the empirical literature. *Fiscal Studies*, vol. 35(4), pp. 421-448.

Dharmapala, D., Hines Jr, J. R. (2006). Which countries become tax havens? *Journal of Public Economics*, vol. 93(9-10), pp. 1058-1068.

Dischinger, M. (2007). Profit shifting by multinationals: Indirect evidence from European micro data. *Munich Discussion Paper* No. 2007-30.

Dischinger, M., Riedel, N. (2011). Corporate taxes and the location of intangible assets within multinational firms. *Journal of Public Economics*, vol. 95(7-8), pp. 691-707.

Dyreng, S. (2015). *Making Sense of Profit Shifting: Scott Dyreng*. Tax Foundation Forum Series.

Gravelle, J. G. (2013). *Tax Havens: International Tax Avoidance and Evasion*. Congressional Research Service Report.

Grubert, H., Mutti, J. (1991). Taxes, tariffs and transfer pricing in multinational corporate decision making. *The Review of economics and Statistics*, vol. 1, pp. 285-293.

Gumpert, A., Hines Jr, J. R., Schnitzer, M. (2016). Multinational firms and tax havens. *Review of Economics and Statistics*, vol. 98(4), pp. 713-727.

Heckemeyer, J. H., Overesch, M. (2017). Multinationals' profit response to tax differentials: Effect size and shifting channels. *Canadian Journal of Economics/Revue canadienne d'économique*, vol. 50(4), pp. 965-994.

Hines Jr, J. R., Rice, E. M. (1994). Fiscal paradise: Foreign tax havens and American business. *The Quarterly Journal of Economics*, vol. 109(1), pp. 149-182.

Huizinga, H., Laeven, L. (2008). International profit shifting within multinationals: A multi-country perspective. *Journal of Public Economics*, vol. 92(5-6), pp. 1164-1182.

Janský, P., Kokeš, O. (2016). Profit-shifting from Czech multinational companies to European tax havens. *Applied Economics Letters*, vol. 23(16), pp. 1130-1133.

Janský, P., Prats, A. (2015). International profit-shifting out of developing countries and the role of tax havens. *Development policy review*, vol. 33(3), pp. 271-292.

Jones, C., Temouri, Y. (2016). The determinants of tax haven FDI. *Journal of world Business*, vol. 51(2), pp. 237-250.

Laffitte, S., Toubal, F. (2018). Firms, Trade and Profit Shifting: Evidence from Aggregate Data. *CESifo Working Paper*, No. 7171.

Markle, K. (2015). *Making Sense of Profit Shifting: Kevin Markle*. Tax Foundation Forum Series.

Markle, K. (2016). A Comparison of the Tax-Motivated Income Shifting of Multinationals in Territorial and Worldwide Countries. *Contemporary Accounting Research*, vol. 33(1), pp. 7-43.

Murphy, R. (2008). *Finding the secrecy world: Rethinking the language of "offshore"*. London: Tax Research LLP.

Nerudova, D., Solilova, V., Litzman, M., Janský, P. (2018). *International tax planning within the structure of corporate entities owned by the shareholder-individual through Panama Papers destinations.* Development Policy Review. (Forthcoming).

OECD (1998). *Harmful tax competition: An emerging global issue.* Publications de l'OCDE.

OECD, (2013). *Addressing Base Erosion and Profit Shifting*. Paris: OECD. Publications de l'OCDE.

OECD, (2015). *OECD/G20 Base erosion and Profit Shifting Project 2015 Final Reports.* Paris: OECD. Publications de l'OCDE.

Tobin, G., Walsh, K. (2013). What makes a country a tax haven? An assessment of international standards shows why Ireland is not a tax haven. *The Economic and Social Review*, vol. 44(3), pp. 401-424.

Weichenrieder, A. J. (2009). Profit shifting in the EU: Evidence from Germany. *International tax and public finance*, vol. 16(3), pp. 281-297.

Zucman, G. (2014). Taxing across borders: Tracking personal wealth and corporate profits*. Journal of Economic Perspectives*, vol. 28(4), pp. 121-148.

# The Financial Education among Pupils in the South Moravian Region

**Josef Nesleha, Lenka Janosova**

Faculty of Economics and Administration, Department of Finance
Lipova 41a, 602 00 Brno, Czech Republic
E-mail: josef.nesleha@econ.muni.cz
E-mail: lenkajanosova@mail.muni.cz

***Abstract:*** *Needles to say that financial literacy has become one of the important topics related to finance. Not only has it been implemented into the curriculums of most of the schools in the Czech Republic, yet it also has become a subject of testing. This confirms the existence of several studies conducted in past. The subject of this study is the level of financial literacy level among young pupils in the Czech Republic, particularly in the South Moravian Region. The goal of it is to provide results concerning a recently conducted study on primary schools in the region. The results are devoted to several tested predictors of the financial literacy level. It has been shown that the area of pupils' hobbies is a statistically significant predictor of financial literacy level, together with pupils' profession. On the other hand, gender and presence of siblings have been rendered as statistically insignificant predictors. The study is based on quantitative research and several statistical methods, such as t-tests or ANOVA are applied.*

*Keywords: financial literacy, primary school, South Moravian Region, Czech Republic, pupil, analysis of variance, ANOVA*

*JEL classification: I22, I31*

## 1 Introduction

Financial literacy is a relatively new phenomenon. Despite it, it has its importance around the world during the past decades. As a consequence of its growing importance, financial literacy and financial education become an inherent element of the curriculum, regardless if we talk about primary schools, high school or universities (Nesleha and Urbanovsky, 2016). It is believed that low level of financial literacy that exists in some parts of the world (even those countries that are developed and have positive and sustainable economic growth) needs to be introduced to children at their childhood (OECD, 2005). On top of that, financial literacy is lectured and thought at schools and universities which have nothing to do with economics or finance (Geiger and Heller, 2011).

When it comes to the definition of what financial literacy means, there has been a great number of such definitions. Some sources state that there exist at least tens of such definitions (Investopedia, 2016). Some sources define solely the financial literacy, while others try (at the same time) to define other related terms, such a literate person, competencies of a literate person, skills of a literate person or parts and "sections" of the financial literacy (OECD, 2015).

Most of the sources agree on the following definition "set of knowledge which is necessary to have in order to make proper decisions related to personal financial administration, financial investment and personal budget" (Ministry of Finance ČR, 2010). The financially literate person is then defined as "a person having knowledge, skills and confidence to make responsible financial decisions that suit our own financial situations" (Ministry of Finance ČR, 2010). Apart from the strict definitions, the financial literacy can be also interpreted in a psychological way, saying that the financial literacy is subject to the mental status or well-being of a person (Shefrin, 2002).

Financial literacy is usually divided into three different sections, particularly the following parts.

- Money literacy
- Price literacy

- Budget literacy

Each group has its characteristics, particularly each group is specified by a specific range of knowledge. Money literacy includes cash and non-cash transactions, banking products, administration of them, bank account, savings account, building society saving account, etc. The price literacy focuses on price mechanisms, inflation, unemployment and other international or multinational indicators. The last group, budget literacy, includes the knowledge related to personal investments and personal debt, administration of deposits, administration of loans, personal budget and administration of a budget within a family and other pieces of knowledge, such as leasing or types of insurance. (Ministry of Finance ČR, 2010)

On the top of that, financial literacy is sometimes completed by a list of competencies or other parts of it, for example, legal literacy, financial literacy related to insurance, "math" literacy (consisting in usage of mathematical skills in financial literacy tasks), consumer protection literacy, etc. (EBF, 2009).

The goal of this article is to provide results concerning an investigation devoted to the financial education on primary schools in the Czech Republic, particularly in the South Moravian Region.

The following four research questions will be taken into account in the research part.

a. How does the profession of pupil's parents influence the financial literacy level of the pupil?
b. Does gender play an important role when it comes to the financial literacy level of young pupils?
c. Does the presence of siblings have an influence on the pupils' financial literacy level?
d. Is there a relationship between the financial literacy level and pupils preferences when it comes to education and favourite subjects?

## 2 Methodology

This chapter is devoted to the description of the employed methodology and for this is divided into two subparts.

**Data collection and dataset**

The data for this research has been collected by a paper-based questionnaire which has been filled by young pupils directly at primary schools. The questionnaire consists of two parts. In the first part, pupils have been asked 15 questions – both multiple choice questions and open questions to be filled in or computed. In total, respondents could gain up to 20 points. In the second part of the questionnaire, pupils provided answer related to their demographic data.

The target audience of the study are only pupils of the second grade of primary schools in the Czech Republic, for the purposes of this research schools in the South Moravian Region.

In total, data from 40 classes has been collected. It accounts for 661 students in total. The data has been processed in the software STATISTICA. All the tests will be run with the significance level 5% (0.05). When any assumptions of particular tests need to be verifiend, the 1% significance level will be utilized.

**Data processing**

With a focus on the set goal and the formulated research questions, the data processing has been based on the quantitative statistical methods.

**Research question no. 1: How does the profession of pupil's parents influence the financial literacy level of the pupil?**

Concerning the first research question, all respondents have been divided into one of the four groups, depending on the type of profession of their parents. Particularly, the following four groups of professions (attitude to employment) have been created.

a. Unemployed
b. An employed person or an entrepreneur working on a manual position, so-called blue-collar positions
c. An employed person or an entrepreneur working on a non-manual positon, so-called white-collar positions
d. Maternity leave, pensioners or others less frequent cases

With account to the set target, the number of realizations this variable can have, the ANOVA will be employed in order to verify if there is a different between the average values among particular groups. This method will help us measure potential differences among the groups and find out which group or groups cause this inequality.

Concerning the assumption of the test, the independence of the observations is obvious from the data itself. Normality of the dataset will be tested, yet even if it fails, the method might be used as the approximate normality will be fulfilled – thanks to the sufficient number of observations.

**Research question no. 2: Does gender play an important role when it comes to the financial literacy level of young pupils?**

As we address the issue of gender in this question, there are only two possible realizations (male and female). The independence of the variables is obvious here, as well as in the previous case. Due to the fact that there are only two possible realizations and that the variables are independent of each other, the two sample t-test will be used.

This might lead to verification if the gender is a significant determinant of the financial literacy level among young pupils.

**Research question no. 3: Does the presence of siblings have an influence on the pupils' financial literacy level?**

As well as in case of the second research question, there will be only two possible realizations – a respondent has siblings or respondent does not have siblings. Therefore, the same statistical method will be employed in order to verify potential differences between the average values of both groups. Two sample t-tests will be utilized, completed by an analysis of various descriptive statistics.

**Research question no. 4: Is there a relationship between the financial literacy level and pupils preferences when it comes to education and favourite subjects?**

For the purposes of the third research question of this study, the respondents have been divided into the following groups:

a. Humanitarian subjects
b. Technically oriented subjects, such as mathematics or biology
c. Languages
d. Sports and arts

In the fourth research question, the logic is similar to the first research question. We work with four different realizations which are independent of each other. As for this, the analysis of variance (ANOVA) will be used. After what this analysis is processed, there will be an analysis of groups which have been confirmed not to be equal, given that there any unequal groups.

## 3 Results and Discussion

The part with results is divided into four parts, according to the particular research questions. Each part investigates and brings an answer to particular research question separately.

**Research question no. 1: How does the profession of pupil's parents influence the financial literacy level of the pupil?**

The first research question works in total with four different groups of respondents. The particular groups have been stated in the chapter devoted to methodology. As these groups are believed to be independent of each other and with the focus on the set target, the analysis of variance (ANOVA) will be employed.

For the purposes of this research question, the tests are divided into two separate parts. In the first part, the influence of the mother's profession will be analyzed, while in the second part the father's profession.

**Influence of mother's profession**

When it comes to the mother's education, this factor plays an important role in the level of the pupil's financial literacy level. According to the results stated in table 1, the p-value has reached almost zero, meaning that the null hypothesis has been rejected.

**Table 1** Results of ANOVA

| Variable | K – number of groups | F | p-value |
|---|---|---|---|
| **Realization** | 4 | 7.02 | 0.0001 |

Source: Own processing in STATISTICA

Such a conclusion is insufficient when it comes to further investigation. As for this, table 2 has been created. This table summarizes basic descriptive statistics of all of the tested groups. The lowest average value of the points (variable defining the financial literacy level, ranging from zero to 20 points) has been measured in case of the first group. According to the original adjustment, the first group consists of pupils whose parents are unemployed. The second lowest value has been measured in case of the last group, consisting of pupils whose parents are on maternity leave or in pension.

The highest value has been observed in case of "white-collar" employees, which has been expected. Yet it is important to say that the difference between this group and the second group (blue-collar workers) accounts for only 0.75 points (out of 20).

**Table 2** Descriptive statistics

| Group number | Means | Number of observations | Standard deviation |
|---|---|---|---|
| 1 | 7.86 | 41 | 4.07 |
| 2 | 9.76 | 254 | 3.33 |
| 3 | 10.4 | 238 | 3.31 |
| 4 | 9.4 | 25 | 3.43 |

Source: Own processing in STATISTICA

More detailed results of ANOVA are stated in table 3). Taking these p-values into account, it is visible that a statistically significant difference has been observed in the following pairs:

- Unemployed parents and parents working manually (so-called "blue-collar" workers)
- Unemployed parents and parents working non-manually (so-called "white-collar" workers)

These are only statistically significant differences revealed by ANOVA test. Although the difference between the first group (unemployed parents) and the fourth group (maternity leave and pensioners) might seem to be significant (with regard to the average values), the test has not rendered this gap as statistically significant.

**Table 3** Results of post-hoc test, Scheffe Test

| Group | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| **1** | -- | **0.011** | **0.0002** | 0.365 |
| **2** | **0.011** | -- | 0.221 | 0.966 |
| **3** | **0.0002** | 0.221 | -- | 0.572 |
| **4** | 0.365 | 0.966 | 0.572 | -- |

Source: Own processing in STATISTICA

**Influence of father's profession**

Not exactly the same situation has been revealed in case of father's profession. Although it also has an impact on pupils' financial literacy level, the particular results and conclusions are different. The law p-value rejects the null hypothesis as well, meaning that at least two average values are statistically different.

**Table 4** Results of ANOVA

| Variable | K – number of groups | F | p-value |
|---|---|---|---|
| **Realization** | 4 | 11.02 | 0.000001 |

Source: Own processing in STATISTICA

Table 5 shows the average values together with numbers of observations and standard deviation. If we compare the average values with values of mother's profession, there is a significant difference when it comes to the fourth group. Yet it is crucial to say that the information value of this number is not representative due to the limited number of observations. Concerning other groups, the average values are relatively similar with a small difference in case of the first group (consisting of unemployed people).

**Table 5** Descriptive statistics

| Group number | Means | Number of observations | Standard deviation |
|---|---|---|---|
| 1 | 7.29 | 19 | 3.35 |
| 2 | 9.38 | 277 | 3.32 |
| 3 | 10.74 | 215 | 3.46 |
| 4 | 7.9 | 6 | 3.45 |

Source: Own processing in STATISTICA

Speaking of the post-hoc test, there have been two confirmed differences as illustrated in table 6. The most important finding that has been revealed is the fact that there exists a significant difference between manual and non-manual workers. This has not been confirmed in case of mothers' profession. Important to say that both the groups (manual and non-manual workers) are represented by a great number of respondents, leading to a higher information value of the results.

The fact that this difference has been rendered statistically significant in case of males (but not in case of females) might be caused by several factors. One of them might be the different scope of manual and non-manual types of jobs of both genders. Another aspect that needs to be taken into account is the fact that (although the p-value is lower than the significance level) the differences are just slightly higher.

**Table 6** Results of post-hoc test, Scheffe Test

| Group | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| **1** | -- | 0.082 | **0.0005** | 0.986 |
| **2** | 0.082 | -- | **0.0002** | 0.772 |
| **3** | **0.0005** | **0.0002** | -- | 0.251 |
| **4** | 0.986 | 0.772 | 0.251 | -- |

Source: Own processing in STATISTICA

**Research question no. 2: Does gender play an important role when it comes to the financial literacy level of young pupils?**

In this case, there are only two particular groups to be compared – males and females. Taking into account the fact that these two groups do not affect each other (are independent of each other), the difference is tested by the usage of t-test for independent samples.

The normality of the groups fails with regard to the set significance level. Yet with the sufficient number of observations, the approximate normality is expected, therefore, the test will be processed. When it comes to the second assumption of the test (homoscedasticity), this one has been fulfilled. The result of the test is stated in the following table, table 7, together with basic descriptive statistics that allow us to make the first impression of the data.

**Table 7** Descriptive statistics and homoscedasticity test

| Variable | Means (M) | Means (F) | N1 (M) | N2 (F) | F-ratio | p-value |
|---|---|---|---|---|---|---|
| **Realization** | 9.582 | 9.504 | 354 | 292 | 1.307 | 0.018 |

Source: Own processing

Looking at table 7, it is obvious that the means of the first group (males) and the means of the other group (females) is similar. The difference is lower than 0.1 points. Taking into account the scale (20 points), such a difference does not seem to be significant.

**Table 8** Results of t-test

| T-value | Degrees of freedom | p-value |
|---|---|---|
| **0.279** | 644 | 0.7802 |

Source: Own processing

The previously mentioned presumption has been confirmed by table 8 (Results of t-test). The computed t-statistics is very close to zero, making the p-value higher, in this case, the p-value reaches almost 0.8. With regard to the significance level, the null hypothesis of the test is not rejected, meaning that the test did not prove any significant difference between the first and the second group. In other words, the data has not revealed any difference between the level of financial literacy among young males and young females. Their results are, more and less, the same.

**Research question no. 3: Does the presence of siblings have an influence on the pupils' financial literacy level?**

When it comes to the evaluating the third research question, the method and the procedure is similar to the procedure of the second research question. Both the questions have something in common – there are two realizations of the tested variable. For the purposes of this study, only the presence of siblings has been taken into account, not the particular number of siblings. This means that there are only two groups of respondents – those who have siblings (in the table marked as "S") and those who do not have siblings (the abbreviation "NS" used).

**Table 9** Descriptive statistics and homoscedasticity test

| Variable | Means(NS) | Means (S) | N1 (NS) | N2 (S) | F-ratio | p-value |
|---|---|---|---|---|---|---|
| **Realization** | 10.302 | 9.555 | 58 | 566 | 1.1202 | 0.523 |

Source: Own processing in STATISTICA

The basic descriptive statistics together with the results of homoscedasticity test are summarized in the table 9. As well as in case of gender, it is visible that the difference between the first and the second group is not enormous. On the other hand, it has reached almost 0.8 points. The following table provides results of the conducted t-test.

With regard to these results, the p-value does not reject the null hypothesis. In order, this difference has not been confirmed to be statistically significant. Yet it is important to mention the realization of the p-value. In this cases, it has reached approximately 0.12. Roughly said, the null hypothesis has not been rejected, yet the realization is just slightly higher than the significance level.

**Table** 10 Results of t-test

| T-value | Degrees of freedom | p-value |
|---|---|---|
| -1.549 | 622 | 0.122 |

Source: Own processing in STATISTICA

**Research question no. 4: Is there a relationship between the financial literacy level and pupils preferences when it comes to education and favourite subjects?**

As stated before, to verify this research question, the analysis of variance has been employed. We work with four different groups which are independent of each other. The homoscedasticity has been complied with, the computed p-value has reached approximately 0.5.

The chosen results of the ANOVA test are summarized in the following table – table no. 11. Taking into account the realization of the statistics and mainly the computed p-value, the null hypothesis has been rejected. In terms of ANOVA, this means that there have been statistically significant differences between at least two of the four investigated groups.

**Table 11** Results of ANOVA

| Variable | K – number of groups | F | p-value |
|---|---|---|---|
| **Realization** | 4 | 6.432 | 0.0002 |

Source: Own processing in STATISTICA

So far we know that there has been a difference, yet from these results, we cannot say which group or groups cause this difference. Looking at the descriptive statistics of all the groups, it is visible what might stand behind this discrepancy.

**Table 12** Descriptive statistics

| Group number | Means | Number of observations | Standard deviation |
|---|---|---|---|
| 1 | 9.215 | 85 | 3.32 |
| 2 | 10.418 | 64 | 3.341 |
| 3 | 10.3 | 194 | 3.631 |
| 4 | 9.01 | 231 | 3.389 |

Source: Own processing in STATISTICA

The groups 2 and 3 (pupils preferring technically oriented subjects and languages) tend to reach a higher number of points, meaning that their financial literacy level tends to be higher compared to the other groups.

The following table, no. 13, summarizes the results of post-hoc tests, particularly Scheffe test. This post-hoc test has been employed as the groups have a different number of observations. For such a case, this method is more appropriate than the other tests (Budikova et al., 2010). Our previous idea has been confirmed, but only partly. Taking into account the originally set 5% significance level, there are only two statistically significant differences, between group 2 and group 4 and then between group 3 and group 4. In other words, pupils preferring sports and arts have been proven to reach the lower level of financial literacy in comparison with students preferring technically oriented subjects and areas and pupils dedicated themselves more to languages.

**Table 13** Results of post-hoc test, Scheffe Test

| Group | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| **1** | -- | 0.227 | 0.12 | 0.974 |
| **2** | 0.227 | -- | 0.998 | **0.043** |
| **3** | 0.12 | 0.998 | -- | **0.002** |
| **4** | 0.974 | **0.043** | **0.002** | -- |

Source: Own processing in STATISTICA

This study has been devoted to young pupils, particularly to pupils in primary schools in the Czech Republic. It has brought certain findings that might be taken into account in further research. Particularly, it has been investigated that the area of hobbies has an impact on the financial literacy level of young pupils.

It is important to take into account that this study is not comprehensive when it comes to the determinants of the financial literacy level. First of all, only four predictors have been measured and tested in this article. For the complex assessment of the relevance of the Financial Literacy Standards more profound analysis will have to be run in order to reveal of possible predictors. In the next study, we will focus on a particular region and location of the schools which pupils visit. If some amendments of the Standards can be proposed, it is crucial to know if the location or type of schools stands behind the financial literacy level.

After this first study into the financial literacy level of young pupils in the Czech Republic, it is obvious that some difference exists and might be worth investigating further, mainly due to the lack of similar studies.

## 4 Conclusions

The goal of this contribution has been to provide results concerning a study devoted to the financial literacy level among young pupils in the Czech Republic, particularly in one of its regions, the South Moravian Region. To do so, in total four research questions have been formulated. For each research question, a different attitude and statistical method have been used. The investigation has used mainly, apart from the basic descriptive statistics, the analysis of variance (ANOVA) and two sample t-tests.

The results have shown that some of the chosen predictors have been statistically significant, while others have not been. When it comes to the first research question, the run analysis has identified several differences. The mothers', as well as fathers' profession, has an impact on pupils' financial literacy level. In both cases, pupils' with non-manually working mothers and fathers have reached better results, yet only in case of fathers' profession, this difference has been statistically significant.

Gender of pupils has not been found statistically significant predictor of the financial literacy level as both genders have reached very similar results. Presence of siblings was not found statistically significant either, however, a difference in the average value of pupils having and not having siblings has been measured.

In the last tested research question, it has been identified that preference over pupils' favourite subject/s has an influence on the financial literacy level. Higher values have been measured in case of pupils preferring technically oriented subjects and languages, while pupils preferring humanitarian subjects, sports and arts have reached a lower level of financial literacy in this study.

## Acknowledgement

Support of Masaryk University within the project MUNI/A/0921/2018 "*Financial Literacy in the Czech Republic*" is gratefully acknowledged.

## References


Budíková, M., Králová, M., Maroš, B. (2010). *Průvodce základními statistickými metodami*. Praha: Grada Publishing, a.s.

EBF (2009). *Financial literacy – empowering consumers to make the right choices, European Banking Federation*. Retrieved from: http://www.ebf-fbe.eu/uploads/documents/publications/Reports/Fin20Litterature/D0305C-2009-EBF_Financial_Education_-_rev7-26-9_webversion-2009-00831-01-E.pdf.

Geiger, R. L., Heller, D. E. (2011). Financial trends in higher education: The United States. *Peking University Education Review*, 1(33), 6.

Investopedia (2016), *Financial Literacy.* Retrieved from: http://www.investopedia.com/terms/f/financial-literacy.asp.

Ministry of Finance (2010). *Národní strategie finančního vzdělávání*. Retrieved from: http://www.msmt.cz/vzdelavani/zakladni-vzdelavani/narodni-strategie-financniho-vzdelavani-2010.

Nesleha, J., Urbanovsky, K. (2016). Financial Literacy Testing in the Area of Insurance Products. *Proceedings of the 9th International Conference of Currency, Banking and International Finance.* Bratislava: EKONÓM, pp. 271-276.

OECD (2005). *Importance of Financial Literacy in the Global Economy*. Retrieved from: http://www.oecd.org/general/35883324.pdf.

OECD (2015). *National Strategies for Financial Education*. Retrieved from: http://www.oecd.org/daf/fin/financial-education/nationalstrategiesforfinancialeducation.htm.

Shefrin, H. (2002). *Beyond Greed and Fear: Understanding Behavioral Finance and the Psychology of Investing*. New York: Oxford University Press.

# Evolution of the Financial Stability Reports – Theoretical Approach

**Aleksandra Nocoń**

University of Economics in Katowice
Faculty of Finance and Insurance, Department of Banking and Financial Markets
ul. 1 Maja 50, 40-287 Katowice, Poland
E-mail: aleksandra.nocon@ue.katowice.pl

***Abstract:*** *Over the last decade, financial stability has become the overriding objective of central banks' monetary policy. Monetary authorities as well as governments paid particular attention to the need to maintain stability of the financial system. The main reason were the negative consequences of the global financial crisis as well as new types of risk, appearing as a result of financial markets and instruments development, increased financial institutions' propensity to undertake excessive risk and persistently high level of systemic risk. One of the visible signs of increased interest in the issue of financial stability is growing number of Financial Stability Reports (FSR), published by central banks. Moreover, after the outbreak of the global financial crisis, production of these reports is a rapidly growing "industry" (Čihák, 2006, p. 4; Čihák et al., 2012, p. 5). The main aim of the paper is the analysis of the evolution of the Financial Stability Reports (FSR) into more preventive tool for identifying how central banks contribute to financial stability and what kind of actions they undertake in this field. Moreover, the study points out that the Financial Stability Reports should be characterized by the proactive approach, which means that they should meet the changing external conditions, adapt to identified new areas of risk that may potentially have a negative impact on the financial system's condition, and at the same time systematically assess quality of central banks' actions, in order to improve them.*

*Keywords: financial stability report, central bank, monetary policy, communication system*

*JEL codes: E50, E52, E58*

## 1 Introduction

*Financial Stability Reports* (FSR) are a useful tool for identifying how central banks contribute to financial stability and what kind of actions they undertake in this field. However, the scope of information, as well as analyzes and results presented in the reports, are significantly different in individual central banks. Nevertheless, these reports are an evident research results, carried out by the monetary authorities to monitor condition of the financial system. They are also an important source of information about how central banks define financial stability, aims they intend to achieve, empirical data used, adopted assumptions and a set of instruments used to assess financial system stability. In addition, they are a significant tool for communication between a central bank and its environment.

The main aim of the paper is the analysis of the evolution of the *Financial Stability Reports* (FSR) into more preventive tool for identifying how central banks contribute to financial stability and what kind of actions they undertake in this field. Moreover, in the paper the main features of FSRs are identified.

Main motivation to undertake this topic were the previous conducted scientific research and their results, presented at the beginning of the 21$^{st}$ century. In particular, these were the results of survey concerning central banks' inflation reports, carried out by Fracasso, Genberg and Wyplosz (Francasso et al., 2003), the research of Allen, Francke and Swinburne (Allen et al., 2004) as well as Bowen, O'Brien, and Steigum (Bowen et al., 2003). Equally important were analyzes directly related to *Financial Stability Reports*, presented by Čihák (Čihák, 2006), conducted on the basis of reports published until 2006. However, they did not include development of FSR reports, observed after the outbreak of the global financial crisis, which significantly increased central banks' interest

in the need, or even the necessity of their preparation. Finally, the achievements of Čihák et al. (2012) were also used, who analyzed in detail the *Financial Stability Reports* of eight selected central banks in the period up to 2011.

## 2 Central banks' communication system

The appropriate functioning of modern economies - to a very large extent - depends on fast and smooth information flow between market participants. Communication is the process of precise information transmission, which allows to modify attitudes, knowledge resources, and thus trigger specific reactions by recipients of formulated message. As in social life, this phenomenon also plays an important role in the financial system, in which a central bank occupies an essential place (Sotomska-Krzysztofik and Szczepańska, 2006, p. 1). It should be noted that communication with the market and preservation of transparency of monetary authorities were not always considered as necessary or even desirable. Until the late 1990s, the dominated view in monetary policy was that full transparency would paralyze the effective functioning of a central bank and its intentions should not be fully disclosed. This theory was based on the belief that central bank's impact on the economy is only possible through an unexpected change of money supply, and an access to information leads to an increase of political pressures in terms of short-term interchangeability between inflation and employment, which can, in turn, lead to long-term inflation growth (Wesołowski and Żuk, 2011, p. 2). It was not until the adoption of flexible inflation targeting by central banks led to development of the concept of an active information policy. The public announcement of a clear, intended level of inflation has become a kind of social contract, which at the same time was a kind of a central bank's commitment to its implementation (Faust and Svensson, 1998, pp. 119-120). Thus, the new challenge required an introduction of instruments, allowing to form inflation expectations of economic operators and thereby increase a chance to achieve previously formulated objective (Pyka et al., 2016, pp. 114-115).

The global financial crisis has revealed that transparency of monetary authorities' actions in stabilizing market conditions plays a vital role. Therefore, apart from the existing instruments of central bank's communication, namely (Nocoń, 2018, pp. 153-154):

- inflation reports,
- current announcements on central bank's website,
- statements of central bank's representatives,
- *minutes of* a monetary policy committee *meeting,*
- voting results of a monetary policy committee,

central banks in recent years have undertaken new forms to communicate with stakeholders. They aimed at - on the one hand - implementation of preventive functions - so counteraction of new undesirable factors that may favor instability and, on the other hand, limitation of the effects of spreading destabilization.

Previous experience, in using a communication channel by central banks in monetary policy, indicates two different possibile models of communication with stakeholders:

- *ex ante* model,
- *ex post* model.

In the *ex-ante* model, the central bank's communication activities are undertaken even in periods of financial system stability. Monetary authorities regularly use communication tools to minimize a degree of information asymmetry and allow financial market participants to better understand and predict their actions. While, the *ex post* model refers to activities undertaken in conditions of a threat to financial system stability. A central bank, in order to maintain stability of financial markets, restricts distribution of information about current economic conditions. Information about reasons of implemented initiatives is revealed only after the end of danger, which allows for continuity in building credibility and confidence of the financial market to a central bank (Pyka et al., 2016, pp. 119-120).

## 3 Structure of *Financial Stability Reports*

The global financial crisis has intensified discussion among academics, practicioners and policymakers over the central banks' responsibility for financial stability. Monetary authorities, apart from fulfilling the monetary policy mandate, have been designated to achieve the purpose of financial system stability and - in many cases – also macro-prudential supervision. The need to create a macro-prudential policy framework, which aims to maintain stability of the financial system and control systemic risk, has become a common response to changes in the global financial environment. *Financial Stability Reports* have become a form of monetary authorities' reaction to their increased responsibility for the financial system. They are quite specific monetary authorities' communication tool. Central banks, responsible for financial stability as a public good, considered that – by this instrument - they expressed their readiness to support financial system stability. However, they directly engaged in control of the inflation target, defined in their strategies. In *Financial Stability Reports*, monetary authorities present current and most likely threats to financial system stability, and indicate actions that may pose a risk of moral hazard, thereby - by moral persuasion - affecting behavior of banking institutions.

Literature studies indicate that so far there are no one commonly used definition of *Financial Stability Reports*. However, it should be emphasized that majority of central banks in the world economy publish cyclical reports, which concentrate in broader or narrower terms on the financial system. However, not all studies dealing with the problem of financial system are considered as a *Financial Stability Report*. For the purpose of this paper, it was adopted a definition of a FSR proposed by M. Čihák in 2006, according to which an FSR is a regular, self-contained monetary authorities publication, that focus on risks and exposures in the financial system (Čihák, 2006, p. 5). This definition also indicates the key elements or features of the *financial stability reports*. These are (Čihák, 2006, pp. 5-6):

1. *Orientation on risks and exposures* - general central banks' publications (*annual reports*) presenting banking sector's results are not therefore classified as FSR reports, if they do not include types and exposure to risk in a given banking sector[6]. Moreover, some central banks publish separate reports on the structure of financial system and related issues, however they do not meet conditions for recognition as a *Financial Stability Report*[7].
2. *Systemic coverage* - *Financial Stability Reports* present aggregated data for the whole financial system. Therefore, studies focusing on the stability of individual institutions or groups of institutions are not considered as a FSR report. Although, some information presented in the *Financial Stability Reports* use data of individual entities, the results are presented in aggregate form and take up systemic issues, not concerning the condition of individual institutions. The systemic approach also reflects the role of central banks in financial regulation and supervision. In particular, when a central bank is also responsible for macro-prudential oversight.
3. *Publisher* - the vast majority of *Financial Stability Reports* are published by central banks. In just a few countries, financial system risk analyzes are made by a separate regulatory agency or a macro-prudential supervision institution. At the global level, reports on the stability of financial system are published by

[6] Some central banks publish two reports on risks and exposures of the financial system. For example, the European Central Bank prepares *the Financial Stability Review* and at the same time till 2010 it published *EU Banking Sector Stability*, which was mainly focused on banking sector stability of the European Union. In turn, the National Bank of Poland since 2001 until now publishes at the end of the year *Financial Stability Report*, considered to as the proper FSR report. However, till 2007 central bank of Poland also prepared half-year *Financial Stability Review*.

[7] The European Central Bank also publishes regular *Reports on financial structures* of banking sectors of the European Union countries. Although, they fulfill a very important function, they are not recognized as *Financial Stability Reports*.

international organizations, in particular the IMF (*Global Financial Stability Report*), but they are much more general than those developed in individual countries by central banks. There are also *Financial Stability Reports* prepared by private sector participants. However, these are usually single or one-off documents rather than cyclical publications that could be considered as FSR reports[8].

4. *Self-contained nature* - *Financial Stability Reports* are usually independent publications, prepared by monetary authorities. However, there are examples in which they are a part of another publication (e.g. an annual report or bulletin). Nevertheless, in order to qualify a text as a FSR report, it has to be relatively self-contained and have analytical depth. This means that a brief note, or information included in several paragraphs in an annual report, regarding banking sector development, does not qualify a document as a report on financial stability. At the same time, presentation of macro-prudential indicators with only a short comment is also not a basis for recognition as an independent FSR report[9].
5. *Regularity of publication* - in accordance to the above provided definition, *Financial Stability Reports* are regular publications (most often annual or semi-annual). Thus, one-off reports concentrate on the condition of financial system are not considered as a FSR report.

## 4 Evolution of the *Financial Stability Reports*

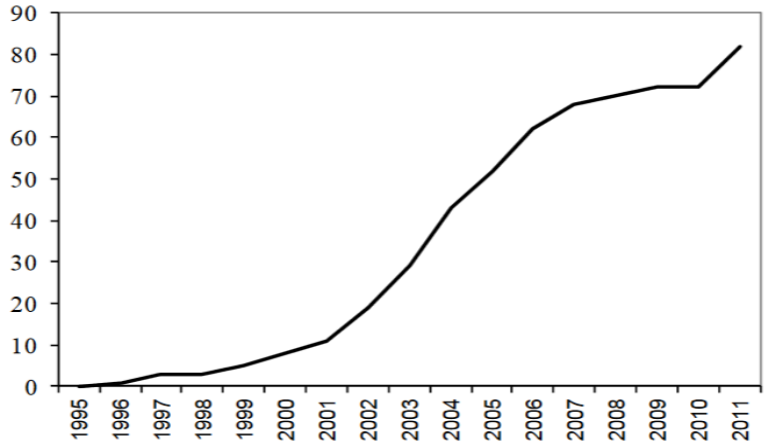
First *Financial Stability Reports* were published in the mid-1990s in the United Kingdom and several Scandinavian countries. In 2006, almost 50 central banks were preparing FSR reports. However, a particularly significant increase occurred after the global financial crisis, which revealed a strong need as well as the importance of analyzes regarding financial system condition and information, presented by monetary authorities for maintaining financial stability. Until 2008, most central banks developed information about financial stability only for internal purposes. After the escalation of the recent crisis, they decided to publish regularly results of their analyzes.

In 2011, as many as 80 countries of the global economy published reports on financial stability (see fig. 1). In some countries (e.g. in Norway and in the United Kingdom), except central banks, similar reports are developed by financial supervision authorities. On the other hand, in the euro area, *Financial Stability Reports* are published by the European Central Bank as well as all individual national central banks of the euro area countries.

[8] *Counterparty Risk Management Policy Group* is an example where private sector participants prepared *Financial Stability Reports*. The authors (practitioners from the leading Wall Street houses) presented recommendations for activities in three areas:
a) those that individual entities can and should take on at their own initiative,
b) those that can be undertaken only jointly, in mutual cooperation between companies,
c) those that require complementary activities by the public sector.
(Counterparty Risk Management Policy Group, 2005; Counterparty Risk Management Policy Group, 2008).

[9] On the other hand, until 2004, the Deutsche Bundesbank published a high-quality document on the stability of domestic financial system (covering a total of 80 pages in 2004), which was recognized as the FSR report, although it was only a chapter in the central bank's monthly report. However, in 2005 Deutsche Bundesbank has started publication of independent *Financial Stability Reports*.

**Figure 1** Number of Countries Publishing *Financial Stability Reports* in 1995-2011




Source: (Čihák et al., 2012, p. 6)

It is worth emphasizing that in the United States, which experienced very strong negative consequences of the global financial crisis, the Federal Reserve System only in 2011 began publication of FSRs[10]. For many years, it had been outside the main stream in this issue. There are also examples of central banks in the world, which for various reasons have ceased publishing them. Bank of Israel ceased issuing FSR reports as a separate document in 2005, presenting data on financial stability in the *Israel's Banking System – Annual Survey*. Banque de France also finished publication of the reports in 2007, conducting analyzes of financial risk assessment solely for internal purposes. Although, central bank of France started publication of the *Financial Stability Review* on its website, it is only a compilation of articles or conference materials (prepared by academics, experts and financial industry leaders looking at the challenges to financial stability), rather than a regular report, presenting the assessment of financial system stability. In turn, Central Bank of Ireland just after the outbreak of the global financial crisis in 2008 suspended publication of the reports (available in 2004-2007). On the other hand, there are also central banks in the global economy, which until 2019 do not publish the FSR reports. However, there are also many those, which prepare many additional analyzes, extremely important from the point of view of financial stability, which effects are not presented in the reports.

Lack of harmonized standards, rules or provisions in the form of a code of good practice makes standardizing *Financial Stability Reports* difficult. It is also the main reason of undertaking the scientific research in this field. At the beginning of the 21st century, research works on the assessment of reports, prepared by central banks, were conducted by Fracasso, Genberg and Wyplosz (Francasso et al., 2003). However, they have studied inflation reports on the example of 19 central banks. In the research, they assessed quality of these reports, applying criteria related to:

- clarity,
- consistency and
- coverage of key issues,

paying particular attention to:

- reports' objectives,
- decision-making process,
- analytical framework,
- data used,

[10] However, FSR reports in the United States are published by the *Financial Stability Oversight Council* (FSOC) - a macro-prudential supervision authority. And although the Federal Reserve System is represented in this committee, it is - unlike the majority of central banks in the world - not the only author of *Financial Stability Reports*.

- presentation or assessment of previous forecasts.

As a result, they proved a positive correlation between quality of these reports and monetary policy predictability.

Against this background, Čihák (2006), using the achievements and methodology proposed by Fracasso et al. (2003), published research results on *Financial Stability Reports*. However, at that time - before the global financial crisis, the number of central banks that published FSR reports was significantly lower. Čihák (2006) focused the research on the analysis of FSR reports also from the point of view of their clarity, consistency and coverage, describing it as *CCC Framework* (Čihák, 2006, p. 13). The central banks' reports that were a subject of his research, were then evaluated according to the above criteria, taking into account:

- objectives to be achieved,
- general assessment of the financial system condition presented in a specific report,
- undertaken issues,
- empirical data,
- adopted assumptions,
- tools used, as well as
- additional features characterizing, for example, structure of a given report.

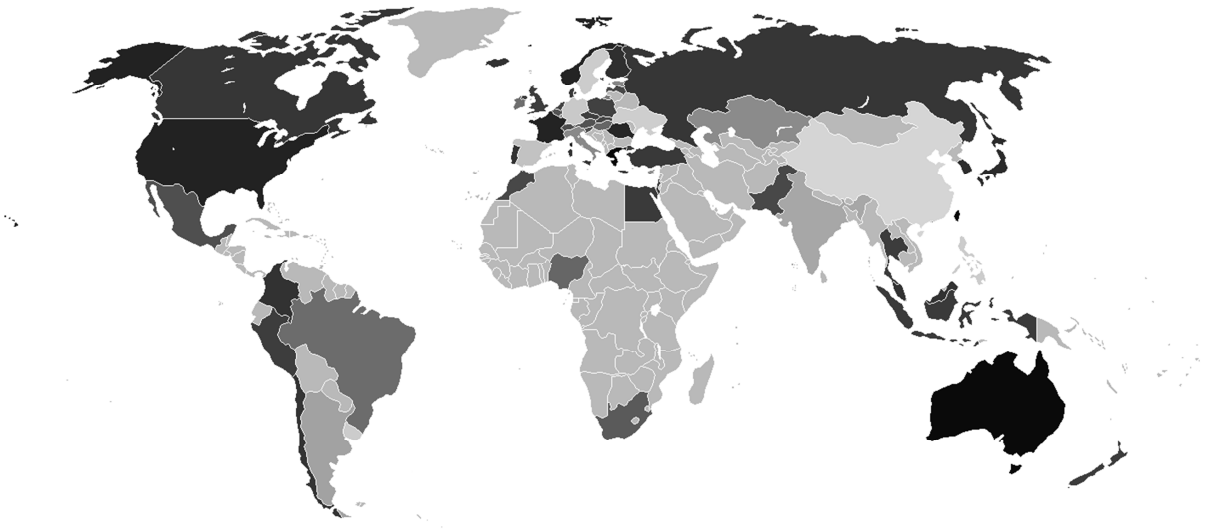
Even then, he drew attention to many aspects that should be improved in the *Financial Stability Reports* and a need to their standarization.

Further research carried out before the outbreak of the global financial crisis, undertaken by Oosterloo, de Haan and Jong-A-Pin (Oosterloo et al., 2007, pp. 337-355) on cross-country *Financial Stability Reports*, did not show a clear relation between publication of FSR reports and financial stability. Intensification of research, discussions and analyzes regarding legitimacy of developing and publishing FSR reports, as well as their optimal contents, occurred after the outbreak of the recent crisis. It was considered that the early identification of risk, threatening financial stability, awareness of a need for systematic monitoring, and undertaking actions to minimize it, is an extremely important task for monetary authorities. It is also an important tool in central bank's communications system, apart from commonly used: cyclical inflation reports, central bankers' speeches, as well as minutes, publication of voting results and *forward guidance* policy, implemented at that time. Born, Ehrmann and Fratzscher (Born et al., 2011) also indicated that monetary authorities communication through the FSR reports reduces market volatility. Thus, it seems to be an important channel not only in central bank's communication system with stakeholders, but also as a tool for stabilizing financial markets.

Čihák et al. (2012), analyzing FSR reports after the global financial crisis, also indicated their important role as a tool to monitor financial stability and thus an effective macro-prudential policy instrument (Čihák et al., 2012, p. 4). They also emphasized that these reports provide detailed information and analytical results, with particular emphasis on central banks' experience after the recent crisis. However, despite some improvements, *Financial Stability Reports* still tend to leave much to be desired in terms of clarity, coverage of key risks, and consistency over time, confirming the conclusions formulated by Čihák in 2006. Čihák et al. (2012) also pointed out that the main disadvantage of FSR reports is the lack of 'forward-lookingness', which means insufficient analysis of risks and threats to stability of the financial system, and thus makes them less efficient to assess systemic risk.

Nowadays, based on financial stability center more than 60 countries publish FSRs regularly. These reports cover 24 advanced and 36 emerging economies (see fig. 2).

**Figure 2** Countries which Publish *Financial Stability Reports* Regularly (as of 2019)



Source: own work based on Center of Financial Stability data

*Financial Stability Reports* are a rich source of information on the financial systems' structure, recent trends in banking and finance, and the impact of the global economy on local markets. For policymakers, FSRs are an important communication tool, a platform to explain their concerns about the financial system to a wider audience, to set down benchmarks for tracking risk in a country, and to present new approaches to regulating the financial system (Center of Financial Stability, 2019).

## 5 Conclusions

The presented above scientific achievements are therefore a main premise for undertaking research on standardization of the Financial Stability Reports, prepared and published by central banks. The article presents the results obtained from preliminary research, which will be expanded into direction to indicate the role and significance of the FSRs in preventing banking sectors' instability. In the previous research, the optimal, relevant features or elements, that the FSR reports should contain, have not been indicated. Nevertheless, Financial Stability Reports should be characterized by the proactive approach. It means that they should meet the changing external conditions, adapt to identified new areas of risk that may potentially have a negative impact on the financial system's condition, and at the same time systematically assess quality of central banks' actions, in order to improve them. Thus, they will effectively supplement the central banks' coomunication tools, becoming an important source of information for banks, other financial instututions, governments and policymakers, market participant as well the whole enviornment.

## References


Allen, F., Francke, L., Swinburne, M. W. (2004). *Assessment of the Riksbank's Work on Financial Stability Issues*. Penning – och Valutapolitik, 3/2004, Stockholm: Sveriges Riksbank. Retrieved from: http://archive.riksbank.se/Upload/Dokument_riksbank/Kat_publicerat/PoV_sve/sv/2004/pv2004_3.pdf.

Born, B., Ehrmann, M., Fratzscher, M. (2011). Central Bank Communication on Financial Stability. *ECB Working Paper,* No. 1332, Frankfurt: European Central Bank.

Bowen, A., O'Brien, M., Steigum, E. (2003). *Norges Bank's Financial Stability Report: A follow-up review.* Oslo: Norges Bank. Retrieved from: https://www.norges-bank.no/globalassets/upload/artikler/fs_review2006.pdf.

Center of Financial Stability (2019). *What is the Role of a Financial Stability Report?* Retrieved from: http://www.centerforfinancialstability.org/fsr.php?.

Čihák, M. (2006). How Do Central Banks Write on Financial Stability? *IMF Working Paper* WP/06/163, June.

Čihák, M., Muñoz, S., Teh Sharifuddin, S., Tintchev, K. (2012). Financial Stability Reports: What Are They Good For? *IMF Working Paper* WP/12/1, January.

Counterparty Risk Management Policy Group (2005). *Toward Greater Financial Stability: A Private Sector Perspective.* The Report of the Counterparty Risk Management Policy Group II, New York, July 27.

Counterparty Risk Management Policy Group (2008). *Containing Systemic Risk: The Road to Reform.* The Report of the CRMPG III, New York, August 6.

Faust, J., Svensson, L. (1998). Transparency and Credibility: Monetary Policy With Unobservable Goals. *Working Paper,* No. 6452, Cambridge: National Bureau of Economic Research.

Fracasso, A., Genberg, H., Wyplosz, Ch. (2003). *How do Central Banks Write? An Evaluation of Inflation Targeting Central Banks*. CEPR/Geneva Reports on the World Economy*,* Special Report 2. Retrieved from: https://cepr.org/sites/default/files/geneva_reports/GenevaP161.pdf.

Nocoń, A. (2018). *Normalization of Modern Monetary Policy*. Uni-edition GmbH, Berlin, pp. 153-154.

Oosterloo, S., de Haan, J., Jong-A-Pin, R. (2007). Financial Stability Reviews: A First Empirical Analysis. *Journal of Financial Stability*, No. 2.

Pyka, I., Nocoń, A., Cichorska, J. (2016). *Nadzwyczajna polityka monetarna banków centralnych a stabilność sektora bankowego*. Katowice: University of Economics in Katowice Publishing House.

Sotomska-Krzysztofik, P., Szczepańska, O. (2006). Polityka informacyjna banków centralnych jako element wspierania stabilności systemu finansowego. *Materials and Studies*, Issue 200, Warsaw, January.

Wesołowski, G., Żuk, P. (2011). *Rola komunikacji banków centralnych z otoczeniem*. NBP, Economic Institute, Monetary Policy Strategy Office, Warsaw, November 29.

# Investment in Land – Strategic Decision

**Josef Novotný[1], Renáta Myšková[2]**

[1] University of Pardubice
Faculty of Economics and Administration, Institute of Business Economics and Management
Studentská 95, 532 10 Pardubice, Czech Republic
E-mail: josef.novotny@upce.cz

[2] University of Pardubice
Faculty of Economics and Administration, Institute of Business Economics and Management
Studentská 95, 532 10 Pardubice, Czech Republic
E-mail: renata.myskova@upce.cz

***Abstract:*** *Nowadays, there is a significant loss of arable land both on a global and national scale and that is why this production factor is becoming an interesting investment tool for the investor public also in the Czech Republic. A problem that occurs in the Czech market environment is the lack of knowledge of the issues related to the investment plans into this asset by the domestic as well as foreigner investors and the uncertainty in the decision-making and the assessment on how strategically profitable it is to own land. The article points out the investment opportunities in land in real form and disadvantages of land ownership resulting from valid legislation of the Czech Republic and from the supply and demand in the land market. The key attributes that encourage the interest in this asset by the investors and speculators are described, and it is shown, using model examples, how the current legislative and market conditions reflect in the price of land and if it is strategically appropriate for the landowners to keep the land or sell it. Given the fact that the Czech investor environment has an absolute lack of finance index of this asset, a methodology of land index creation is designed.*

*Keywords: Land, Investment, Finance index, Investor, Production Factor*

*JEL codes: G10, M21, Q24, R30*

## 1 Introduction

The land is a specific factor of production without which man is not able to sustain its existence and it was the land management that led to the emergence of the first comprehensive and organised economic sector which later became agriculture. Nowadays agricultural land is considered to be a key factor of global character, which is becoming more and more interesting for investors. Investor public understood that it is an undervalued investment with a significant potential which can generate a lot of revenues in the future. Investment in land offers many investor and business opportunities, both in real and finance form. Investment in land in real form is linked to improvement and expansion of business activity in plant or animal production, to develop property for business or commercial purposes including rent and also for speculative purposes with this asset. The land is becoming an important factor which influences several industries, especially the construction and related investment products. Land, like any other investment, comes with a certain level of risk.

In the context of agriculture, the business risk is among others related to global warming in the world which is reflected in reducing revenue from land in some areas as a result of climate change and unforeseen natural events. There is also a loss of agricultural land as a result of developers´ efforts to change its use and use it for commercial purposes. The interest in land ownership is also connected to the process of globalisation and not only associated with the establishment of multinational corporations, but also with the migration of inhabitants in certain parts of the world. As a result of factor of production the worldwide population explosion and unsuccessful land interventions, there are already some countries that are significantly dependent on the import of agricultural commodities and their dependency is only further deepening. This strengthens the investment plans of speculators. So far, the Czech Republic has enough agricultural land

in relatively good quality, even though a fair amount of it is disappearing every day. The aim of this article is to draw attention to the investment possibilities of this asset in real form, to describe advantages and disadvantages of these investments from investor´s long-term perspective and to assess whether it is reasonable or not to own or sell land under current conditions using a model example. Investors who invest in land in the Czech market environment have very limited and difficult conditions to obtain information in comparison to the amount of information on the joint-stock market, i.e. because of the lack of a land index. That is why the calculation of the land index is suggested further in this article.

Turral et al. (2010) define investment as an expenditure that creates conditions for the production of economic outputs. Investors who invest in land in the Czech market environment have very limited and difficult conditions to obtain information. Unlike the positive influence of dividend policy of joint-stock companies on stock purchase, see Sejkora and Duspiva (2015), land in real form lacks this aspect; however, it is necessary to realize that it gives back additional revenue to the investors in the form of annuities. Land annuities in the Czech Republic are ranging between 2 and 3 % but it is stable in time. We shall not forget the relation of investors towards the risk, their economic conditions, education, age, profession and the gender gap. (Mohammadi and Shafi, 2018)

The Czech Republic is considered to be a very developed country, but there is a lack of information on the land market. The land is a factor of production of a global character; therefore, its pricing policy is, according to the authors, influenced by other factors which lead to degradation and loss of soil, such as population growth and climate change in the world. This opinion is underlined by Meij et al. (2018), who claim that demand for agricultural products is influenced more by the population growth than GDP performance, and between 2020 and 2050 they, for instance, expect an increase of the consumption of animal commodities by 20 per cent. According to Domanski and Heath (2007), the interest from speculators in commodity markets will rise.

The positive aspect of the real form of land is that it is over-inflationary because the production of agricultural commodities is underway in all stages of the economic cycle. Furthermore, land does not have any production cost, according to Walpole et al. (1996), and it can be sold or rent can be collected from it. Due to societal changes also land in the rural areas is interesting (Alig and Kline, 1999), where residential, commercial and industrial development takes place as it does in urban areas. The disadvantage of land is its immovable character (Christophers, 2016), in other words, it cannot be transported as it is possible with agricultural commodities. This is complemented by Hubacek and Bergh (2006), who draw attention to the fact that land is not time constant. This inconstancy is caused by human intervention.

## 2 Methodology

To assess the investment opportunities and characteristics of the investment in land the research of academic literature was conducted, which included data from open databases to assess the investment potential of land; based on analysis and synthesis of the findings about the advantages and disadvantages of investments in land from investor´s long-term perspective taking into account the specifics of investment in land. Based on the assessment of the current situation, a complex indicator for evaluation of the land market is missing, that is why the methodology for the creation of Land price index is suggested. There are model examples created comparing the market and official prices of land that take into account the possibility of getting a subsidy. These examples can be used by the landowner to assess whether under current conditions it is better to keep the land or sell it. Taking into consideration all of the above, a research question was formulated: Is it more profitable to own or sell the land under current economic conditions in the Czech Republic?

## 3 Data and problem solving

To answer the research question it is necessary to determine the land potential in the Czech Republic.

In the Czech market environment, land investment opportunities in the real form have the longer tradition than in the financial form. In the case of investment into real land for appreciation of property assets, there are two options: first – to use the land for speculation, with the assumption that the price will rise or the land use plan will be changed or the land will be newly determined as industrial zone; second – to rent the land and collect annuities.

Investment in land for speculative purposes is riskier than renting, however, Czech land offers a high speculative potential in comparison with land in other countries. There are several key factors that back up speculative investments. First one of them is the price of Czech land which is significantly undervalued in comparison to some other countries; see Table 1 (Eurostat, 2018).

**Table 1** Comparison of one hectare of land in selected countries in 2016

| Country | Price for one hectare (EUR) | Comparison with CZ, in absolute terms (EUR) | Comparison with CZ, in absolute terms (%) |
|---|---|---|---|
| **the Czech Republic** | 5,463 | | |
| **Poland** | 9,100 | + 3,637 | + 66.55 |
| **Slovenia** | 17,136 | + 11,673 | + 213.67 |
| **Denmark** | 21,202 | + 15,739 | + 288.10 |
| **Netherlands** | 62,972 | + 57,509 | + 1,052.70 |

Source: own data processing based on Eurostat, 2018

The market differences between the Czech Republic and foreign countries are substantial which contributes to the speculators´ interests also from abroad. For the sake of completeness we point out there are countries in Europe where the price for a hectare of land is lower than in the Czech Republic, for example, Bulgaria 3,937 EUR/ha, Estonia 2,735 EUR/ha and Croatia 2,809 EUR/ha. (Eurostat, 2018)

Another speculative factor is the population growth in the world which influences the growing consumption of agricultural commodities. According to the data from the Český Fond půdy (2018), there may be only 0.18 hectares of land per capita in 2030 or even less. In the Czech Republic as well as in other European countries the population grows overall not only due to birth dates but mainly as a result of migration processes. In 2017, the number of inhabitants in the Czech Republic reached 10,610,000, i.e. increase by 31,000 inhabitations per year (ČSU, 2017) and this trend will probably be maintained. In the Czech Republic as of 31.12.2017, there were 7,887,027 hectares of land, of which 4,205,288 hectares were agricultural and 3,681,739 hectares non-agricultural (ČSU, 2017). This means 0.74 hectares of land per capita and only 0.4 hectares of arable (agricultural) land per capita. Prolonging life expectancy and increase in the standard of living also contribute to the trend as well as the construction industry as residential property business booms. For the investor public in the Czech market environment, a certain shortcoming is the fact that there is no complex indicator for evaluation of land market state and price trend of this factor of production.

**Suggestion of the Index for land price**

The goal of the index is to summarise the performance and risk of the researched asset into one number in the most objective way possible. The method of creating an index for the land price which would facilitate investment decision-making is described in four steps.

1. To create the index basis, selection of quality locations must be put into a basket which is the index basis. This should be done in a way so it reflects the land market most

accurate possible. A number of selected locations: for example 10, with agricultural land. The index basis is constant for a certain time and the size of the basis is determined for that day.

2. Determination of the land price exchange rate in selected agricultural locations with good quality land that is in the basket, including the day for which will be taken into account for the calculation of the index.

3. Determination of the method of calculation of market capitalization $B_t$ and $B_0$ using weighted average market prices in selected agricultural locations per one hectare of land, including the determination of starting period $t_0$. This method of calculation is based on the market price of land between 15 and 40 CZK per $m^2$ in 2017 (Farmy, 2018).

4. Determination of the formula for the calculation of the index. Its advantage is that it takes into account time as one of the factors because then it shows not only the current state of the market but also the change in market prices in absolute terms (market trends) for a certain time period. The final formula for the index is:

$$I_t = (B_t/B_0) \times V \quad (1)$$

$I_t$ – land index value in time t,

$B_t$ – market capitalization of the basis in time t,

$B_0$ – market capitalization of the basis on the starting date of the index determination (in time $t_0$),

V – starting point value.

It is recommended to use 10,000 points as starting point value, given the fact that 1 hectare is 10,000 $m^2$. This reflects the reality in the land market the best.

In the model example below the Land price index is calculated using data in Table 2. In total 12 locations were used for the basis and then an average market price per hectare was calculated for selected areas and multiplied by the total number of hectares in the selected location. That is how the market capitalisation was obtained. After that, the individual market capitalisations from all selected locations were summed up and that is how the total market capitalisation of the basis was calculated. This is also the market capitalization basis of the starting date for the index setting. The ratio of the market capitalizations is multiplied by the starting point value of 10,000 points. Data on the average market prices are valid as of January 2017 (Farmy, 2018), the number of hectares of agricultural land in selected locations as of 31st December, 2016 (CUZK, 2017).

**Table 2** Determining of the market capitalization of the starting date to calculate the Land price index

| Location | The average market price for 1 hectare in CZK | Amount of hectares of agricultural land in a selected location | The market capitalization of the location in thousands of CZK | Weight in % |
|---|---|---|---|---|
| **Břeclav** | 270,000 | 26,174 | 7,066,980 | 5.13 |
| **Cheb** | 315,000 | 28,367 | 8,935,605 | 6.48 |
| **Kolín** | 315,000 | 42,504 | 13,388,760 | 9.72 |
| **Kroměříž** | 315,000 | 31,864 | 10,037,160 | 7.28 |
| **MB** | 270,000 | 51,095 | 13,795,650 | 10.01 |
| **Mělník** | 270,000 | 28,305 | 7,642,350 | 5.55 |
| **Nymburk** | 270,000 | 24,957 | 6,738,390 | 4.89 |
| **Prostějov** | 315,000 | 43,289 | 13,636,035 | 9.90 |
| **Přerov** | 315,000 | 29,463 | 9,280,845 | 6.73 |
| **Tachov** | 315,000 | 43,132 | 13,586,580 | 9.86 |
| **Vyškov** | 315,000 | 24,263 | 7,642,845 | 5.55 |

| | | | | |
|---|---|---|---|---|
| **Znojmo** | 315,000 | 82,711 | 26,053,965 | 18.91 |
| **Total** | | 456,124.00 | 13,7805,165 | 100.00 |

Source: own data processing

The market capitalization of the basis on the starting day of the index setting is 137,805,165,000 CZK as of January 2017.

The data in Table 3 is used to determine the current value of the index as of January 2018 and the source of it is the price map (Farmy, 2018). Number of hectares of agricultural land in selected locations was valid as of 31. 12. 2017 (CUZK, 2018).

**Table 3** Determination of the market capitalization of the basis of the Land price index

| Location | The average market price for 1 hectare in CZK | Number of hectares of agricultural land in a selected location | The market capitalization of the location in thousands of CZK | Weight in % |
|---|---|---|---|---|
| **Břeclav** | 310,000 | 26,171 | 8,113,010 | 4.82 |
| **Cheb** | 360,000 | 28,342 | 10,203,120 | 6.06 |
| **Kolín** | 410,000 | 42,493 | 17,422,130 | 10.35 |
| **Kroměříž** | 405,000 | 31,861 | 12,903,705 | 7.67 |
| **MB** | 370,000 | 51,070 | 18,895,900 | 11.22 |
| **Mělník** | 280,000 | 28,301 | 7,924,280 | 4.71 |
| **Nymburk** | 325,000 | 24,953 | 8,109,725 | 4.82 |
| **Prostějov** | 465,000 | 43,270 | 20,120,550 | 11.95 |
| **Přerov** | 405,000 | 29,458 | 11,930,490 | 7.09 |
| **Tachov** | 310,000 | 43,102 | 13,361,620 | 7.94 |
| **Vyškov** | 395,000 | 24,265 | 9,584,675 | 5.69 |
| **Znojmo** | 360,000 | 82,698 | 29,771,280 | 17.69 |
| **Total** | | 455,984.00 | 168,340,485 | 100.00 |

Source: own data processing

Market capitalization basis ($B_t$) as of January 2018 was 168,340,485,000 CZK, market capitalization basis of the starting date ($B_0$) was determined to 137,805,165,000 CZK and the starting point value to 10,000. So the Land price index is the following:

$I_t = (B_t / B_0)*10,000 = (168,340,485,000 / 137,805,165,000) * 10,000 = 12,215.83$

Value of the Land price index, therefore, increased from April 2017 to August 2018 by 2,215.83 points, i.e. by 22.16 %. Given the one year period, it can be said that this is an investment with good prospects. This is underlined by the inverse relation of the number of hectares of land and the increase in the prices of land in selected locations. Tables 2 and 3 show that in April the selected locations had 456,124 hectares, but a year later they had 140 hectares of agricultural land less, which is 455,984 hectares. Furthermore, it is necessary to periodically recalculate the percentage for each location because any change in the percentage of the basis of the index can significantly affect the increase or decrease of the Land price index.

**Assessment of the investment in land from the investor´s perspective**

Land-related intentions influence investor's decision-making. It can be either an active farmer or landowner who uses the land for rent. In both cases, it is favourable to combine as many hectares of land as possible as it makes the investment more profitable. Recommended minimum for investment purposes is 10 ha which is not easy at all in the Czech market environment because an area of 10 ha is owned, by average, by 30 owners.

When assessing the investment in terms of its implementation or its rejection it is necessary to evaluate whether the investment can produce the expected benefit. In

connection to the information above, there was one balance sheet model that uses historical prices selected as a starting point. The carrying value of the asset (in the balance sheet model as the value of the asset), in this article referred to as the theoretical value of land, is determined based on the prices of land in the Czech Republic.

There are two types of prices for land in the Czech Republic, firstly the official price and secondly the price of land according to the cadastral area. The official price serves for tax purposes, for selling and buying land that is owned by the state and for the changes in land use. The official prices are updated based on qualitative changes in land characteristics and subsequent changes in the BPEJ (bonited soil-ecological unit) as well as the development of the situation in market relations and expenses. The price of land according to the cadastral areas is used to determine the property tax (land tax) to set the amount of annuity for land that is a part of the agricultural land fund in cases when the owner and the renter do not agree on its rental price and to determine the purchase price for the transfer of agricultural and forest land from the state ownership to another entity. In this article, the theoretical price of land is calculated using the official price.

Generally, if the ratio of the actual market price per 1 $m^2$ of land to the theoretical determined price of land per 1 $m^2$ is higher than 1, then in at that time the investors value the land more than it is valued by the state – therefore it is profitable to own the land. In practice, it is necessary to modify this assessment because the selling and buying of land are not by 1 $m^2$, but areas much larger and usually the land quality caries, even within a few acres of land.

The land quality is assessed by BPEJ (bonited soil-ecological unit). The authors express the Price-to-Theory Value ratio (PTV) of the above-mentioned facts in the mathematical formula:

$$\mathrm{PTV} = \frac{\mathrm{PV}}{\sum_1^{\mathrm{n}} \mathrm{w_i}\ \mathrm{TV_i}} \qquad (2)$$

PV is Price (marketed) value of land for the total area,

$w_i$ is the weight of the i sub-area when taking into account its quality, expressed as % of the area of the total area,

$TV_i$ is the quality of i area in official price per $m^2$,

n is a number of sub-areas with various quality.

In the case of land ownership as a part of business property, the calculation will simplify. The carrying amount of asset (in theoretical land price model) will be expressed as the cost of land acquisition which does not change (because according to the Czech legislation the historical prices are used and the land belongs to the assets that cannot be depreciated). It is true that if an indicator PTV shows the value higher than 1, the land is over-appreciated; the current owner should not consider selling it. For a potential investor, the investment is not profitable. However, let´s not leave out other aspects that decide about the ownership change, such as financial distress, speculative intention, and others. An owner or potential investor assesses the amount of profitability of an investment compared to alternative profitability of other investments. In the Czech Republic, the profitability is determined by the land annuity of 2-4 %, according to the cadastral areas. The profitability of an investment is different for a landowner, an active farmer (tenant or owner) as a result of subsidies (especially so-called direct payments) that are provided for entities in the agricultural sector.

**Case study: profitability of sale or purchase of land?**

The real situation accepts both official and market price in the Czech Republic valid as of January 2018. Land – arable land – is located in the Polabská lowland and its area is 169,710 $m^2$. Other data are stated in Table 4, in connection to Formula 2. Market price in this area ranges between 26-36 CZK/$m^2$. The buyout offer in January 2018 was 5,261,010 CZK, i.e. 28 CZK/$m^2$ (data obtained from an anonymized source). The land is currently rented, at 3 % of the official price of land which is 10.20 CZK/$m^2$ in the

cadastral area (CUZK, 2018). The tenant pays the land tax and that is why the annuity is increased by the amount of the annual tax, so the net annual yield of 3 % can be considered only while maintaining the current situation (see Table 4).

**Table 4** Market and official price of land, annual annuities

| | BPEJ | The area in $m^2$ ($TV_i$) | Price for $m^2$ ($w_i$) | Total official price | Market price | Annual annuities |
|---|---|---|---|---|---|---|
| | 32,051 | 52,210 | 7.28 | 380,088.8 | | |
| | 32,001 | 22,010 | 9.34 | 205,573.4 | | |
| | 31,000 | 82,650 | 17.92 | 1,481,088 | | |
| | 31,010 | 12,840 | 16.52 | 212,116.8 | | |
| **Total** | | 169,710 | | 2,278,867.8 | 5,261,010 | 68,366 CZK |

Source: own data processing

Current market price is considerably higher than the official price (Table 4), so PTV = 5,261,010/2,278,867.8 = 2,3. Again, if PTV is bigger than 1, then it is profitable to sell the land. Rental contracts are concluded for approx. 10 years, the rent does not increase during the duration of the contract, so the landowner receives 383,660 CZK in this time period (so his revenues do not cover the difference between market and official price). However, it is important to take into consideration the risk related to holding of this asset at the minimum and the revenue of 3 % in the current situation is interesting for the landowners. Moreover, in the case of proper care, the value of land does not decrease and its market price in the Czech Republic grows steadily (as the suggested Land price index shows). Therefore the market value can be predicted using the actual market price and trend which is obvious from the Land price index. If it is an individual owner, then decision making plays an important role in whether to sell the land, as well as the economic situation, age, family members and other subjective factors.

Why there is a significant investors´ interest in land for ´theoretically´ very unfavourable price? Because of all the reasons stated above, especially when buying land with speculative intentions. Furthermore, the loss of agricultural land threatens the business of agricultural cooperatives who face buyouts by foreigner investors. From the perspective of farmers, unified payments for the farmers are also important. The payment rate for agricultural land is 3,388.15 CZK per hectare in 2018. The subsidy policy together with the quality of land provides a good prerequisite for a successful entrepreneurial activity.

## 4 Results and Discussion

The land fun in the Czech Republic is decreasing due to the change of purpose of land in the surrounding residential and industrial zones. The price of land compared to other countries is still low, whereas the quality of land in the Czech Republic is very high. Therefore the demand exceeds the supply and the land is becoming a strategic investment. A complex indicator for evaluation of land market is missing, that is why there is a suggested methodology for the creation of Land price index which can be described as an indicator suitable for the market with this asset. Based on the results stated above, it is obvious that the value of land assessed using this index is increasing and it is a very profitable asset. The authors are aware of the fact that the observed time period is not very long, however, there is not enough data from previous years to assess a longer time period. It is absolutely clear that the market price of land significantly exceeds its official price which is due to the growing demand for this asset. There is no clear answer to the research question because the approach of the investor and the owner plays a great role in it, and not only when it comes to expected revenue. Apart from the high market price of land in the Czech Republic, the most important factors are psychological factors that decide on the sale of land of individual owners. In the case of active farmers, there is mostly the effort to meet their need which is to ensure a

sufficient amount of this factor of production that is in the risk of transferring ownership to a foreign entity.

## 5 Conclusions

Land can be seen as a specific factor of production that shows zero or minimal depreciation but also as a strategic asset which generates profit for its owner in the form of rent and provides revenue for its use as a result of their business activities. At the same time, it is a very profitable investment for which we can assume appreciation in the future. Therefore investment in land may have a speculative character and it is necessary to observe the price trend of this asset. Unfortunately, there is not enough information available so far to compare the price trend in time and space in individual locations in the Czech Republic. There are only partial data for the past two years.

## References


Alig, J. R., Kline, D. J. (1999). Does Land Use Planning Slow the Conversion of Forest and Farm Lands? *Growth and Change,* vol. 30, pp. 3-22.

Český statistický úřad (ČSU) (2017). *Vybrané demografické údaje v České republice.* Retrieved from: https://www.czso.cz/documents/10180/61508910/32018118_0101.pdf/14cb0350-e7ce-44c4-a6ee-5f53614c6b94?version=1.0.

Český úřad zeměměřický a katastrální (CUZK) (2018). *Nahlížení do katastru nemovitostí.* Retrieved from: https://nahlizenidokn.cuzk.cz/.

Český úřad zeměměřický a katastrální (CUZK) (2018). *Ročenky půdního fondu 2017 a 2018.* Retrieved from: https://www.cuzk.cz/Periodika-a-publikace/Statisticke-udaje/Souhrne-prehledy-pudniho-fondu/Rocenka_pudniho_fondu_2018.aspx.

Domanski, D., Heath, A. (2007). Financial Investors and Commodity Markets. *BIS Quarterly Review,* March 2007, pp. 53-67.

Eurostat (2018). *Agricultural land prices by region*. Retrieved from: http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=apri_lprc&lang=en.

Farmy (2018). *Zpráva o trhu s půdou leden 2018.* Retrieved from: http://www.farmy.cz/dokumenty/ZPRAVA-o-trhu-s-pudou-FARMYCZ-leden-2018.pdf.

Fond půdy (2018). *Výměra půdy na 1 člověka.* Retrieved from: http://www.fondpudy.cz/.

Hubacek, K., Bergh, J. (2006). Changing concepts of 'land' in economic theory: from single to multi-disciplinary approaches. *Ecological Economics,* vol. 56(1), pp. 5–27.

Christophers, B. (2016). For real: land as capital and commodity. *Transactions of the Institute of British Geographers,* vol. 41(2), pp. 134-148.

Meij, H., Havlík, P., Campen, H. L., Stehfest, E., et al. (2018). Comparing impacts of climate change and mitigation on global agriculture by 2050. *Environmental Research Letters,* vol. 13(6), pp. 1-19.

Mohammadi, A., Shafi, K. (2018). Gender differences in the contribution patterns of equity-crowdfunding investors. *Small Business Economics,* vol. 50(2), pp. 275-287.

Sejkora, F., Duspiva, P. (2015). The Position of Management of Czech Joint-Stock Companies on Dividend Policy. *Economics and Management,* vol. 18(2), pp. 73-88.

Turral, H., Svendsen, M., Faures, J. M. (2010). Investing in irrigation: Reviewing the past and looking to the future. *Agricultural Water Management,* vol. 97(4), pp. 551-560.

Walpole, S., Sinden, J., Yapp, T. (1996). Land quality as an input to production: the case of land degradation and agricultural output. *Economic Analysis and Policy,* vol. 26(2), pp. 185–207.

# Identifying of the Expectations of Stock Trading Participants for the Diagnosis of Financial Market Environment Using the Online Analysis of an Order Book

**Sergey Petrov[1], Nadezhda Yashina[2], Oksana Kashina[3],**

**Nataliya Pronchatova-Rubtsova[4], Mikhail Rogozin[5]**

[1, 2, 3, 4, 5] Lobachevsky State University of Nizhny Novgorod
Institute of Economics and Entrepreneurship, Department of Finance and Credit
Bolshaya Pokrovskaya street 37, 603000 Nizhny Novgorod, Russian Federation
E-mail: [1]petrov_ss@list.ru, [2]sitnicof@mail.ru, [3]oksana_kashina@mail.ru, [4]pronat89@mail.ru, [5]Mikhail.V.Rogozin@gmail.com

***Abstract:*** *Modern trading platforms made it possible to monitor the exchange auction of counter orders in real time that opened up an access to valuable information on many intramarket processes and the emergence of new market price trends. The paper aims to develop an original approach permitting to discover stock market players' expectations with regard to the future share price dynamics. The theoretical framework is based on the microeconomic model of individual trader's net demand proposed in the authors' previous studies. The model explains conditions under which traders place either limit or market orders to buy and to sell stock. It associates price and volume of any limit order with the capital capacity of the trader's net demand which is viewed as an indicator of the trader's holding of the given stock. In this way it becomes possible to construct an algorithm for monitoring of holdings of stocks owned by traders responsible for the separate quotes in the order book. As an application of the algorithm an example is considered signaling about market participants' expectations of a share price rising at a given point in time. The experimental procedure proposed in the paper involves the ongoing analysis of instantaneous data of the trading platform that are displaying by an order book for stock. Some variants of computerizing of the algorithm are discussed aiming to implement it for the monitoring of financial market environment. The methods developed are of interest either for portfolio investors and high-frequency traders or for national regulators of financial markets.*

*Keywords: financial market forecasting, investors' expectations, flows of exchange orders, bid-ask spread, the depth of the stock market*

*JEL codes: G10; G12; G17; G19*

## 1 Introduction

Advanced technologies for internet-trading have made it possible to monitor the real-time processes within the stock market. In principle, this monitoring provides hope for detecting the precursors of new price trends. Primarily, the data on the flows of buy and sell limit orders for stock are of great interest in this regard. Theoretical models, methods and some results of the data processing are described in extensive studies of the market microstructure (Hasbrouck, 2007; O'Hara, 2015; Easley et al., 2016). They shed the light on many practically known phenomena which economists had considered to be puzzling: the effect of long memory of order flows (Bouchaud et al., 2004; Lillo et al., 2005), the influence of trades on market prices in connection with "explicit" and "implied" liquidity (Bloomfield et al., 2015; O'Hara, 2003), non-equilibrium of market prices (Kyle, 1985) and many others. Consistent microeconomic and phenomenological models allowed to explain the formation of bid-ask spread (Glosten and Milgrom, 1985; Huang and Stoll, 1997), to study the relationship among the flows of limit orders, market depth and price volatility (Ahn et al., 2001; Lee et al., 1993) and etc.

However, the fact that limit orders of individual traders in the stock market can inform about the variables that define their position in the market exchange has not been given sufficient reference so far. In order to "decipher" these variables, a single microeconomic model is needed to explain traders' motives to submit both limit and market orders.

Developing the analytical framework to describe the asset pricing under the exchange processes in the stock market, Petrov et al. (2013) proposed a theoretical representation for the function of net demand for shares of an individual investor trading stock. However, in this paper an ideal auction was considered without taking into account transaction costs, reflected in the existence of a bid-ask spread between the prices of offsetting limit orders.

The aim of the paper is, first, to construct a microeconomic model describing placing of orders by individual traders; the model should explain the order type (market or limit), its volume as well as (for limit orders) the price. Second, to monitor the ongoing market processes the goal is to interface the designed model and the ongoing information broadcast by the order book of the trading platform. As it was shown below, this interfacing allows us to evaluate the capital holdings of market players behind individual quotes based on the order book. Allocation of these holdings across the quotes can, in particular, reflect a tendency to wait among major players, or, on the contrary, their desire to facilitate deals.

Movement of capital between near and far quotes must be evidently connected with the appearance of new price trends in the stock market; an opportunity to predict the trend critical points for Russian securities were previously discovered and studied in a number of works (Petrov and Kashina, 2013; Petrov et al., 2017) using more simple method that do not go deeply into the analysis of the fine structure of an order book.

The above-mentioned proves how topical the digital procedures of online monitoring and analysis of demand and supply in the stock market based on the consistently applied microeconomic method are with regard to the forecasting of future share price dynamics.

## 2 Methodology and Data

### Model Representation of an Individual Net Demand for Shares

The developed microeconomic model of bidding by an individual trader is based on the concept of individual net demand of an exchange participant, which was used in the theory of general market equilibrium (Varian, 2003). Supposing, share auction trade of various companies (let us assume N is their total number) in the stock market is supported by two types of orders: market and limit. Then it is assumed that during each exchange transaction between the parties there is an exchange of risk assets (shares) and risk-free assets (money).

For the analytical description of the orders of a single participant of *i*-emitter share trading one can use a model correlation for the instant net demand for these shares (let us assume that $p_i$ is their current market price)

$$\delta n_i = \frac{f_i}{p_i} - c_i, \tag{1}$$

derived within the developed (Petrov et al., 2013) approach to Walrus's equilibrium in the stock market. The referred work showed that combinations of $f_i$ and $c_i$, occurring in the correlation (1), can be expressed via variables defining the current position of the trader in the market exchange: their capital stock in monetary form M and share stocks from various emitters $n_j$, $(j = 1,2,\dots,N)$, characterizing the actual state of their portfolio as well as the monetary part $x_i$ of the shares of the selected i-type in the portfolio they want to stick to

$$f_i = x_i \cdot \left( M + \sum_{\substack{j=1 \\ j \neq i}}^{N} p_j n_j \right), \tag{2}$$

$$c_i = n_i \cdot (1 - x_i). \tag{3}$$

Summing up in the formula (2) is done for shares of all the emitters except the selected i-type one; the expression in the brackets, hence, is a total capital stock of the trader that can be exchanged for the shares under consideration. Taking into consideration the

idea of the "target" part $x_i$ the combination $f_i$ can be called an effective free capital of a trader for *i*-type shares (Petrov et al., 2013).

It should be mentioned that the relative amount $x_i$ is one of the key variables of the original approach to the treatment of share evaluating proposed in the paper (Petrov et al., 2013). Owing to the reasons set out in the paper, the relative amount $x_i$ may be further considered as independent on the share price $p_i$. In such a case combinations $f_i$ and $c_i$ also do not depend on the price. Furthermore, a really significant role in the theory of order placing developed below belongs to the price $R_i$ of the *i*-th shares, which is defined by the condition of zero individual instant net demand for these shares (see the relation (1)):

$$R_i = \frac{f_i}{c_i}\,. \tag{4}$$

According to this share price called "reservation" price from the trader's point of view (Varian, 2003), they obviously have an indifferent attitude to selling and buying these shares. If the market price exceeds the reservation price $p_i > R_i$, , the trader's individual net demand is negative: they are on the supply side selling "excessive" shares. On the contrary, if $p_i < R_i$ the trader is on the demand side trying to reach the target share stock.

For monitoring expectations of the stock market participants the combination $c_i$, proportional to the share stock of this emitter $n_i$, which the trader possesses (as it is seen from the expression (3), it has the same size) is of considerable relevance. According to the correlation (4), it shows how much the trader's effective free capital should increase for the reservation price of the respective shares to increase by one unit. In this regard combination $c_i$ can be interpreted as "capital capacity" of individual net demand.

Price correlation of the type (1) of individual net demand $\delta n_i$ for *i*-type shares is graphically shown in Fig.1 with a solid line (*i*-index hereinafter is skipped). The point of intersection of the graph with the vertical axis corresponds to the share reservation $R$. The vertical dotted straight line $\delta n = -c$ is an asymptote of the graph of individual net demand $\delta n(p)$.

**Market and Limit Orders: Model Interpretation**

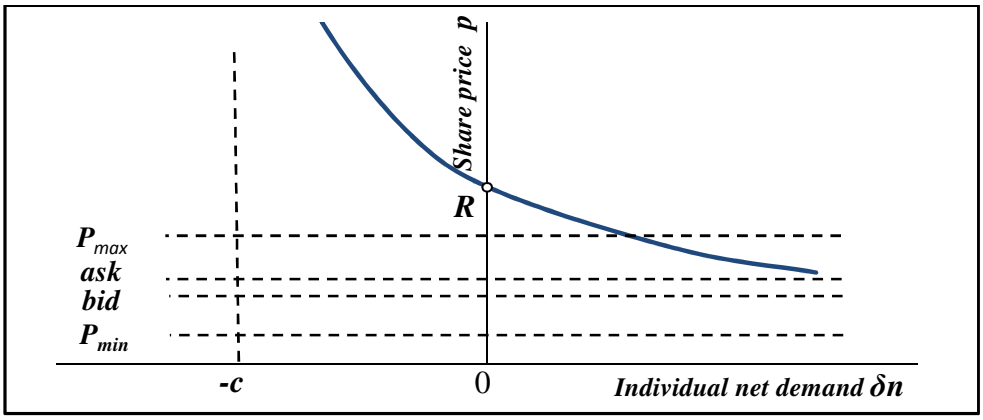
The previously provided reasoning about the effect of a trader's reservation price $R$ on their position in the market exchange is idealized. It does not take into account eh fact that under real conditions of a stock auction deals are made during interaction of counter market and limit orders. In this situation there is a wide range of prices visualized by quotes in order book. The conditional borders of this range can be the prices of the last quotes for sale and purchase; let us assume them as $P_{max}$ and $P_{min}$ respectively (see Fig. 1). Ask and bid prices, also shown in Fig. 1 are approximately in the middle of the area occupied by a range of possible stock prices.

1. Let us first assume that the reservation price of a share in the trader's opinion lies above the total quotes for sale $R > P_{max}$. This case is shown in Fig.1; as in any potentially possible price in the market the traders' net demand is significantly positive $\delta n > 0$, most probably they will issue a market order for sale. Although an attempt to buy shares for the lowest price by the corresponding limit order is also theoretically possible, this scenario is highly unlikely: gaining inconsiderably on the criterion of consumer surplus, it is associated with the loss of time and a risk that the order will not be completed at all. Similar reasoning can be provided in the opposite situation when a share reservation price in the trader's opinion is below the total quotes for purchase $R < P_{min}$. The most probable scenario of their action is a market order for sale.

2. The trader faces a more difficult choice when a reservation price for shares gets into the area of potentially possible market prices $P_{min} < R < P_{max}$ – prices of quotes in order book. For example, in the situation when $ask < R < P_{max}$, (the reservation price is in the

area of prices for quotes for sale), a market order is impossible because in this price range there are no counter limit orders for purchase. As it can be seen from the figure, limit orders in general can be put up by the trader both for sale (for prices $R < p < P_{max}$), and for purchase (for prices $P_{min} < p < bid$). However, if the trader behaves rationally the latter option is more preferable for the reasons of maximizing consumer surplus. The scenario where the trader leaves a market order in this case is evidently also possible (there are counter limit orders for sale for the prices $ask < p < R$).

**Figure 1** Model Price Dependence for an Individual's Net Demand




Source: author's construction

The above-mentioned arguments lead to the conclusion that in the given situation the trader's purchase of shares is to be expected. Their decision depends a lot of the correlation between the reservation price $R$ and the price $ask$: the probability of the choice in favor of a limit order increases if the reservation price increases the $ask$ price insignificantly being at the level of "near" quotes for sale. Similar arguments can be provided in case the reservation price is in the area of quote prices for purchase $P_{min} < R < bid$.

3. Finally, let us consider the situation when the reservation price from the trader's point of view is within the range of bid-ask spread $bid < R < ask$, and a market order is impossible. Limit orders, generally speaking, can be issued both on the demand side and on the supply side. To model the most probable strategy of their action we need to specify the price corresponding to the middle of bid-ask spread via $Mid$:

$$Mid = \frac{1}{2}(bid + ask). \quad (5)$$

And let us assume as above that choosing between possible purchases and sales the trader is guided by the principle of maximizing of consumer surplus. It is obvious that they will prefer orders for purchase if $Mid < R < ask$, and orders for sale if $bid < R < Mid$.

**The Model "Price-Volume" for a Limit Order and an Analysis of an Order Book**

The developed in paragraph 1 model of individual net demand for shares allows us to connect the volume and price of a limit order of an individual trader with variables defining their position in the market. Let us assume that a trader thinking that a reservation price for shares is equal to $R$, issues a limit order for purchase with price $\pi_+$ (limit orders for purchase and sale are indicated with lower indices of «+» and «–» respectively; evidently, $\pi_+ < R$). Now let us define the parameter of the order "margin" $\theta_+$ with an equation

$$\pi_+ = \frac{R}{1+\theta_+}; \quad (6)$$

it, obviously, has a sense of expressed in relative units discount between the reservation price for shares $R$ and the order price $\pi_+$ and being completed characterizes consumer surplus.

The volume of an order for purchase (let us assume it as $q_+(\theta_+)$) is easy to calculate using equations (1), (4) and (6):

$$q_+(\theta_+) = c \cdot \theta_+. \quad (7)$$

Hence, within the developed approach the volume of a limit order is determined only by two variables: its margin $\theta_+$ and capital capacity $c$ of individual net demand of the trader.

For further considerations it is important to note that the reservation price $R$ can be considered the same for various traders issuing limit orders for purchase of highly liquid shares within this order book. Actually, in regard to the above-mentioned the interval of reservation prices changes equal to the semi-width of bid-ask spread, in reality is much less that "discount" of prices $R - \pi_+$

$$\frac{1}{2}(ask - bid) \ll R - \pi_+. \quad (8)$$

For all limit orders for purchase reflected by this order book. Therefore, we can approximately assume a single reservation demand price (let us define it as $R_+$) as equal to half-sum of prices for $ask$ and $Mid$:

$$R_+ \approx \frac{1}{2}(ask + Mid) = ask - \frac{1}{4}(ask - bid). \quad (9)$$

In this case the analysis of the quotes observed in the order book is considerably simplified. Let us consider the content of a single demand quote with the price $\pi_+$; evidently it aggregates and visualizes the total limit orders for purchase with this price from various traders. For all these limit orders in approximation of a single reservation demand price (9) margin $\theta_+$, defined by the equation (6) is also the same:

$$\theta_+ = \frac{R_+}{\pi_+} - 1. \quad (10)$$

This margin can be assigned to all the demand quote under consideration; defining its volume via $Q_+(\theta_+)$, and having

$$Q_+(\theta_+) = \sum_k q_+^{(k)}(\theta_+). \quad (11)$$

Summing up in the formula (11) is carried out in accordance with all the forming this quote limit orders with margin $\theta_+$ ($k$ index defines a hypothetical number of a single order). By calculating the sum with the equation (7), it is possible to express total capital capacity $C_+(\theta_+)$ of net demand of the traders behind the quote under consideration

$$C_+(\theta_+) = \sum_k c^{(k)} = \frac{Q_+(\theta_+)}{\theta_+}\ . \quad (12)$$

Taking into account the definition (3) of capital capacity of a trader's individual net demand as a value proportional to its share stock of this emitter based on equations (9), (10) and (12) it is possible to «decipher» (up to a multiplier$(1 - x_i)$) the distribution of share stocks according to the quotes represented in the order book. Obviously, due to the factor $1/\theta_+$ it considerably differs from the observed picture of quotes: behind the nearest in $bid$ price quotes having the lowest margin $\theta_+$, there are considerably bigger share stocks of market players than it can be expected from visual observation of the order book.

Similarly, one can analyze the quotes for sale observed in the order book. Let us assume that $R$ is a reservation price of a single trader lying within the borders defined at the end of paragraph 2, $\pi_-$ is the price of a limit order for sale ($\pi_- > R$) issued by the trader. Defining "the trader's margin" $\theta_-$ with the following equation

$$\pi_- = R \cdot (1 + \theta_-). \quad (13)$$

And using formulas (1), (4) and (13), we can find the volume $q_-(\theta_-)$ of the corresponding limit order:

$$q_-(\theta_-) = \frac{c \cdot \theta_-}{1 + \theta_-}. \quad (14)$$

Similar arguments allow us to consider the reservation price for all the traders who issue orders for sale within one order book to be the same and equal to

$$R_- \approx \frac{1}{2}(bid + Mid) = bid + \frac{1}{4}(ask - bid). \quad (15)$$

Total capital capacity of the net demand of traders who by their orders form quotes for sale with margin $\theta_-$, the volume of which is equal to

$$Q_-(\theta_-) = \sum_k q_-^{(k)}(\theta_-), \quad (16)$$

is defined from the equation which is insignificantly different from the formula (12):

$$C_-(\theta_-) = \sum_k c^{(k)} = \frac{Q_-(\theta_-)}{\theta_-}(1 + \theta_-). \quad (17)$$

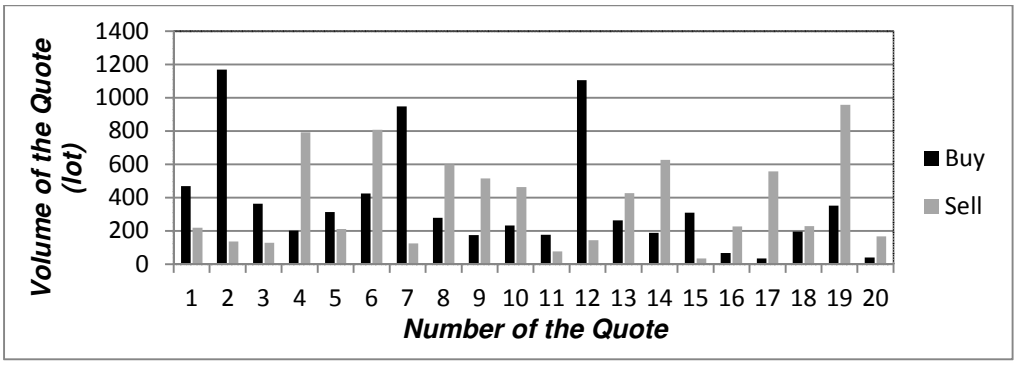
It allows us (17) basing on the record of instant realization of the order book to diagnose distribution of capital capacity of supply in various quotes for sale showing the considered share stocks of the traders behind single quotes.

## 3 Results and Discussion

The procedure described in the above-mentioned paragraph can be illustrated by its application for processing of a single record in the order book of Public Joint Stock Company "Lukoil". The record was fixed during the trade on the Moscow Stock Market on February 25, 2019 at 1o'clock 6 minutes 27 seconds p.m. The picture of twenty best quotes for sale and purchase ranged in the order of their distance from $bid\ price$ and from $ask\ price$ respectively is graphically represented in Fig. 2. Horizontally and vertically are the numbers of quotes and their volume respectively; demand quotes are shown with black colour while supply quotes are shown with grey color.

By calculating on the basis of order book data reservation prices for quotes for purchase and sale $R_+$ and $R_-$ with formulas (9) and (15), one can find margin corresponding each quote from the order book. Then equations (12) and (17) allow building the functions of distribution of capital capacity in accordance with demand and supply quotes $C_+(\theta_+)$ and $C_-(\theta_-)$, which are presented in the Fig. 3.

**Figure 2** The Instant Picture of Quotes of Public JSC "Lukoil" Recorded on February 25, 2019 at 01 O'clock 06 minutes 27 seconds p.m.

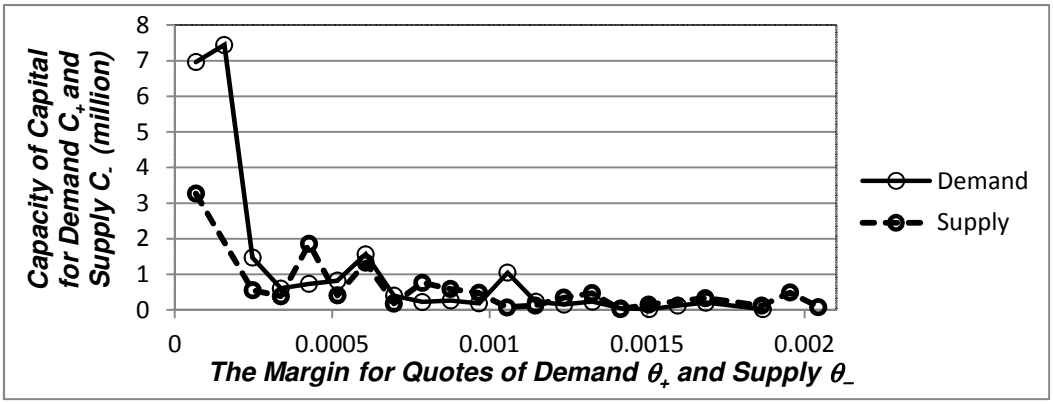



Source: author's calculation based on Moscow Exchange data (https://www.moex.com/)

Comparison of distributions of capital capacity (Fig. 3) with the picture of quotes (Fig. 2) demonstrates that just visual observation of an order book does not give a real picture of the capitals of the participants trading at specific price levels; although, "high margin" orders are represented in the order book with considerable weight, the capitals behind them are usually not big. Taking into account economic sense of total capital capacities defined by equations (12) and (17), it is natural to expect that correlations $C_+(\theta_+)$ and $C_-(\theta_-)$ will to some extent characterize the sentiment of the market players issuing limit orders, and their "inclination to make concessions", in particular. Thus, if in distribution $C_+(\theta_+)$ small values $\theta_+$ are represented with considerable weight, it can be concluded that

the majority of traders on the demand side are ready to be content with a small margin and on the contrary; the same reasoning holds true for the function $C_{-}(\theta_{-})$, which is built on the basis of the analysis of quotes for sale. Similar diagnostics of market sentiment, however, faces two problems.

**Figure 3** An Instant Allocation of Capital Capacity Across the Demand and Supply Quotes for the Shares of PJSC "Lukoil" (February 25, 2019, at 01 o'clock 06 min. 27 sec. p.m.)




Source: author's calculation based on Moscow Exchange data (https://www.moex.com/)

Firstly, to identify and understand the specificity of distribution of capital capacity $C_{+}(\theta_{+})$ and $C_{-}(\theta_{-})$, it is desirable to pass over to more compact characteristics of their functions. As an example we would like to evaluate for the presented in this paragraph order book an "average margin" of limit orders for purchase $\overline{\theta_{+}}$ and for sale $\overline{\theta_{-}}$ ("effective depth" for demand and supply) defined by the following equations:

$$\overline{\theta_{+}} = \left( \sum_{\alpha=1}^{20} C_{+}(\theta_{+\alpha}) \right)^{-1} \sum_{\alpha=1}^{20} C_{+}(\theta_{+\alpha}) \cdot \theta_{+\alpha} \,, \tag{18}$$

$$\overline{\theta_{-}} = \left( \sum_{\alpha=1}^{20} C_{-}(\theta_{-\alpha}) \right)^{-1} \sum_{\alpha=1}^{20} C_{-}(\theta_{-\alpha}) \cdot \theta_{-\alpha} \tag{19}$$

By doing simple calculations we get $\overline{\theta_{+}} \approx 0.00032$, $\overline{\theta_{-}} \approx 0.00062$. Therefore, it can be concluded that "buyers" tend to facilitate completion of their limit orders even at the expense of lower margin (because $\overline{\theta_{+}} < \overline{\theta_{-}}$).

Secondly, the values of capital capacities calculated according to formulas (12) and (17) for the current change in the order book, change considerable after each update. At the same time integral characteristics of share stock distribution according to the quotes also change. Since the described analysis is targeted at the development of digital methods of monitoring expectations of the participants of the stock market and thus at identification of precursors of new market trends, fluctuations of instant distributions of capital capacities and parameters of these distributions should be in this or that way averaged.

## 4 Conclusions

Instability of economic development and volatility of capital markets being characteristic of the last two decades, have incentivized the search for new opportunities to forecast crises and mitigate their effects. These opportunities are opened by the analysis of information of the stock market trading platform usually used for online trading. For its scientific interpretation this work proposes a microeconomic model explaining market and limit orders in the context of a trader's economic behavior, taking into account the existence of a whole range of market prices reflected by an order book of the trading platform. The designed model compactly connects the price and the volume of a share quote in an order book with an analytical indicator of the total capital capacity of the net

demand of the traders standing behind, the demand being directly dependent on their share stocks under consideration

To interface the theoretical model with instant trading information we designed a computer algorithm of monitoring distribution of share stocks according to quotes. It allows comparing the effective depth for demand with the effective depth for supply, which reflects some sentiments of buyers and sellers, in particular, their readiness to wait ("favorable market forecast") or, on the contrary, to facilitate completion of their orders making concessions in prices ("unfavorable market forecast"). By organizing a continuous developed procedure one can monitor the dynamics of investors' sentiment.

Digital methods of diagnostics of market players against the background of the ongoing price trend have another interesting application. Transitions of capitals between near and far quotes of demand and supply can highly like signal about insiders' actions and market manipulations; previously these signals were revealed by Petrov et al. (2016). The ideas and methods developed in this article allow designing sensitive and operative indicators. Using them in the automated mode we can significantly increase the efficiency of countering illegal trade practices by the national financial market regulators.

## References


Ahn, H., Bae, K., Chan, K. (2001). Limit Orders, Depth, and Volatility: Evidence from the Stock Exchange of Hong Kong. *The Journal of Finance*, vol. 56(2), pp. 767–788.

Bloomfield, R., O'Hara, M., Saar, G. (2015). Hidden Liquidity: Some New Light on Dark Trading. *The Journal of Finance*, vol. 70(5), pp. 2227-2274.

Bouchaud, J.-P., Gefen, Y., Potters, M., Wyart, M. (2004). Fluctuations and Response in Financial Markets: The Subtle Nature of "Random" Price Changes. *Quantitative Finance*, vol. 4(2), pp. 176-190.

Easley, D., de Prado, M., O'Hara, M. (2016). Discerning Information from Trade Data. *Journal of Financial Economics*, vol. 120(2), pp. 269-285.

Glosten, L., Milgrom, P. (1985). Bid, Ask, and Transaction Prices in a Specialist Market with Heterogeneously Informed Traders. *Journal of Financial Economics*, vol. 14(1), pp. 71-100.

O'Hara, M. (2003). Presidential address: Liquidity and price discovery. *The Journal of Finance*, vol. 58(4), pp. 1335-1354.

O'Hara, M. (2015). High Frequency Market Microstructure*. Journal of Financial Economics*, vol. 116(2), pp. 257-270.

Hasbrouck, J. (2007). *Empirical Market Microstructure: The Institutions, Economics and Econometrics of Securities Trading*. Oxford University Press, Oxford.

Huang, R., Stoll, H. (2001). Tick Size, Bid-Ask Spreads, and Market Structure. *Journal of Financial and Quantitative Analysis*, vol. 36(4), pp. 503-522.

Kyle, A. (1985). Continuous Auctions and Insider Trading. *Econometrica*, vol. 53(6), pp. 1315- 1335.

Lee, C., Mucklow, B., Ready, M. (1993). Spreads, Depths, and the Impact of Earnings Information: An Intraday Analysis. *Review of Financial Studies*, vol. 6(2), 345-374.

Lillo, F., Mike, S., Farmer, J. (2005). Theory for Long Memory in Supply and Demand. *Physical Review*, vol. 71(6), pp. 66-122.

Petrov, S., Medvedeva, M., Kashina, O. (2013). Capital assets pricing during stock exchange trading: an analytical model based on the market equilibrium theory*. Audit and Financial Analysis*, vol. 3, pp. 249-257.

Petrov, S., Yashina, N., Kashina, O., Pronchatova-Rubtsova, N. (2017). Forecasting of Crisis Phenomena in Emerging Financial Market: Real-Time Monitoring of Demand and

Supply Anomalies in the Stock Exchange. In: *Proceedings of the 14th International Scientific Conference European Financial Systems 2017*, Brno: Masaryk University, part 2, pp. 150-158.

Varian, H. (2003). *Microeconomic Analysis*, 3rd ed., Norton & Company, Inc., New York.

# Implementation of the European Directive on Non-financial Information in the European Economic Area

**Veronika Popelková[1], Jaroslav Sedláček[2]**

[1] Masaryk University
Faculty of Economics and Administration, Department of Finance
Lipová 41a, 602 00 Brno, Czech Republic
E-mail: veronika1popelkova@gmail.com

[2] Masaryk University
Faculty of Economics and Administration, Department of Finance
Lipová 41a, 602 00 Brno, Czech Republic
E-mail: sedl@econ.muni.cz

***Abstract:*** *With effect from 1 January 2017, states of the European Economic Area were obliged to implement Directive 2014/95/EU of the European Parliament and of the Council amending Directive 2013/34/EU as regards the disclosure of non-financial information and information on diversity by some large companies and groups. The aim of this article is to compare, on the basis of the chosen criteria, the national transpositions of the individual states concerning the reporting of non-financial information and to assess the degree to which individual Member States have transposed the requirements of the European Directive 2014/95/EU on non-financial information. Based on a detailed analysis of the European Non-Financial Information Directive, the following criteria have been chosen to compare national legislation: definition of public interest entity, public topics of non-financial information and their content, standards and frameworks for reporting non-financial information, auditor's involvement, Safe Harbour Principle, description of diversity policy, disclosure requirements and sanctions for breach of obligations. Based on the statistical evaluation, the degree of implementation of the European Directive in the individual states is assessed.*

*Keywords: non-financial reporting, Corporate Social Responsibility, the European Directive on non-financial information*

*JEL codes: M48, Q01, M41, O35*

## 1 Introduction

The requirements of the European Non-Financial Information Directive apply only to large companies and groups with more than 500 employees. According to the European Commission (2019), there are such corporations around 6000 in the European Union. Especially companies whose securities are listed on European capital markets, banks, insurance companies or other companies designated by the states as public interest entities. The reasons for publishing non-financial information by these entities are as follows in the European Directive 2014/95/EU:

- the need to achieve a higher level of transparency and comparability of non-financial information between businesses within and across the states,
- increasing corporate social responsibility *„leading to a sustainable global economy that combines long-term profitability with social justice and environmental protection,"*
- non-financial Key Performance Indicators allow to monitor, measure and manage the performance of companies and their impact on the community as a whole,
- increase the confidence of investors, consumers and other Stakeholders, and provide easy access to information on the impact of businesses on society.

## 2 Methodology and Data

This publication presents the results of a comparison of the national regulations of the individual states of the European Economic Area that have implemented the Directive 2014/95/EU of the European Parliament and of the Council amending Directive 2013/34 / EU as regards the presentation of non-financial information and information on diversity by some large companies and groups. The comparison was made on the basis of criteria taken from the Stichting Global Reporting Initiative (GRI) and CSR Europe (2017). In the following chapter, these criteria are characterized and described in accordance with the European Directive. Based on these criteria, data from the above comparative study were selected. The chosen criteria have been evaluated to determine whether the states have incorporated, omitted or changed their national requirements in their national legislation. Based on this knowledge, the data are originally statistically processed and the degree of implementation of the requirements of the European Directive by the individual states is assessed. The comparison includes 30 states of the European Economic Area.

## 3 Results and Discussion

This chapter characterizes selected comparison criteria according to the European directive on non-financial information. Subsequently, the level of implementation of individual requirements the states is presented.

**Definition of public interest entity**

The European Directive 2014/95/EU on non-financial information requires the disclosure of this information to large enterprises that are public interest entities that exceed the criterion of an average of 500 employees per financial year.

According to European Directive 2013/34/EU, large enterprises mean enterprises that exceed at least 2 of the 3 criteria at the balance sheet date:

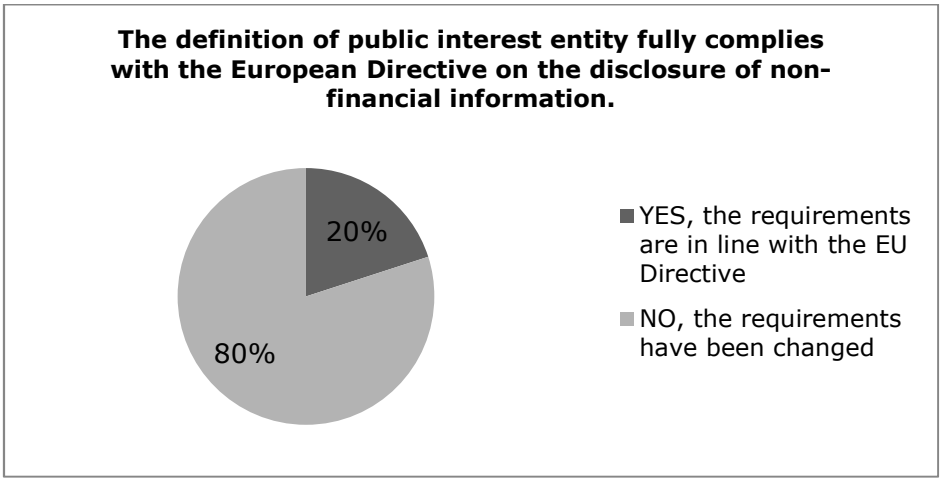
- balance sheet total: 20 000 000 EUR;
- net turnover: 40 000 000 EUR;
- the average number of employees during the financial year: 250.

The European Directive 2013/34/EU defines public interest entities as:

- companies whose securities are listed on a regulated European market,
- credit institutions,
- insurance companies,
- other companies designated by the Member States as public interest entities (because of the nature of their activities, their size or the number of employees).

Accordingly, under the European Directive, the obligation to report non-financial information applies to undertakings that are public interest entities under points 1, 2, 3 or 4, the average number of employees in the accounting period exceeds 500 and their balance sheet or net turnover exceeds the above criteria.

**Figure 1** Definition of Public Interest Entity




| | |
|---|---|
| **Number of states** | 30 |
| **YES, the requirements are in line with the EU Directive** | 6 |
| **NO, the requirements have been changed** | 24 |

Source: own processing, data was taken from from the Stichting Global Reporting Initiative (GRI) and CSR Europe (2017)

**Public topics of non-financial information and their content**

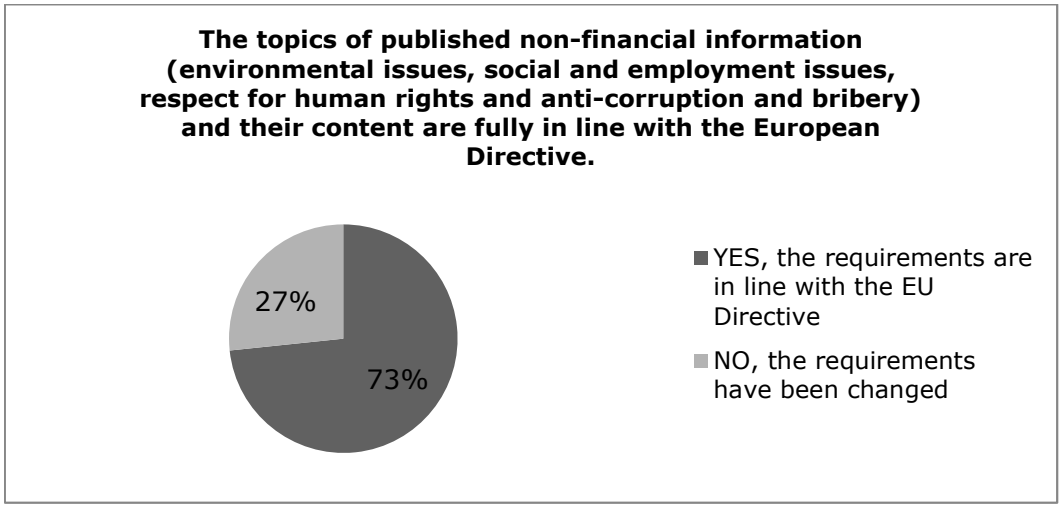
An entity or group under the European Directive will provide non-financial information for at least the following issues:

- the environment,
- social and employment,
- respect for human rights,
- anti-corruption and bribery.

The European Directive also defines the following content of reported information:

- a brief description of the business model,
- the description of the measure applied to the question, if no action is taken, must state the reasons,
- a description of the results of these measures,
- a description of the main risks associated with these issues and related to the entity's or group's activities,
- non-financial Key Performance indicators related to the business.

**Figure 2** Public Topics of Non-financial Information and Their Content



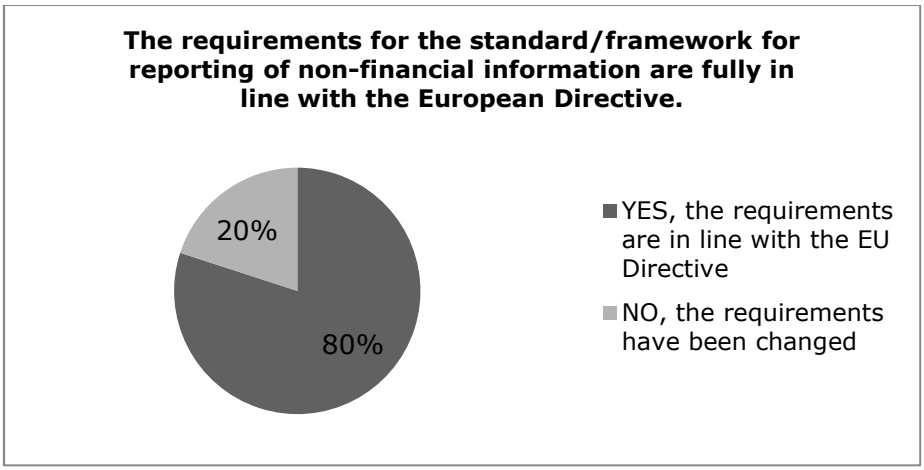

| | |
|---|---|
| **Number of states** | 30 |
| **YES, the requirements are in line with the EU Directive** | 22 |
| **NO, the requirements have been changed** | 8 |

Source: own processing, data was taken from from the Stichting Global Reporting Initiative (GRI) and CSR Europe (2017)

### Standards and frameworks for reporting non-financial information

Entities and groups may use some national, European or international standards or frameworks to report non-financial information. In the case that entities choose to build on some frameworks, they will report on the frameworks that have been used for these purposes.

**Figure 3** Standards and Frameworks for Reporting Non-financial Information



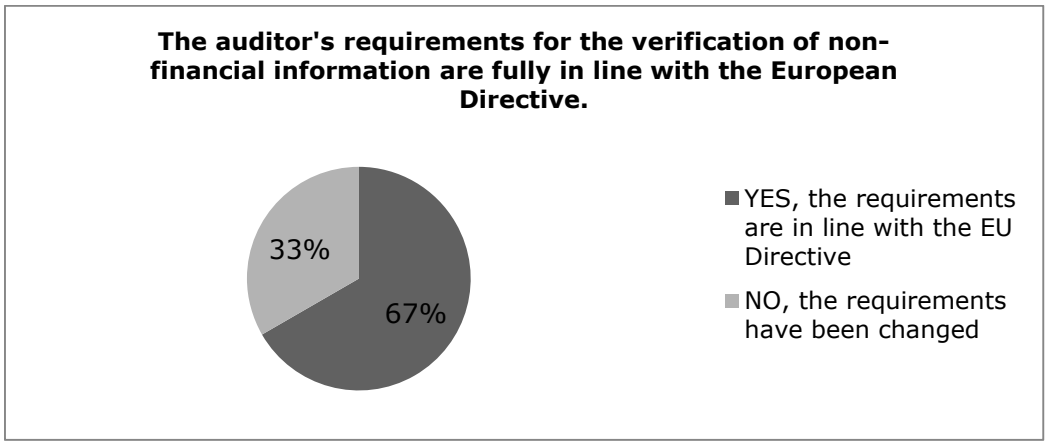

| | |
|---|---|
| **Number of states** | 30 |
| **YES, the requirements are in line with the EU Directive** | 24 |
| **NO, the requirements have been changed** | 6 |

Source: own processing, data was taken from from the Stichting Global Reporting Initiative (GRI) and CSR Europe (2017)

**Auditor's involvement**

According to the European Directive, the auditor should verify whether the entity or groups have prepared and disclosed non-financial information.

**Figure 4** Auditor's Involvement




| | |
|---|---|
| **Number of states** | 30 |
| **YES, the requirements are in line with the EU Directive** | 20 |
| **NO, the requirements have been changed** | 10 |

Source: own processing, data was taken from from the Stichting Global Reporting Initiative (GRI) and CSR Europe (2017)

**Safe Harbour Principle**

The Directive allows the Member States to refrain from disclosing non-financial information relating to the entity's future development, in exceptional circumstances, on the basis of a duly substantiated opinion by the management or supervisory body, if disclosure of such information could significantly impair business position. At the same time, the non-disclosure of this information does not prevent their users from a balanced assessment of the company's development, performance and impact.

**Figure 5** Safe Harbour Principle

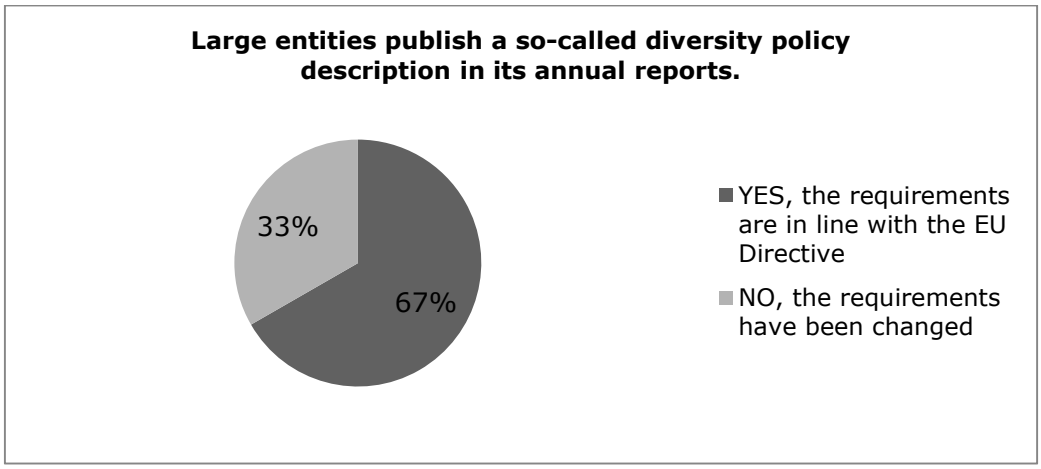

| | |
|---|---|
| **Number of states** | 30 |
| **YES, the requirements are in line with the EU Directive** | 25 |
| **NO, the requirements have been omitted** | 5 |

Source: own processing, data was taken from from the Stichting Global Reporting Initiative (GRI) and CSR Europe (2017)

**Description of diversity policy**

The large entities that are issuers of securities, publishes in its annual reports a so-called diversity policy description applied to the corporate governance, management and supervisory bodies with regard to, for example, age, gender, education or professional experience. It will also set out the objectives of this policy, the way it is implemented and the results over the period. If an entity does not apply any policy, it shall provide a proper justification for this decision.

**Figure 6** Description of Diversity Policy




| | |
|---|---|
| **Number of states** | 30 |
| **YES, the requirements are in line with the EU Directive** | 20 |
| **NO, the requirements have been changed** | 10 |

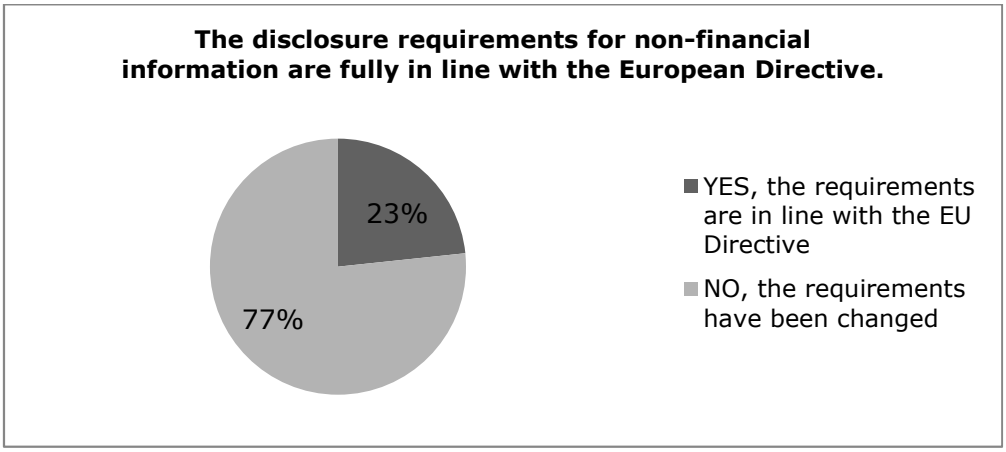
Source: own processing, data was taken from from the Stichting Global Reporting Initiative (GRI) and CSR Europe (2017)

**Disclosure requirements**

According to the European Directive, entities or groups can publish information in two formats:

- An overview of non-financial information is included in the annual report as described above.
- Where an entity or group processes a separate report containing the required non-financial information, Member States may exempt the entity from the obligation to draw up an overview of the non-financial information referred to in the previous paragraph. This report shall be published together with the annual report or made available to the public within a reasonable time, which may not exceed 6 months from the end of the balance sheet date. There is also a reference to this separate report on the website and in the annual report of the entity.

**Figure 7** Disclosure Requirements for Non-financial Information



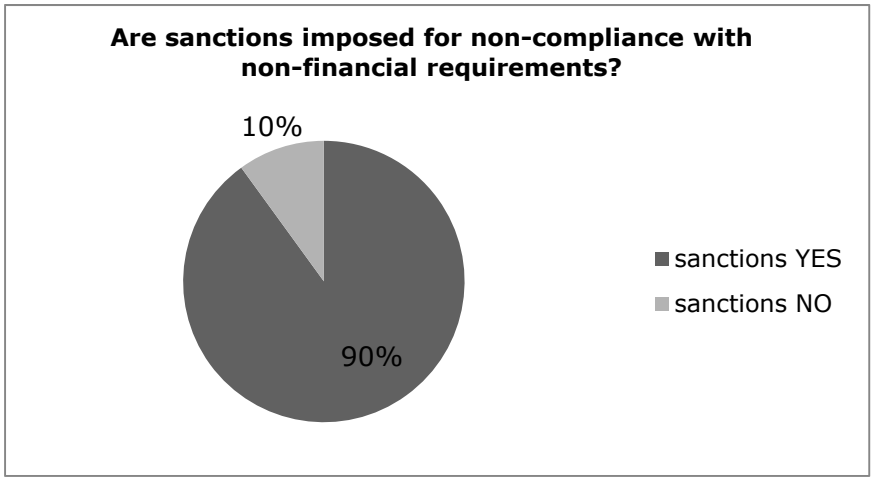

| | |
|---|---|
| **Number of states** | 30 |
| **YES, the requirements are in line with the EU Directive** | 7 |
| **NO, the requirements have been changed** | 23 |

Source: own processing, data was taken from from the Stichting Global Reporting Initiative (GRI) and CSR Europe (2017)

### Sanctions

Member States may lay down rules on penalties applicable to infringements of the obligations required by national law and the measures necessary to ensure that they are implemented. Sanctions should be proportionate, effective and dissuasive.

**Figure 8** Sanctions




| | |
|---|---|
| **Number of states** | 30 |
| **sanctions YES** | 27 |
| **sanctions NO** | 3 |

Source: own processing, data was taken from from the Stichting Global Reporting Initiative (GRI) and CSR Europe (2017)

## 4 Conclusions

The highest implementation rate was recorded for the imposition of sanctions. 90% of the states have implemented this requirement in their legislation. Only Estonia, the Netherlands and Spain have not introduced sanctions for non-compliance. Conversely, the smallest consensus between the European Directive and national regulations has

been recorded for the definition of a public interest entity. A total of 80% of states have adapted the definition in their regulations and only 20% of states have fully transposed it from the European directive. Countries that have fully adopted the definition include Estonia, Finland, Ireland, Malta, Slovenia and the United Kingdom.

Regarding the overall implementation rate of the European Directive by the individual states, Finland has the highest implementation rate, which is the only one that has implemented all requirements in its legislation in line with the European Non-Financial Information Directive. Ireland, Luxembourg and Portugal have not only implemented one requirement of the European Directive.

**Table 1** States with the highest rate of implementation

| State | Implementation Rate |
|---|---|
| **Finland** | 100,00% |
| **Ireland** | 87,50% |
| **Luxembourg** | 87,50% |
| **Portugal** | 87,50% |

Source: own processing

Denmark has the lowest implementation rate, fully implementing only two requirements of the European Directive. Bulgaria, Italy and Spain have only implemented three requirements of the European Directive.

**Table 2** States with the lowest rate of implementation

| State | Implementation Rate |
|---|---|
| **Denmark** | 25,00% |
| **Bulgaria** | 37,50% |
| **Italy** | 37,50% |
| **Spain** | 37,50% |

Source: own processing

The median and the most common implementation rate (mode) is 62.50%. The average implementation rate was 62.92%.

**Table 3** Value of implementation rate

| Value | Implementation Rate |
|---|---|
| **Median** | 62,50% |
| **Mode** | 62,50% |
| **Mean** | 62,92% |

Source: own processing

The Czech Republic had an implementation rate of 75%, did not implement only two requirements of the European Directive in its regulations, specifically changed the definition of public interest entity and requirements for disclosure of non-financial information.

The comparison showed that most states implemented most of the requirements of the European Directive in their regulations unchanged. The trend of today's, Corporate Social Responsibility, Sustainable Development as well as surveys in this field (KPMG, 2017 or Deloitte, 2015) show that most large entities, regardless of legislation, already compile a report on corporate social responsibility or sustainable development or report this information in their annual reports. Disclosure of this information provides entities an important marketing tool to strengthen their business position.

The implementation of the European Directive in the national legislation of the individual states can unify the format and content of the published information, thereby increasing the comparability of this information between companies within national states as well as between companies across the European Economic Area. According to Deloitte survey

(2015), 63% of respondents believe that the implementation of the European directive will have a positive impact on the quality of non-financial reporting in the country.

## Acknowledgments

The support of the Masaryk University internal grant No. 2158 is gratefully acknowledged.

## References

Deloitte (2015). *CSR Managers Survey 2015 in Central Europe*. Retrieved from: https://www2.deloitte.com/ce/en/pages/about-deloitte/articles/dce-csr-managers-survey.html.

Directive 2013/34/EU of the European Parliament and of the Council of 26 June 2013 on the annual financial statements, consolidated financial statements and related reports of certain types of undertakings, amending Directive 2006/43/EC of the European Parliament and of the Council and repealing Council Directives 78/660/EEC and 83/349/EEC, *Official Journal of the European Union*, 2013.

Directive 2014/95/EU of the European Parliament and of the Council of 22 October 2014 amending Directive 2013/34/EU as regards disclosure of non-financial and diversity information by certain large undertakings and groups, *Official Journal of the European Union*, 2014.

KPMG (2017*). Průzkum stavu nefinančního reportingu 2017.* Retrieved from: https://home.kpmg.com/cz/cs/home/pro-media/tiskove-zpravy/2017/10/nefinancni-reporting-pruzkum.html.

Stichting Global Reporting Initiative (GRI) and CSR Europe (2017). *Member State Implementation of Directive 2014/95/EU: A comprehensive overview of how Member States are implementing the EU Directive on Non-financial and Diversity Information*. Retrieved from: https://www.globalreporting.org/resourcelibrary/NFRpublication%20online_version.pdf.

European Commission (2019). *Non-financial reporting*. Retrieved from: https://ec.europa.eu/info/business-economy-euro/company-reporting-and-auditing/company-reporting/non-financial-reporting_en. (Accessed on 09. 04. 2019)

# The Expense Ratio Development of Insurance Portfolios in Selected Insurance Companies in the Czech Republic in 2010-2017

**Lenka Přečková[1], Eva Vávrová[2]**

[1] Silesian University in Opava
School of Business Administration in Karviná, Department of Finance and Accounting
Univerzitní nám. 1934/3, 733 40 Karviná, Czech Republic
E-mail: preckova@opf.slu.cz

[2] Masaryk University
Faculty of Economics and Administration, Department of Finance
Lipová 507/41a, 602 00 Brno, Czech Republic
E-mail: eva.vavrova@econ.muni.cz

***Abstract:*** *This paper shall compare insurance portfolios in selected insurance companies operating in the Czech Republic based on the growth rate of premiums written and the expense ratio. It shall compare these insurance companies: ČSOB Pojišťovna, Komerční pojišťovna, Kooperativa pojišťovna, Pojišťovna České spořitelny and Česká podnikatelská pojišťovna. ČSOB Pojišťovna and Komerční pojišťovna were selected because they are subjects with a developed bancassurance model and because the previous research suggested that insurance companies applying this model achieve a lower expense ratio. Kooperativa pojišťovna, Česká podnikatelská pojišťovna and Pojišťovna České spořitelny were selected because they are members of the insurance group VIG in the Czech Republic and the group has cooperated with the Erste Group Bank since 2008 based on their Strategic Cooperation Agreement. The aim of this paper is to determine whether or not the selected insurance companies and the group VIG achieve lower expense ratio of the insurance portfolio than what is the average of the expense ratio of insurance portfolios on the Czech insurance market. The paper shall compare the expense ratio of selected commercial insurance companies and the average of the expense ratio on the Czech insurance market in the 2010-2017 period. The research confirms that ČSOB Pojišťovna and Komerční pojišťovna reach lower values of expense ratio in life insurance. The insurance companies belonging to the VIG group (with the exception of Česká podnikatelská pojišťovna) reach lower values of ER in life insurance than the overall insurance market on average.*

*Keywords: bancassurance, insurance group, insurance company, expense ratio*

*JEL codes: G22*

## 1 Introduction

Bancassurance came into existence in the United States approximately 50 years ago. According to Mesršmíd (2016), the development of bancassurance was supported by many different economic reasons. The aim was to take advantage of the synergy to reduce costs and provide clients with a comprehensive offer and more services in what is called a one-stop shop. There are a variety of publications which compare advantages and disadvantages of bancassurance. The main advantage of using this distributional channel is that financial subjects can use it to reduce costs.

According to the statistics provided by the European insurance and reinsurance federation (2010), the results for bancassurance in Europe were as follows: Bancassurance was not very well developed in non-life insurance and represented less than 10% in all countries of Europe. Bancassurance was the main distribution channel for life insurance products in many western European countries. It represented up to 84.5% of total life insurance policies concluded in Portugal, proving the model developed in the 1990s successful as it allowed great numbers of clients to conclude policies on a regular basis, with providers having good knowledge of their clients' financial resources. The high penetration rate of bancassurance in the distribution of life insurance products was particularly true for unit-linked products. Bancassurance for unit-linked products was

notably developed in Italy (91%), Belgium (74%), France (65%) and Croatia (55%). In the Czech Republic, it is unfortunately not possible to evaluate this distributional channel because there is no available data providing sales volume of bancassurance products.

Daňhel et al. (2007) claims that if a bank merges with an insurance company, operational costs can decrease by 10% to 20% for one of the integrating partners. According to Polouček (1999), providers of bancassurance report operational costs lower by 40% compared with standard insurance companies. Most (82%) bancassurance groups operating in Europe have lower costs in providing life insurance than traditional insurance companies providing life insurance.

A comparison of expense ratios of life insurers in France in 1991 showed that insurers relying on traditional agents had a considerably higher expense ratio than banks' in-house companies (Genetay and Molyneux, 1998). The latter showed expense ratios varying from 3.1% to 9.1% while traditional insurers had expense ratios between 10.5% and 23.7% (Leach, 1993).

Other studies performed in Ireland (10 life insurance companies were surveyed from 1991 to 2000) by Hwang and Gao (2005) suggest that a dummy indicating the distribution of insurance policies by bank branches is positively related to cost efficiency and the coefficient is statistically significant. Research done by Barros et al. (2006) in Portugal (14 life insurance companies from 1995 – 2003) confirmed that a dummy indicating a cooperation with a bank institution is positively related to cost efficiency, but the coefficient is not statistically significant.

According to Swiss Re (2007) bancassurance is often considered to be more cost effective than traditional agency and broker channels. In Italy, the total expense ratio, as a percentage gross premiums from banks, was clearly lower than that of agents and financial advisors. In France, bank channels had a clear cost advantage in 2005 compared to companies which use intermediaries. In contrast, direct writing companies had a slightly lower expense ratio than banks, due to lower administration cost. Similarly, in household insurance in France, the bank channel enjoyed a lower expense ratio than other channels, apart from "mutuals without intermediaries".

The empirical results find that the following factors have played a significant role in the expanding and consolidation of bancassurance: reduction in company risk, the size of the company, reductions in company costs and increases in company revenues, the size of the national banking industry, the level of financial deregulation within a country, and the national inflation rate (Chen et al., 2009).

The aim of this paper is to determine whether or not the selected insurance companies and the group VIG achieve lower expense ratio of the insurance portfolio than what is the average of the expense ratio of insurance portfolios on the Czech insurance market. Five insurance companies were chosen for the research: ČSOB pojišťovna (hereinafter referred to as ČSOBP), Komerční pojišťovna (hereinafter referred to as KP), Kooperativa pojišťovna (hereinafter referred to as KOOP), Česká podnikatelská pojišťovna (hereinafter referred to as ČPP) and Pojišťovna České spořitelny (hereinafter referred to as PČS).

Starting with the acquisition of Komerční banka, a.s. by Société Générale S.A. in 2001, KP started implementing SG's bank-insurance business model. KP therefore cooperates primarily with companies that belong to the KB Group. The majority owner of KP's shares is the insurance company SOGECAP S.A., SG is a wholly owned subsidiary, which holds a 51% ownership interest. KB is a 49% minority shareholder. (Annual Report KP, 2018)

ČSOBP is a member of the ČSOB holding and is a universal insurance company. It came into existence in 1992 and it has had its current name since 2003. In 2003, ČSOBP merged with IPB Pojišťovna. The majority shareholder of ČSOBP is KBC Verzekeringer (Insurance) NV with a 99.755% share. The remainder (0.245%) is owned by Československá obchodní banka, a.s. (Annual report ČSOBP, 2018)

ČSOBP and KP were selected because they are subjects with a developed bancassurance model and because the previous research suggested that insurance companies applying this model achieve a lower expense ratio. As already mentioned, ČSOBP and KP prefer distribution of their financial products through bancassurance. The following table shows how much insurance was arranged using the distributional channel of bancassurance.

**Table 1** Share of bancassurance in GWP in the period 2012 - 2016

| Year | Share of bancassurance, % | |
|---|---|---|
| | **ČSOBP** | **KP** |
| **2012** | Not specified | 93.82 |
| **2013** | 8.7 | 95.68 |
| **2014** | 8.4 | 95.80 |
| **2015** | 9.8 | 92.96 |
| **2016** | 15.4 | 93.39 |

Source: Author's own work based on Cach (2016) and questionnaire (2017)

Volume of bancassurance has a rising tendency in case of ČSOBP. It reached 15.4% in 2016. The growth between 2015 and 2016 reached 57%. KP arranges insurance exclusively using bancassurance. Between 2012 and 2016, the share of bancassurance exceeded 90%.

Přečková and Vávrová (2018) compared expense ratios (hereinafter referred to as ER) reached by ČSOBP and KP with the Czech insurance market over the period 2012 - 2016. The research findings are as follows. ER of non-life insurance in ČSOBP and KP does not reach lower values than those shown by the Czech insurance market. This applies not only to the individual years in the period from 2012 to 2016, but also to the average value over this period. In the same period, the value of ER of non-life insurance is higher than the recommended value of 30%. ER of life insurance in both ČSOBP and KP shows lower values than the average value on the Czech insurance market. The same applies to total insurance. KP reached significantly lower value of ER. The average value of ER in life and total insurance is lower by more than 70% as compared with the average value on the market. The research also confirms that KP shows lower average value of ER than ČSOBP. The average value of ER of the insurance company KP is 55% lower in case of life insurance and 65% lower in case of total insurance.

KOOP, ČPP and PČS were selected because they are members of the insurance group VIG in the Czech Republic and the group has cooperated with the Erste Group Bank since 2008 based on their Strategic Cooperation Agreement. The insurance group VIG consists of three insurance companies. 96% of KOOP is owned by the company VIG. 100% of ČPP is owned by KOOP. 90% of PČS is owned by VIG, the other 5% are owned by KOOP and the remaining 5% are held by the bank Česká spořitelna (which is a subsidiary company of the Erste group). (Annual Report KOOP, 2018; Annual Report CPP, 2018;Annual Report PCS, 2018)

There is a strategic cooperation between VIG and the Erste Group Bank thanks to which Česká spořitelna can offer integrated bancassurance products. These bancassurance products are offered in the form of a blanket agreement in which Česká spořitelna is the policyholder. (Přečková, 2016)

Based on these facts, one could expect that insurance companies belonging to the VIG insurance group will conclude many bancassurance-related contracts. However, the data showing what portion of VIG's gross premium written is gained through bancassurance is unavailable.

To achieve the target, one research question shall be formulated. **Is the average value of ER in selected insurance companies lower than the average value of ER on the Czech insurance market?**

## 2 Methodology and Data

The first part of the research compares all of the selected insurance companies from the perspective of life and non-life insurance written and the market share. Average values over the period 2010 – 2017 shall be compared. The data necessary for calculation were accessed in Czech Insurance Association (ČAP) statistics.

The following part of the research shall present development of ER indicator for the selected insurance companies from 2010 to 2017. The indicator "expense ratio" (ER) was calculated, which is very often used in evaluating costs of insurance activities (Pulchart, 2002; Gestel et al., 2007; Vávrová, 2014). It is the proportion of operating costs and premiums written. For the calculation, gross operating expenses (GOE) and gross premiums written (GWP) were taken into account. This indicator should reach an amount lower than 30% (Vávrová, 2014). The formula for calculating is:

$$ER = \frac{GOE}{GWP}$$

ER is calculated for life and non-life insurance and it is compared with the development of the insurance market. Subsequently, average values for the selected period for both the insurance companies and the insurance market shall be calculated and compared. The data necessary for calculation of ER were gained in Czech Insurance Association statistics.

## 3 Results and Discussion

All of the surveyed insurance companies offer life and non-life insurance. The table 2 shows whether each insurance company is dominated by life or non-life insurance. Average values over the period 2010 – 2017 were used. The insurance companies KP and PČS are to a great extent dominated by life insurance (more than 90% of concluded policies). On the contrary, the insurance companies KOOP and ČPP offer mainly non-life insurance (more than 70% of concluded policies). ČSOBP sells slightly more life insurance than non-life insurance, which is not typical considering that Czech insurance market is dominated by non-life insurance.

**Table 2** Comparison of Average Value of Life and Non-life Gross Written Premium Ratio from 2010 to 2017

| Insurance Company | Average Value of Life Gross Written Premium Ratio | Average Value of Non-Life Gross Written Premium Ratio |
|---|---|---|
| **ČSOBP** | 59.01% | 40.99% |
| **KP** | 95.61% | 4.39% |
| **KOOP** | 28.56% | 71.44% |
| **ČPP** | 27.71% | 72.29% |
| **PČS** | 92.65% | 7.35% |
| **Market** | 44.86% | 55.14% |

Source: Author's own work based on ČAP's statistics

Table 3 shows the average market shares achieved on the Czech insurance market over the monitored period. The table offers not only the average market share gained through the total premium written but also through life and non-life insurance. The insurance company KOOP is the second largest insurance company in the Czech Republic as far as total insurance premium is concerned (2018). The other surveyed insurance companies share from 5% to 8% of the insurance market. The smallest share is held by the insurance company ČPP.

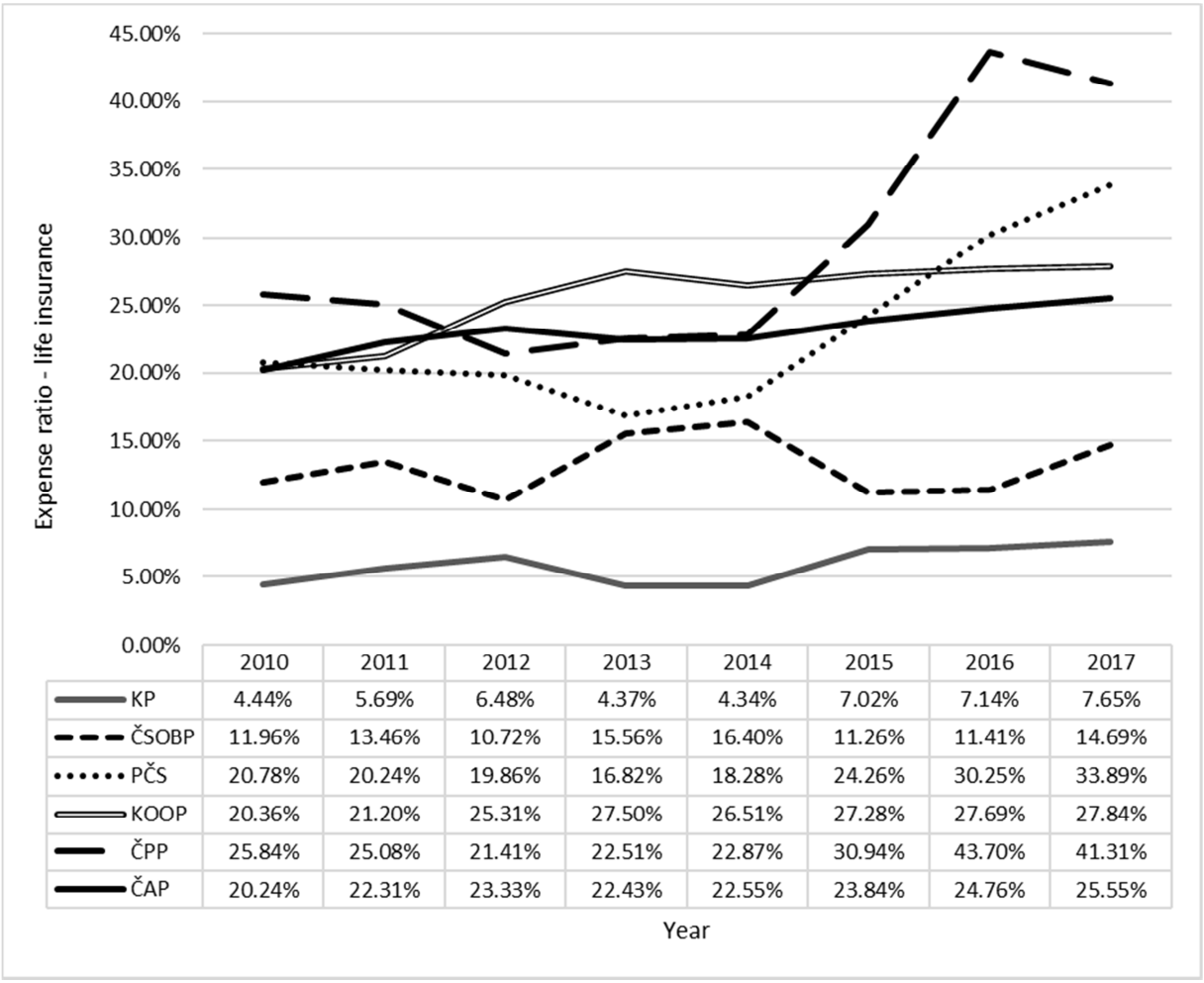
**Table 3** Comparison of Average Value of Market Share from 2010 to 2017

| Insurance Company | Average Value of Market Share (Total) | Average Value of Market Share (life insurance) | Average Value of Market Share (non-life insurance) |
|---|---|---|---|
| **ČSOBP** | 7.79% | 10.25% | 5.79% |
| **KP** | 5.09% | 10.84% | 0.40% |
| **KOOP** | 21.38% | 13.61% | 27.69% |
| **ČPP** | 5.10% | 3.51% | 6.68% |
| **PČS** | 6.58% | 13.58% | 0.88% |

Source: Author's own work based on ČAP's statistics

The following figures 1 and 2 evaluate the development of ER over the period 2010 – 2017. Whereas Figure 1 shows ER of life insurance in the surveyed insurance companies and the Czech insurance market, Figure 2 shows non-life insurance in the surveyed insurance companies and the Czech insurance market.

**Figure 1** Development of Expense Ratio of Life Insurance from 2010 to 2017




| | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|---|---|---|---|
| KP | 4.44% | 5.69% | 6.48% | 4.37% | 4.34% | 7.02% | 7.14% | 7.65% |
| ČSOBP | 11.96% | 13.46% | 10.72% | 15.56% | 16.40% | 11.26% | 11.41% | 14.69% |
| PČS | 20.78% | 20.24% | 19.86% | 16.82% | 18.28% | 24.26% | 30.25% | 33.89% |
| KOOP | 20.36% | 21.20% | 25.31% | 27.50% | 26.51% | 27.28% | 27.69% | 27.84% |
| ČPP | 25.84% | 25.08% | 21.41% | 22.51% | 22.87% | 30.94% | 43.70% | 41.31% |
| ČAP | 20.24% | 22.31% | 23.33% | 22.43% | 22.55% | 23.84% | 24.76% | 25.55% |

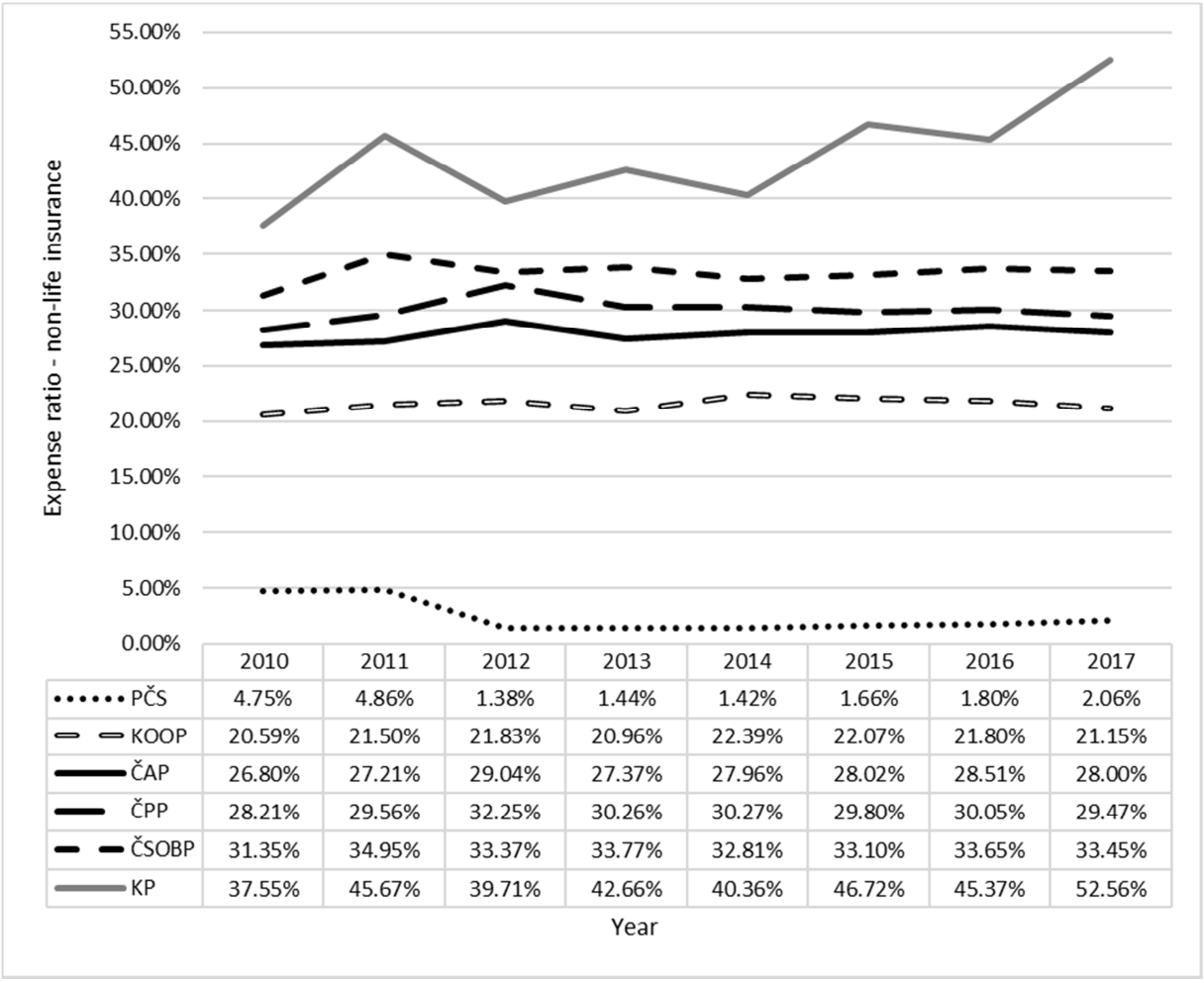
Source: author's own work based on ČAP's statistics

As expressed by Figure 1 (development of ER values in life insurance), the insurance companies KP and ČSOBP reached lower values than the insurance market on average over the monitored period. Both the insurance companies reached significantly lower levels of ER than the other surveyed insurance companies.

The insurance company PČS (member of VIG) reached lower values in 2011, 2012, 2013 and 2014. From 2014 to 2017, ER of life insurance was growing. The insurance company

KOOP (member of VIG) started to reach higher values of ER than the insurance market starting in 2012 and from 2013; the values tend to be stable around 27% (this value is higher than the average value reached by the insurance market). The insurance company ČPP (member of VIG) reached also higher values of ER (except for 2012). Also, ER of life insurance was growing in ČPP and PČS from 2014.

**Figure 2** Development of Expense Ratio of Non-life Insurance from 2010 to 2017




| | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|---|---|---|---|
| PČS | 4.75% | 4.86% | 1.38% | 1.44% | 1.42% | 1.66% | 1.80% | 2.06% |
| KOOP | 20.59% | 21.50% | 21.83% | 20.96% | 22.39% | 22.07% | 21.80% | 21.15% |
| ČAP | 26.80% | 27.21% | 29.04% | 27.37% | 27.96% | 28.02% | 28.51% | 28.00% |
| ČPP | 28.21% | 29.56% | 32.25% | 30.26% | 30.27% | 29.80% | 30.05% | 29.47% |
| ČSOBP | 31.35% | 34.95% | 33.37% | 33.77% | 32.81% | 33.10% | 33.65% | 33.45% |
| KP | 37.55% | 45.67% | 39.71% | 42.66% | 40.36% | 46.72% | 45.37% | 52.56% |

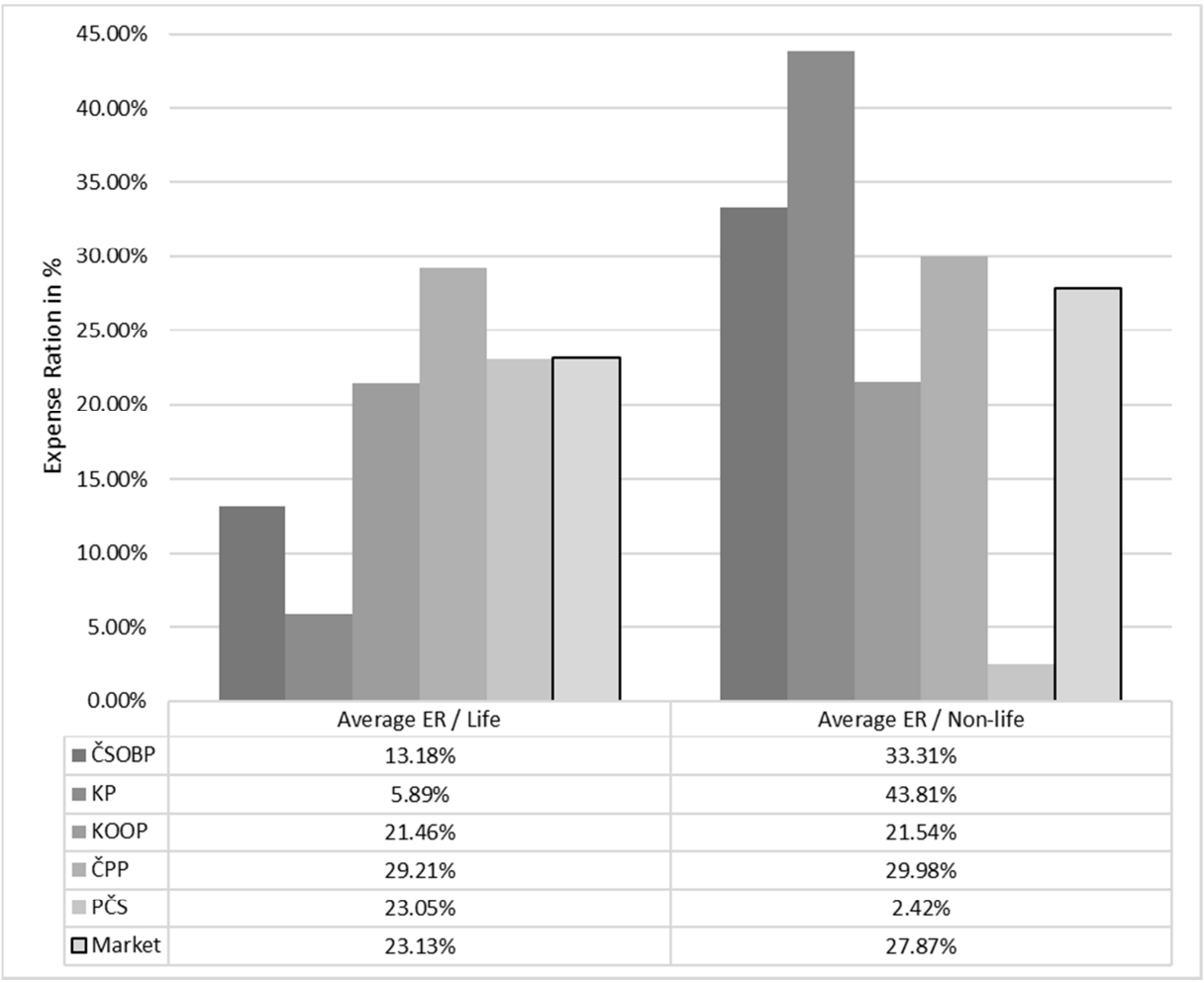
Source: author's own work based on ČAP's statistics

As expressed by Figure 2 (development of ER of non-life insurance), the insurance companies PČS (member of VIG) and KOOP (member of VIG) reached lower values than the insurance market. Both of these insurance companies show significantly lower values of ER than the other surveyed insurance companies. The insurance company ČPP is also a member of VIG but the ER values of non-life insurance were higher than the insurance market in the monitored period.

On the contrary, the other insurance companies, ČSOBP and KP reached higher values than the insurance market, and than the surveyed insurance companies. The development of values in ČSOBP loosely copied those of the insurance market. In the monitored period, the insurance company KP reached the highest values of ER of non-life insurance. Compared to the insurance market on average, the development of values was unstable but showing a growing tendency (growth from 37.55% to 52.66%).

The following Figure 3 shows a comparison of average values of ER of life and non-life insurance over the period 2010 – 2017.

**Figure 3** Comparison of Development of Expense Ratio Averages Values from 2010 to 2017




| | Average ER / Life | Average ER / Non-life |
|---|---|---|
| ČSOBP | 13.18% | 33.31% |
| KP | 5.89% | 43.81% |
| KOOP | 21.46% | 21.54% |
| ČPP | 29.21% | 29.98% |
| PČS | 23.05% | 2.42% |
| Market | 23.13% | 27.87% |

Source: author's own work based on ČAP's statistics

All of the insurance companies (except for ČPP) show lower average values of **ER of life-insurance** compared with the average value of the overall market. The lowest value (5.89%) was reached by the insurance company KP. The ČSOBP is the second insurance company with the lowest average value of ER in life insurance. Figure 3 also shows that the values of ER in life insurance are significantly lower for the insurance companies ČSOBP and KP as compared with the other insurance companies belonging to the VIG group.

The situation is very different for average values of **ER of non-life insurance**. All of the insurance companies except for KOOP and PČS reached higher ER of non-life insurance than what was the average value of the overall market. PČS reached the lowest value (2.42%). The insurance companies ČSOBP and KP reached higher average values of ER as compared with the overall market. KP, followed by ČSOBP, reached the highest values compared to the market. Figure 3 shows that values of ER of non-life insurance are, in comparison with the overall market, lower for all insurance companies belonging to the group VIG with the exception of ČPP. The values are also significantly lower than the values of the insurance companies ČSOBP and KP.

## 4 Conclusions

This paper has compared expense ratios of insurance portfolios belonging to these insurance companies: ČSOBP, KP, KOOP, ČPP and PČS over the period 2010 – 2017. Two selected insurance companies (ČSOBP and KP) focus on offering bancassurance products.

They are subsidiary companies of financial groups, to which they belong. The other selected insurance companies (KOOP, ČPP and PČS) belong to the insurance group VIG, which owns them. Thanks to the strategic cooperation between VIG and Erste Group Bank, Česká spořitelna can offer bancassurance products to its clients in the Czech Republic.

All of the surveyed insurance companies offer life and non-life insurance. The insurance companies KP and PČS focus almost solely on selling life insurance (more than 90% policies). On the contrary, the insurance companies KOOP and ČPP predominantly offer non-life insurance (more than 70% policies). The insurance company ČSOBP is selling only slightly more life that non-life insurance policies. The insurance company KOOP is the second largest insurance company by total premium in the Czech Republic (2018) and its average market share is 21.38%. The other surveyed insurance companies each share from 5% to 8% of the market. The insurance company ČPP holds the smallest market share (of 5.1%).

The aim of this paper is to determine whether or not the selected insurance companies and the group VIG achieve lower expense ratio of the insurance portfolio than what is the average of the expense ratio of insurance portfolios on the Czech insurance market. To achieve the target, one research question was formulated. **Is the average value of ER in selected insurance companies lower than the average value of ER on the Czech insurance market?** The average value was based on the average from 2010 to 2017.

As far as **life insurance** is concerned, it can be concluded that insurance companies with a developed bancassurance model and membership within a financial group (ČSOBP and KP) reach lower values of ER. The insurance companies belonging to the VIG group (with the exception of ČPP) reach lower values of ER in life insurance than the overall insurance market on average. These average values are, however, much higher than those reached by the insurance companies ČSOBP and KP. The insurance group VIG also offers integrated bancassurance products, with its property structure independent of any financial groups.

In case of average values of ER in **non-life insurance**, the situation is completely different. All insurance companies except for KOOP and PČS have reached higher ER than the market. The reason for this might be found in the fact that products of non-life insurance are offered less often through bancassurance, not affecting the expense ratio and efficiency of the insurance company to such an extent.

Regarding the **insurance group VIG**, it is important to compare the insurance companies belonging to this group with the insurance market. The research suggests that the insurance companies reach higher values of ER than the insurance market in case of life insurance (with the exception of KOOP) whereas in non-life insurance, the insurance companies reach lower ER than the market (with the exception of ČPP). It seems that better knowledge of who holds shares in VIG's insurance companies and what insurance products these offer is needed. The size of VIG's share differs from company to company and insurance products (in life and non-life insurance) also greatly vary. The VIG Group is not homogenous, which hinders efforts to evaluate and discuss any research findings.

On January 1, 2019, the VIG Group merged the companies PČS and KOOP as a result of its bancassurance project. There is a question how KOOP's expense ratio will be affected by this merger. This fusion might become a subject of further research.

## Acknowledgments

This paper was supported by the project IP/01/2019 "Comprehensive assessment of financial stability of banks and insurance companies in the Czech Republic and Slovakia".

## References


Barros, C. B, Barroso N., Borges, M. R. (2006). *Measuring Efficiency in the Life Insurance Industry with a Stochastic Frontier Model*. Retrieved from: http://www.ica2006.com/Papiers/3063/3063.pdf.

Cach, M. (2016). Bankopojištění jako pohodlí pro klienta a výhoda pro banku. *Pojistný obzor*, 2016(2), pp. 60-61.

CEA (2010). *Insurance Distribution Channels in Europe.* Retrieved from: https://www.draudimas.com/allpics/distribution.pdf.

Česká podnikatelská pojišťonva (2018). *Annual report 2018.* Retrieved from: https://www.cpp.cz/User_data/Media/Original/CPP/201904/m4_vyrocni_zprava_2018_06150dpi.pdf.

ČSOB Pojišťovna (2018). *Annual report 2018.* Retrieved from: https://www.csobpoj.cz/documents/10332/32806/2018_vyrocni-zprava_CSOB-Pojistovna.pdf/ef76e737-366b-4d76-b13f-8f673618167e.

Daňhel, J., Ducháčková, E., Radová, J. (2007). *Analýza globálních trendů ve světovém a českém komerčním pojištění.* Praha: VŠE.

Genetay, N., Molyneux, P. (1998). *Bancassurance*. Hampshire: Palgrave Macmilan.

Gestel, T., Martens, D., Baesens, B., Feremans, D., Huysmans, J., Vanthienen, J. (2007). Forecasting and analyzing insurance companies' ratings. *International Journal of Forecasting*, vol. 23(3), pp. 513-529. DOI: 10.1016/j.ijforecast.2007.05.001.

Hwang T., Gao, S. (2005). An Empirical Study of Cost Efficiency in the Irish Life Insurance Industry. *International Journal of Accounting, Auditing and Performance Evaluation*, vol. 2(3), pp. 264-280.

Chen, Z., Li, D., Liao, L., Moshirian, F., Szablocs, C. (2009). Expansion and consolidation of bancassurance in the 21st century. *Journal of International Financial Markets, Institutions and Money*, vol. 19(4), pp. 633-644.

Komerční pojišťovna (2018). *Annual report 2018*. Retrieved from: https://www.kb-pojistovna.cz/file/edee/cs/hospodarske-vysledky/vyrocni-zpravy/kp-vyrocni-zprava-annual-report-2018.pdf?2fa763638ac51992704094b13ed5d5e2.

Kooperativa pojišťovna (2018). *Annual report 2018*. Retrieved from: https://www.koop.cz/dokumenty/flexi/vyrocni-zpravy-pcs/vyrocni-zprava-2018/PCS_VZ_CZ_2018.pdf.

Leach, A. (1993). *European Bancassurance: Problems and Prospects to 2000*, *Financial Times Management Reports.* London: Financial Times Business Information.

Mesršmíd, J. (2016). *Marketing v pojišťovnictví.* Praha: Professional Publishing.

Pojišťovna České spořitelny (2018). *Annual report 2018*. Retrieved form: https://www.koop.cz/dokumenty/flexi/vyrocni-zpravy-pcs/annual-report-2018/PCS_VZ_EN_2018.pdf.

Polouček, S. (1999). *České bankovnictví na přelomu tisíciletí.* Ostrava: Ethics.

Přečková, L. (2016). Evaluation of the Financial Groups Erste Group Bank and UniCredit Group. *Financial Assets and Investing*, vol. 2(7), pp. 19-33.

Přečková, L., Vávrová, E. (2018). Evaluation of Expense Ratio of Insurance Portfolios Belonging to Selected Insurance Companies Operating on Czech Insurance Market. *In: Proceedings of the 15th International Scientific Conference.* Brno: Masarykova univerzita, pp. 550–558.

Pulchart, V. (2002). K ziskovosti neživotního pojištění – pohled na dlouhodobé trendy ve světě. *Pojistný obzor*, vol. 79(10), pp. 4-5.

Swiss Re (2007). Bancassurance: Emerging Trends, Opportunities and challenges. *Sigma*, 2007(5), pp. 1-39.

Vávrová, E. (2014). *Finanční řízení komerčních pojišťoven.* Praha: Grada.

# Extreme Tools of World Economy Management and Their Risks

**Rejnuš Oldřich**

Masaryk University
Faculty of Economics and Administration, Department of Finance
Lipová 41a, 602 00 Brno-Pisárky, Czech Republic
E-mail: rejnus@econ.muni.cz

***Abstract:*** *This paper deals with the problems of contemporary development of world economy and the manner of its management. Its aim is to evaluate current development of the economy of the most important countries of the world and, subsequently, to analyze assets and risks of their macroeconomic management and to predict future development, with special respect to early identification of possible commencement of future crisis. Firstly, this is an analysis of contemporary economic development of the most important world economies, before all the US, China, Japan, the most important member states of the EU and further globally important countries, in context with specific manners of their management. In connection with this, pros and cons of tools of monetary and fiscal regulation, used by them, as well as further problems that might result in future world crisis, are specified. Furthermore, contemporary global economic development is analysed and its future course is predicted and the most important risks are specified, both current risks and those ones related to potential feasible introduction of further, newly considered extreme tools of macroeconomic management. In conclusion, prognosis made by German economist and politician Marcus Faber, published in 2015: "The collapse of contemporary system is unavoidable" has been confirmed.*

*Keywords: World economics, fiscal and monetary policy, economic system, new macroeconomic tools, economic crises*

*JEL codes: E58, F01, G18, O11, P11*

## 1 Introduction

There are a number of questions, connected to not very positive contemporary economic development, present in most economically important countries of the world. In the first place, we are seeking for response to a question whether a future economic crisis is approaching, or rather whether the financial crisis of the year 2008 has been finally overcome. And secondly, following contemporary unfavourable economic development, new tools of macroeconomic regulation that might be able to make world economy move again, have been searched for intensively. In the case in question, these are extremely serious issues, connected with a number of issues of problem. Nevertheless, in accordance with an opinion, presented by former Secretary of State Henry Kissinger in 1974: *„who controls money can control the world"* (Engdahl, 2016) it is clear that one of the most important topics connected with the future of the mankind is, before all, economic future, connected with capitalizing money. This is closely connected with the endeavour of individual countries, corporations and individuals to gain every effort and wealth. This is why the future of the mankind is very closely connected with the issues of economic development, not only in the field of economic growth, but in the area of ways of redistribution of generated product.

## 2 Methodologies and Date

A number of individual development periods can be identified throughout the historical development of world economy. They are related on one hand with economic cycles, on the other hand with newly introduced tools of macroeconomic management, used in the connection with an effort to solve actual, usually problematic economic situation. In case of occurrence "standard crises" that occur in the course of common cyclic development of market economy, standard macroeconomic tools of fiscal and monetary regulation have been used until recently; it corresponded with the findings of contemporary economic theory. In the year 2018, so called global financial crisis occurred and standard tools

were not powerful enough to solve it. As a result, ”new, non-standard tools of monetary regulation” were used for the first time in the history; they managed to suppress the crisis, but were not able to solve it. And, what is important, in spite of the fact that more than 10 years have passed since the beginning of the crisis, almost all trials to terminate their use have failed, which means that they have been being used in most countries yet.

Above mentioned facts suggest an important question: shall it be possible to terminate them and get back to standard fiscal and monetary regulation, done in accordance with classical economic theory? Or shall it never happen again? If this is the case, what consequences shall it have in the future?

Used methodology represents a combination of qualitative and quantitative analysis. The quantitative component of pursued research will be represented by findings of economic theory; adherence to basic theoretic rules and principles in the process of managing economies of the most important countries of the world will be analyzed. First of all, adherence to common principles of fiscal and monetary policy will be in question; it will be subsequently confronted with the development of corresponding statistical macroeconomic indicators.

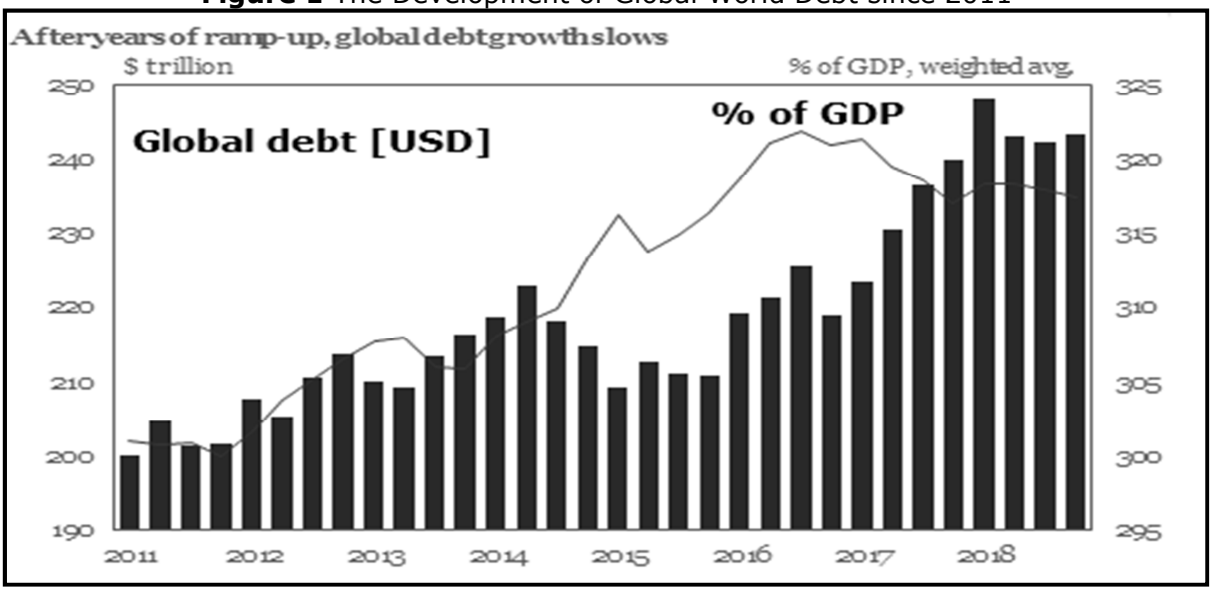
As far as investigation of adherence to theoretic principles of macroeconomic management of the economy, or breach of the above, in case of analysis of contemporary exploiting of interest rates, principles *„Classical theory of interest rates*" *and „The loanable funds theory”* will be taken into consideration. "*Fischer's quantity theory of money*" will be taken into consideration when analyzing the development of the volume of money in circulation. As far as quantitative segments are concerned, it will be based on economic data, obtained from databases Tradingeconomics, Eurostat, European Central Bank (ECB), International Monetary Fund (IMF), Institute of International Finance (IIF), Bank for International Settlements (BIS) and Knoema.

## 3 Results and Discussion

The world has a number of economic problems these days. One of them has developed into dimensions that not only threatens future economic growth, but it threatens functionality of world economic system itself, and consequently the future of world population. The problem is long-term intensive growth of world debt – public debt, corporate debt as well as household debt.

According to data of the International Monetary Fund (IMF), world debt exceeded the border of 244 trillion USD in the end of the year 2018 and it reached 318 % of world GDP (about 86 thousand USD per person).

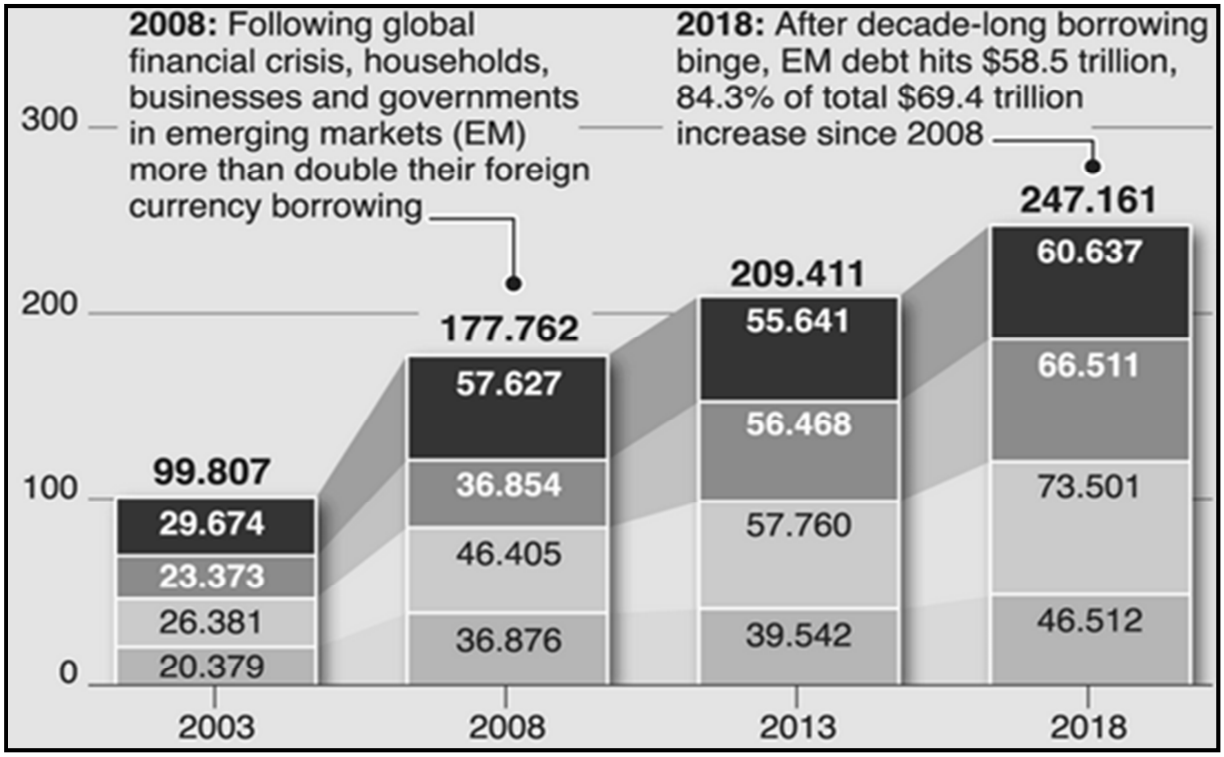
**Figure 1** The Development of Global World Debt since 2011




Source: IIF, BIS, IMF (2019)

The debt consists of four basic segments – as can be seen in Figure 1, retrieved from the Institute of International Finance (2019); these are (from bottom to top) Household, Non-financial corporates, Government and Financial corporates.

**Figure 2** The Development of Indebtedness of Individual Segments of World Economy since 2003




Source: Institute of International Finance (2019)

Currently there are 21 states in the world the indebtedness of which exceeds 90 % of GDP. The fact itself would not represent a serious problem, unless more than half of them were important or the most important world economies. Moreover, three biggest

debtors in the world – US, China and Japan, represent more than half of the world debt that exceeds their share on world production.

**Table 1** Current relation of public debt of twenty one most indebted countries of the world to their GDP

| Order | State | Debt/GDP [%] | Order | State | Debt/GDP [%] |
|---|---|---|---|---|---|
| **1.** | **Japan** | **253,0** | 12. | Jamaica | 103,3 |
| **2.** | **Greece** | **181,1** | **13.** | **Cyprus** | **102,5** |
| 3. | Lebanon | 152,0 | **14.** | **Belgium** | **102,0** |
| **4.** | **Italy** | **132,2** | 15. | Egypt | 101,2 |
| 5. | Cape Verde | 123,4 | **16.** | **France** | **98,4** |
| **6.** | **Portugal** | **121,5** | **17.** | **Spain** | **97,1** |
| 7. | Congo | 117,7 | 18. | Jordan | 94,2 |
| **8.** | **Singapore** | **112,2** | 19. | Bahrain | 93,4 |
| 9. | Mozambique | 110,5 | 20. | Djibouti | 90,7 |
| **10.** | Bhutan | 108,6 | **21.** | **Canada** | **90,6** |
| **11.** | **USA** | **105,4** | | | |

Source: Tradingeconomics database

Beside the 21 states mentioned above, further 52 states (according to database Tradingeconomics) evince public debts in the range of 50 to 90 % of their GDP.

After the outbreak of financial crisis in 2008, central banks did generally good thing, loosened their monetary policies and "pumped" extreme volume of money into the world economy system. It was made specifically by substantial decrease of interest rates, by providing extremely cheap money to commercial banks; they started to purchase securities, mainly state bonds, issued by governments; this indirectly supported them. As a result, interest rate substantially decreased worldwide; on one hand, it supported economy and worldwide growth of GDP, on the other hand, it led to disproportionate indebting of states, corporates and households and resulted in (Rejnuš, 2016):

1) Suppression of market allocation of disposable financial resources into the most profitable investment projects.
2) Suppression of willingness to save and invest into debt instruments and redirecting interest of the investors into purchasing shares and real assets.
3) Change of properties of financial investment assets and liabilities with impact on compromising their correct evaluation.
4) Negative impact on activities of most financial institutions.
5) Compromising effective monetary regulation.
6) Support of further indebting of all sorts of economic entities.

Subsequently, it resulted in creating conditions for:

7) Purposeful weakening of exchange rates of national currencies; this resulted into monetary wars.
8) Creating conditions for hyper-inflation and monetary reforms.

There are 16 states in the world the yearly GDP of which exceeds one trillion USD. These 16 countries create about three quarters of the world GDP; according to the International Monetary Fund (IMF), it reached the value of 84.8 trillion USD in 2018.

Following Table shows their mutual succession, the value of GDP in 2018, annual growth rate of GDP in the last five quarters of the year, unemployment rate and number of inhabitants.

**Table 2** Selected economic parameters of the economically most effective countries of the world

| | Countries | GDP 2018 [billion USD] | GDP Annual Growth Rate [%] I / 2018 | II / 2018 | III / 2018 | IV / 2018 | I / 2019 | Jobless rate [%] | Population [mil. people] |
|---|---|---|---|---|---|---|---|---|---|
| **1.** | **USA** | 20,494 | 2,6 | 2,9 | 3,0 | 3,0 | 3,2 | 3,6 | 326 |
| **2.** | **China** | 13,407 | 6,8 | 6,7 | 6,5 | 6,4 | 6,4 | 3,7 | 1395 |
| **3.** | **Japan** | 4,972 | 1,3 | 1,5 | 0,1 | 0,2 | 0,8 | 2,5 | 127 |
| **4.** | **Germany** | 4,000 | 2,1 | 2,0 | 1,1 | 0,6 | 0,7 | 3,2 | 83 |
| **5.** | **Great Britain** | 2,829 | 1,2 | 1,4 | 1,6 | 1,4 | 1,8 | 3,8 | 66 |
| **6.** | **France** | 2,775 | 2,4 | 1,9 | 1,5 | 1,2 | 1,2 | 8,7 | 67 |
| **7.** | **India** | 2,717 | 7,7 | 8,0 | 7,0 | 6,6 | 5,8 | 3,5 | 1284 |
| **8.** | **Italy** | 2,072 | 1,4 | 1,0 | 0,5 | 0,0 | –0,1 | 10,2 | 60 |
| **9.** | **Brazil** | 1,868 | 1,2 | 0,9 | 1,3 | 1,1 | 0,5 | 12,7 | 208 |
| **10.** | **Canada** | 1,711 | 2,2 | 1,8 | 2,0 | 1,6 | 1,3 | 5,7 | 37 |
| **11.** | **Russia** | 1,631 | 1,9 | 2,2 | 2,2 | 2,7 | 0,5 | 4,7 | 147 |
| **12.** | **South Korea** | 1,619 | 2,8 | 2,8 | 2,0 | 3,1 | 1,8 | 4,1 | 52 |
| **13.** | **Spain** | 1,426 | 2,9 | 2,6 | 2,5 | 2,3 | 2,4 | 14,7 | 47 |
| **14.** | **Australia** | 1,418 | 3,1 | 3,1 | 2,7 | 2,3 | 1,8 | 5,2 | 25 |
| **15.** | **Mexico** | 1,223 | 1,2 | 2,6 | 2,5 | 1,7 | 1,2 | 3,5 | 125 |
| **16.** | **Indonesia** | 1,022 | 5,1 | 5,3 | 5,2 | 5,2 | 5,1 | 5,0 | 264 |

Source: Knoema, Tradingeconomics database (May 2018)

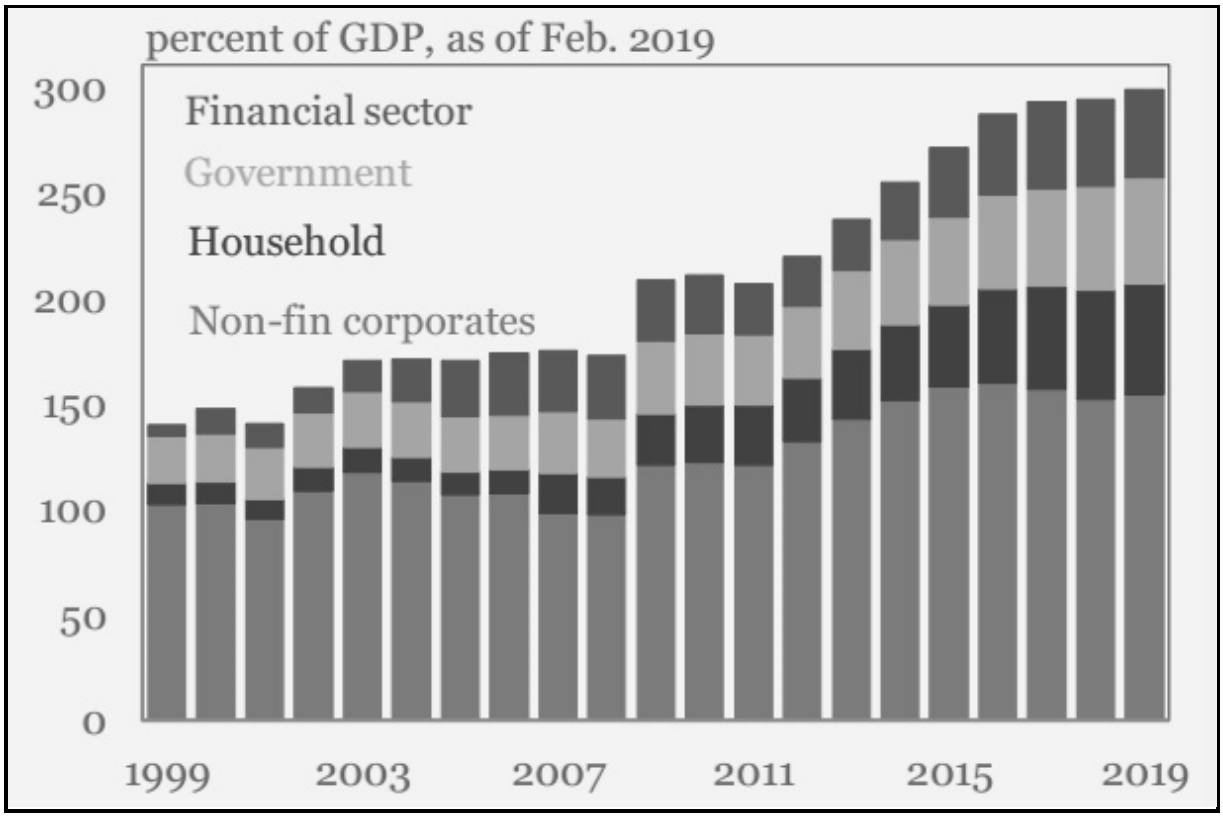
The Table above shows that the economic climate of the most important countries of the world has not been favourable at the moment, even taking into account the fact that monetary and fiscal expansion has been moving on in most countries. And in case that the development of GDP has been stagnating or even decreasing under full deployment of all available tools of fiscal and monetary stimulation, the situation can be evaluated to be extremely dangerous.

What is current real economic climate of the most important countries of the world?

**USA:** The economy of the US has been growing successfully at the moment. Unfortunately this is caused by extremely intensive indebting (before all in connection with long-term negative trade balance and strong armament) as well by the fact that there is still positive influence of recent decreasing of taxes; this is going to get exhausted soon.

**China:** Economic growth has been very strong on a long-term basis, on the other hand, very high (and partially hidden) and fast growing indebtedness must not be forgotten.

**Figure 3** The Development of Indebtedness of China in Per Cent of GDP



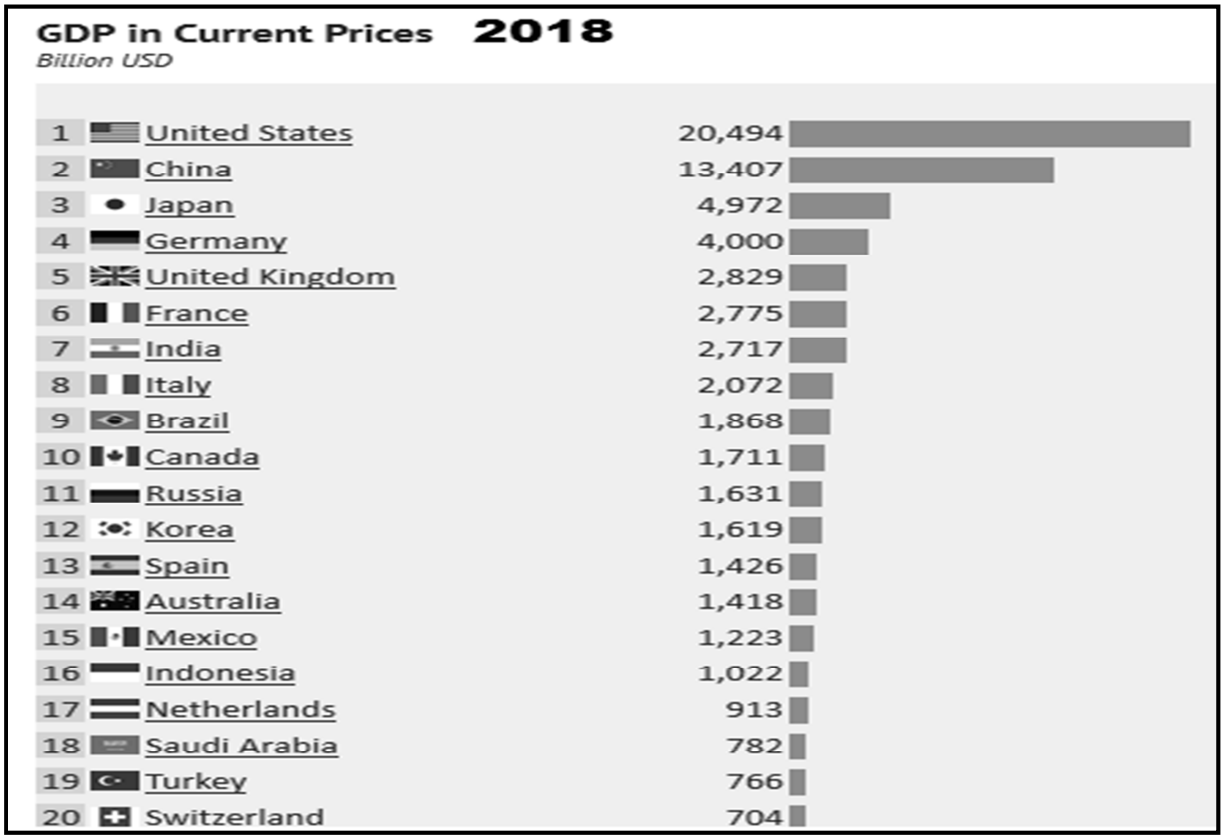

Source: Global Debt Monitor (February 2019)

**Japan:** Japan is the most indebted country of the world, with long-term based very low economic growth. Furthermore, the central bank of the country has been keeping negative interest rates on a long-term basis; the bank has been doing extremely strong "quantitative easing" by means of purchasing shares of individual limited liability companies via Exchange Traded Funds; according to Nikkel calculations, they have purchased them in the total value of over 250 billion USD. Economic growth of Japan depends before all on stimulation (or rather subsidies); this is a serious risk for the whole Japanese economy.

**EU States (Germany, France, Italy, Spain, and Great Britain): "**Eurozone" countries have one basic problem in common – they have common currency. Despite the fact that individual countries evince different economic maturity, they have to use common currency – EUR. It means that they are unable to perform their own monetary regulation and they have to adhere to ECB monetary policy. All of them, including UK, have to adhere to, sometimes purposeless, decisions of "Brussels". As a result of the above, their economies have been stagnating, and it has started to change into recession. Gradual disintegration of the European Union, evidenced not only by Brexit, but by stagnating GDP of the most important EU countries and by extremely high unemployment rate in Italy and Spain, as well as by exceptionally high costs, spent on migration and European Union "management" (Rejnuš, 2018).

**Other countries:** As far as other countries are concerned, only India and Indonesia have been showing distinct economic growth; together with China, they demonstrate basic difference between fast economic growth of most Asian economies and economic stagnation of the rest of the world.

**Figure 4** GDP 2018 in Current Price [Billion USD]




Source: KNOEMA (2019)

Currently, the situation has developed into such a situation that further considerable decrease of world economy is commonly supposed, and, the worst thing, this refers to highly developed and economically strongest countries of the world. If it was a standard crisis, arising from cyclic development of market economy, the problem would not be so serious. Nevertheless, if this happens in the environment of severe indebtedness and, moreover in the time of extremely low or even negative interest rates, the situation will be highly dangerous and it can develop into further global crisis, which would be much worse than the previous one. It can be assumed from the fact that central banks do not have any space for significant decreasing of interest rates as they had in 2008. Furthermore, in 2008, most countries were not seriously indebted, unlike they are now.

Nowadays, the situation is very different: most countries are extremely indebted and most central banks do not have any space to use standard tools of monetary regulation for monetary expansion. And even worse, the effectiveness of newly introduced tools has been gradually decreasing (Carlsson-Szlezak, 2019). Subsequently, there is a need to search for further, even more extreme regulation tools, which causes concerns regarding their possible use.

In connection with it, further significant decreasing of interest rates, up to negative values, has been considered, as well as the method of "helicopter money".

The first mentioned tool is based on brutal decreasing of interest rates up to considerably negative values. It would result in substantial decrease of savings and allocation of savings into the most profitable investment products would stop working. As bank depositors would be burdened not only by taxes and inflation, but by negative interest rates as well, it is clear they would massively collect their money and they would prefer keeping cash. Subsequently it would result into collapse of bank system – and economy is unable to work without it. Afterwards, forcible administrative restriction of collecting cash can reasonably be expected and, subsequently, termination of cash payments.

As far as the method of "helicopter money" is concerned, it is clear this would be the last desperate act of central banks, which would, in accordance with quantitative theory of money (or according to transaction equation by Irving Fisher), sooner or later lead to hyperinflation. What would it result into? As a general rule, cashless economy does not give the owners of the money any practical possibility to withdraw their financial assets from the financial system in the case of bankruptcy of particular commercial bank or in case of failure of the whole bank system and they do not have any chance to save "their" assets. Obligatory execution of all financial transactions solely by means of banks leads to loss of control over one's own financial assets and loss of possibilities to protect oneself from any monetary experiments. This is due to the fact that one's privacy has been passed into someone else's hands (Vlachynský, 2017).

## 4 Conclusion

The analysis shows that worldwide debt relief of the human society by means of standard fiscal and especially monetary macroeconomic tools is not possible any more. Worldwide indebtedness of states, corporations and nowadays even households has reached such a level that it is not possible any more to return it to common state by means of standard tools of macroeconomic regulation. It is connected especially with the fact that increasing interest rates would accelerate worldwide economic collapse, which can be expected in foreseeable future, anyway.

Based on the above mentioned facts, a moment can be predicted in not too distant future, when standard, historically proven tools of macroeconomic regulation would fail and it will be necessary to start using new tools. These new tools will only prolong the duration of worldwide economic failure and it will consequently result into even stronger social unrest, compared with those that would occur nowadays in case of the failure of economy. This would lead not only to termination of contemporary way of world economy management, but contemporary social order of the whole human society

And why is the current system of functioning of human society doomed to decline? The main reason is, before all, in the failure of human morality. Particularly, there is extreme and ever growing difference between the incomes of "the rich and the poor", growing bureaucracy, (especially within the European Union), growing costs of armament and last but not least so called migration costs.

And how this will all end? The analysis has confirmed the validity of Marc Faber's words (2015) that: „Central banks are the biggest danger of the mankind. They are able to drive the whole world to bankruptcy. There is the only one question: how and when it will happen. The problem is that there are mostly academicians in the central banks, who have never earned money and have never paid their employees. They do not know how it works in real world. It was Fed that started printing money, later the European Central Bank followed and China is starting with it now. It will inevitably result in complete loss of the value of money. One day we will wake up and find out that the bubble has burst and the prices of shares and other assets that had been pushed up due to "new" money, are rapidly falling down into the abyss. One thing can be taken for sure: **The collapse of current system is inevitable.**

## References

Carlsson-Szlezak (2019). *Subsequent Downturn Might See „Radicalization" of Insurance Policies Used Final Time.* Retrieved from: https://automobilnews.eu/next-downturn-could-see-radicalization-of-policies-used-last-time-news-by-automobilnews-eu/.

Engdahl, F. W. (2016). *From Golden Dollar to Petro Dollar to Narco Dollar*. Retrieved from: http://journal-neo.org/2016/05/09/from-golden-dollar-to-petro-dollar-to-narco-dollar/.

Faber, M. (2015). *Největším nebezpečím pro svět jsou centrální banky.* Retrieved from: http://ceskapozice.lidovky.cz/faber-nejvetsim-nebezpecim-pro-svet-jsou-centralni-banky-pzu-/tema.aspx?c=A150814_110647_pozice-tema_houd.

Institute of International Finance (2018). Retrieved from: https://www.irishexaminer.com/breakingnews/business/global-debt-hits-record-247-trillion-854806.html

Institute of International Finance (2019). Retrieved from: http://files.clickdimensions.com/iifcom-ai7nn/files/globaldebtmonitor_april_vf.pdf?m=4/2/2019%201:12:22%20PM&_cldee=YmJ1cmdlc3NAYmxvb21iZXJnLm5ldA==&recipientid=contact-ab025b13eaf0e81180d102bfc0a80172-33ad0f1d2edb40998c586774f72ead42&esid=94eb0970-4855-e911-80fc-000d3a011cec.

KNOEMA (2019). Retrieved from: https://knoema.com/nwnfkne/world-gdp-ranking-2018-gdp-by-country-data-and-charts.

Rejnuš, O. (2016). Prediction of Future Development of the World Economy Under Conditions of Negative Interest Rates. *Proceedings of the 13TH international scientific conference "European Financial Systems 2016"* , Brno: Masaryk university, 2016. s. 646-653. ISBN 978-80-210-7962-5.

Rejnuš, O. (2018). The Current Problems of the Eurozone and the Future Transformation of the European Union. *Proceedings of the 15TH international scientific conference "European Financial Systems 2018"*, Brno: Masaryk university, 2018. s. 575-582. ISBN 978-80-210-8980-8.

Vlachynský, M. (2017). *Hotovost je opět pod palbou*. Retrieved from: https://pravyprostor.cz/hotovost-je-opet-pod-palbou/.

# Reliability of Investment Recommendations

**Pavla Říhová[1], Milan Svoboda[2]**

[1]University of West Bohemia in Pilsen
Faculty of Economics, Department of Economics and Quantitative Methods
Univerzitní 22, 306 14 Plzeň, Czech Republic
divisova@kem.zcu.cz

[2]University of West Bohemia in Pilsen
Faculty of Economics, Department of Economics and Quantitative Methods
Univerzitní 22, 306 14 Plzeň, Czech Republic
svobodm@kem.zcu.cz

***Abstract:*** *This article deals with the reliability of investment recommendations for selected companies traded on the Prague Stock Exchange. Stock analysts issue investment recommendations and set the so-called target share prices. The target price of a share is an intrinsic value of the share that has been determined by fundamental analysis. The market price of the share should reach exactly this value within one year. The investor should therefore buy (sell) such shares where there is a sufficiently large difference between the intrinsic value and the current market price in favour of the intrinsic value (in favour of the market price). The article aims to evaluate the overall reliability or, more precisely, the accuracy of investment recommendations. The target share price to be reached within one year has been compared with the development of its market price for every published investment recommendation. If the market price of the share has reached its target price within one year, the investment recommendation can be considered as a successful one and vice versa. The investment recommendations were analysed for the six-year period, from the beginning of 2012 until the end of 2017. The data were taken from the database of Patria a.s. The analysis has shown that investing based on investment recommendations does not yield good results.*

*Keywords: intrinsic value, investment recommendations, market price, share, target price*

*JEL codes: G12, G14, G17*

## 1 Introduction

In times of low-interest savings accounts, households are looking for ways how to better increase the value of their savings. One option is to invest in shares. If we do not want to keep a close eye on the share price development and to think up business strategies ourselves, we can follow the recommendations of stock analysts. Investment recommendations are based on the so-called target share price. The target share price is a price that the share should reach within one year. It is represented by an intrinsic value (fair value). The final investment recommendation results from the comparison of the current market price and the fair value. If the current market price is lower than the fair value, the share is suitable for buying, otherwise for sale.

To what extent can these target prices be trusted? Target prices (investment recommendations) are issued by stock analysts who are employed by brokerage firms. Sales of brokerage firms are based on commissions for brokering purchases and sales of securities for clients. It is therefore in the interest of securities traders to encourage investment investors to take action, i.e. to buy or sell. As a result, stock analysts are in the conflict of interest. On the one hand, they advise investors whether to buy or sell shares, but, on the other hand, they are paid by securities traders, whose interest is to make the target price as different as possible from the current market price. For example, as (Jílek, 2009) states, stock analysts mainly give investment recommendations to buy. They justify it as follows: If the market is growing, it is advisable to buy the share because it will cost even more in the future. If the market is

declining, it is also advisable to buy the share because prices are low and, in all probability, there will be a change in trend soon.

In addition to the conflict of interest of stock analysts, the calculating methods of the intrinsic value of a share are also in question. To put it simply, these methods are based on the assumption that the correct company´s present value is a sum of all discounted future cash flows. This can be formally expressed according to (Damodaran, 2012), adjusted, as follows:

$$H = \sum_{i=1}^{n} \frac{CF_i}{(1+r)^{t_i}} \tag{1}$$

where $H$ is the intrinsic value of a share, $n$ is a number of years of firm's life (it is usually assumed that a firm will exist indefinitely), $CF_i$ is the value of *i*-th cash flow (the cash a company generates after cash outflows to support operations and maintain its capital assets) in period $t$, $r$ is the discount rate reflecting the riskiness of the estimated cash flows, $t_i$ is time in years.

Free cash flow to the firm (FCFF), free cash flow to equity (FCFE), economic value added (EVA) or dividends paid can be considered disposable CF. It always depends on the particular situation which of these financial flow options is to be used to calculate the company value.

The method itself is not in question, but the ability to predict future financial flows (the difference between future incomes and expenditures) and discount rates is arguable. To determine, or more precisely to estimate future incomes and expenditures correctly is very difficult, as well as to determine the discount rate. These models are very sensitive to input parameters and cannot correctly determine the intrinsic value for a longer period of time. Various studies pointed out that even a relatively moderate range of input parameters in valuation models results in significant differences in a final intrinsic value. The sensitivity analysis of these models is dealt with, for example, by (Ramnath et al., 2008) or (Veselá, 2011). The simulation that was carried out by (Říhová and Svoboda, 2015) has shown that the resulting target prices may vary by up to 50 %. The research by (Krch, 2015) has also revealed that the analyst recommendations show different quality not even in comparison of individual institutions, but also in comparison of individual analyses from the same institution. The study of (Bradshaw and Tan, 2012) has proved that analyst target price revision is more reliable than target price level in predicting future returns. Another study, for example (Bilinski et al., 2012), has stated that analysts with higher forecasting experience, following more firms, country-specialized, and employed by a large broker predict more accurate target prices. The study of (Kerl, 2011) the ability of analysts to exactly forecast the unknown 12-month stock price and to determine factors that explain this accuracy. According to (Gregoire and Marcet, 2014), target prices do not provide useful information to the market, but timing of the market and the issue of the forecast horizon is more significant, because it is an unexplored field yet. Antônio et al. (2017), in turn, investigated the hypothesis whether the consensus among analysts (a smaller standard deviation) is a factor which can affect target price prediction errors. This hypothesis has been confirmed.

This way, stock analysts have the possibility (using estimate of variables in models) to set a target price that encourages a client to take action.

The article aims to evaluate the overall reliability of published investment recommendations (target prices) for shares traded on the Prague Stock Exchange.

## 2 Methodology and Data

The success of target price prediction is verified as follows. For each examined share, the average expected (theoretical) yield is compared with the average real (empirical) yield. The calculations are based on the following assumptions:

- Investors have enough capital and take a long or short position with each published investment recommendation. They take a long position (they buy shares) if the target price is higher than the current share market price. They take a short position (they borrow shares from a brokerage firm and then sell them at the current market price) if the target price is lower than the current share market price. The value of shares bought or sold is always the same, i.e. it is theoretically possible to buy part of the share.
- If investors hold a long position, they sell the shares when the share price reaches the target price. If the share price does not reach the target price within one year, they sell the shares exactly after the year at the current market price. The percentage yield from this one transaction is then:

$$y_i = y_{i,E} = \left( \frac{TP_{i,t} - P_t}{P_t} \right) \cdot 100 \ (\%) \quad \text{or} \quad y_i = \left( \frac{P_{t+365} - P_t}{P_t} \right) \cdot 100 \ (\%), \tag{2}$$

  where $y_i$ is the real yield on the *i*-th investment recommendation, $y_{i,E}$ is the expected yield on the *i*-th investment recommendation, $TP_{i,t}$ is the target share price of the *i*-th recommendation that was published on day $t$, $P_t$ is the closing share price on day $t$ and $P_{t+365}$ is the closing share price for 365 days (for a year) after issuing the investment recommendation. It is obvious from this relationship that the real yield is equal to the expected one when the share price reaches the target price. If the share price does not reach the target price, but it has risen (the correct share price development was predicted), the yield is positive. If the share price development was not predicted correctly, the yield is negative.

- If investors hold a short position, they buy back and return the borrowed shares at the moment when the share price drops to the target price level. If the share price does not drop to the target price within one year, they buy the shares and return them after one year at the current market price. Theoretically, there is no need of any capital for this transaction. The capital for the later purchase of shares has been obtained from the sale of the borrowed shares. However, in fact, we need some capital because the share price can rise, and the capital obtained from the sale of the shares would not suffice. So, the capital is locked up in the value of borrowed shares. This capital will be used in the event that the share price at the time of purchase is higher than the price at the time of sale. Because the potential loss from this operation may theoretically be unlimited (the share price growth is not theoretically limited), we add one more rule. We also buy shares when the market price reaches twice the price at which the shares were sold. In this case the locked-up (reserve) capital is sufficient to cover the loss. This condition reduces the amount of potential losses. The percentage yield from this transaction is calculated analogically to (2), we only sell for price $P_t$ and buy for price $TP_{i,t}$ or $P_{t+365}$, and it is expressed as:

$$y_i = y_{i,E} = \left( \frac{P_t - TP_{i,t}}{P_t} \right) \cdot 100 \ (\%) \text{ or } y_i = \left( \frac{P_t - P_{t+365}}{P_t} \right) \cdot 100 \ (\%) \tag{3}$$

- Any fees related to the purchase, sale and borrowing of shares are not taken into account. Potential income from dividends is not considered either.

The average yield of each examined share is calculated according to the following formula:

$$\bar{y} = \frac{1}{n} \sum_{i=1}^{n} y_i, \tag{4}$$

where $r$ is the total number of recommendations issued for the particular share within the examined time period. The average expected yield of each share is calculated analogically according to the following formula:

The reliability of target price prediction is measured by the ratio coefficient $k$ and the difference $d$ .

$$k = \frac{\overline{y}}{\overline{y}_E} \tag{6}$$

$$d = \overline{y}_E - \overline{y} \tag{7}$$

Ideally, the coefficient $k$ should be equal to one and the difference $d$ should be equal to zero. In such a case, all predictions would be met. These values can be achieved even for conflicting predictions (where one predicts growth and the other one predicts a decline in a share price). For example, the share price may decline in the first period, but later the trend will change and the share price will rise. Both predictions can be met in the one-year period.

**Data**

Historical recommendations and target prices as well as daily share prices were obtained from the database of Patria a.s. This database contains target prices since 2012. The reliability of the target price prediction has been verified for the following shares: ČEZ, KB, O2 ČR (O2), Philip Morris ČR (PM), PEGAS. All these companies are traded on the stock exchange at least since 2012 up to the present and the Prague Stock Exchange is their domestic market. The target prices were analysed for the six-year period, from the beginning of 2012 until the end of 2017. Duplicate data were removed (e.g. one recommendation was published by two companies – the parent company and its subsidiary), and the target prices in currencies other than CZK were removed (there were only a few of them). In addition to these target prices, we have used daily prices (open, close, min, max) from the beginning of 2012 until the end of 2018.

## 3 Results and Discussion

The following section summarizes the results for all the examined shares and shows their prices and target price predictions in graphs. Each graph is briefly commented on.

The results for the 5 analyzed shares are given in Table 1. To explain, the first row shows the share price as at 28 December 2018 (at the end of the examined period); the second row shows the price as at 2 January 2012 (at the beginning of the examined period); the third row shows the price change (in percentage); the fourth row shows the average daily trading volume in millions of CZK; the fifth row shows the number of issued target prices; the sixth row shows percentage of positive recommendations (recommendations predicting growth); the seventh row shows the ratio of successful predictions (the market price of the share reached the target price within one year); the eight row shows the average yield calculated according to (4); the ninth row shows the average expected return calculated according to (5); the tenth row shows the coefficient $k$ calculated according to (6) and the last row shows the difference $d$ calculated according to (7).

**Table 1** Summary results for all examined shares

| | ČEZ | KB | O2 | PEGAS | PM |
|---|---|---|---|---|---|
| **$P_{2018\text{-}12\text{-}28}$** | 535.0 | 847.0 | 241.0 | 806.0 | 14 080 |
| **$P_{2012\text{-}01\text{-}02}$** | 786.0 | 677.0 | 382.5 | 457.0 | 12 456 |
| **change (%)** | -31.9% | 25.1% | | 76.4% | 13.0% |
| **volume** | 252 | 190 | 72 | 8 | 11 |
| **n** | 370 | 270 | 146 | 52 | 39 |
| **positive TP** | 68.9% | 84.4% | 63.0% | 73.1% | 66.7% |
| **success rate** | 50.0% | 61.9% | 80.1% | 82.7% | 76.9% |

| | | | | | |
|---|---|---|---|---|---|
| **average y** | -4.0% | 4.1% | 3.2% | 8.9% | 3.3% |
| **average $y_E$** | 13.1% | 11.1% | 8.6% | 10.9% | 6.1% |
| **k** | | 0.37 | 0.38 | 0.82 | 0.54 |
| **d** | 17.1% | 7.0% | 5.4% | 2.0% | 2.8% |

Source: our calculation based on Patria Finance: https://www.patria.cz/

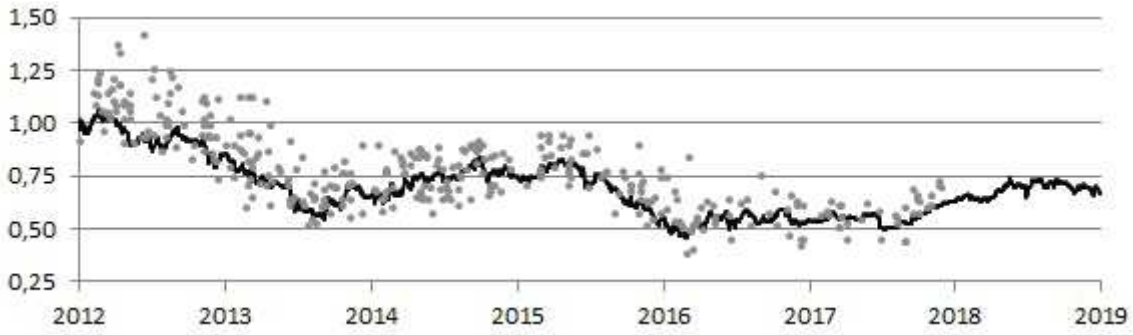
A total of 877 recommendations were analyzed, the most for ČEZ - 370 and the fewest for PM - 39. The number of issued recommendations corresponds to the daily trading volume. The greater the trading volume and the number of stock exchanges on which the shares are traded are, the more attention is paid to them by analysts. Of the total number of recommendations, 72.8% were positive (they predicted growth in the share price). The overall success rate is 61.8%. Provided the investors followed the recommendation, they would achieve (with the exception of the ČEZ share) a positive yield (average $y$). However, for the three most traded shares there have been big differences between what the analysts promised and what the reality was, see the values of $k$ and $d$ (they do not make sense for ČEZ). Taking into consideration the values of $k$ and $d$, the analysts were most successful in predictions for PEGAS and PM, where the real yields are closest to the expected ones.

The figures show the development of the share price (the black line) and the target prices (the gray points). In order to compare the figures, relative values with the share value being equal to 1.00 as at 2 January 2012 have been presented. All other prices relate to this level.

**ČEZ**

If the investors followed the analysts' recommendations, they would lose an average of 4.0% on one transaction. Due to the negative yield the coefficient $k$ was not calculated. The reasons for these losses and high $d$ are given in Figure 1. It is obvious that the target prices were very high in 2012 and early 2013, although the shares had a downward tendency. The high target prices were probably fueled by the belief in the upturn in the market trend, which had been downward since 2008. In 2012, the shares lost about 50% of the 2008 maximum.

**Figure 1** Development of the Share Price and the Target Prices of ČEZ

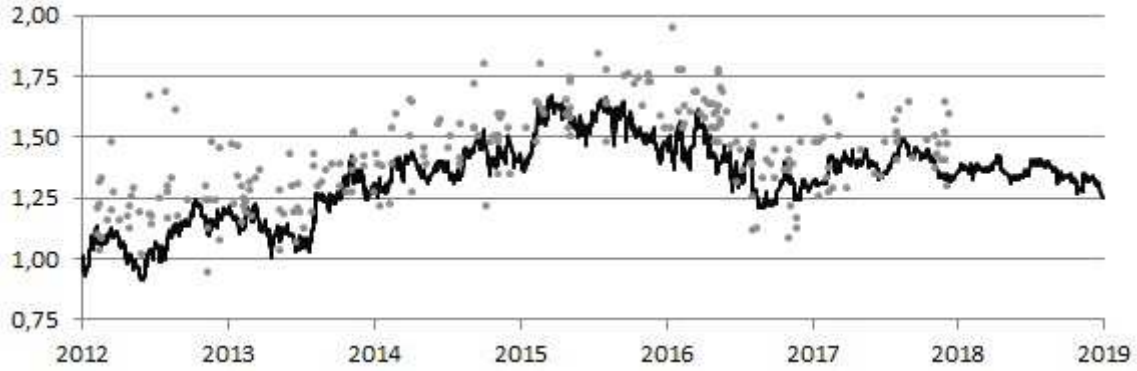



Source: our calculation based on Patria Finance: https://www.patria.cz/

**KB**

As is obvious from Figure 2, there was great optimism and growth expectations for shares of KB among the analysts. Many target prices are higher than the current market price. The analysts had estimated an upward trend until 2015 and investors reached positive real yields, although the expected yields had been higher. The very high target prices have been the reason for the low value of $k$.

**Figure 2** Development of the Share Price and the Target Prices of KB

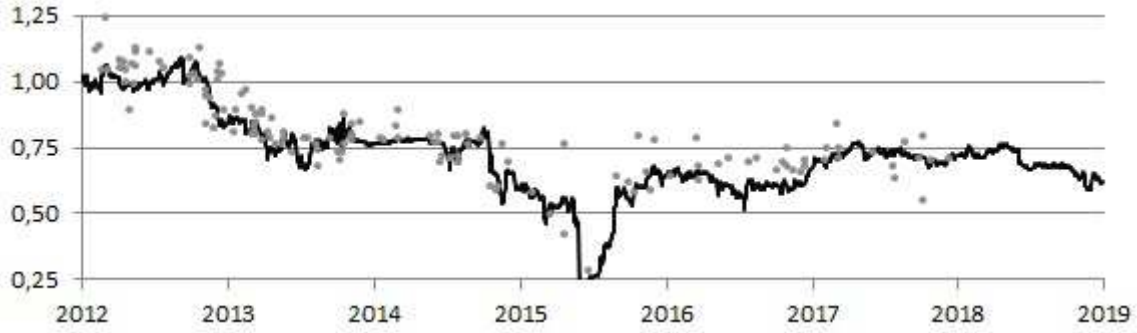



Source: our calculation based on Patria Finance: https://www.patria.cz/

**O2**

In the examined period, there was a change in the majority shareholder of O2 CR in Figure 3. Telefónica O2, a Spanish company, sold its 65.9% stake in the company to PPF Group, an investment company, in January 2014. In June 2015, O2 ČR was divided into CETIN and O2 CR, a successor company. At that moment there was a slump in the share price. New companies are different from the original one. Due to the company division and the split of its shares, the data are not consistent, and results are thus distorted. If the value of CETIN before its withdrawal from the market was added to O2 CR, the successor company of O2, the same price level would be achieved as in 2012. We can also notice that the target prices are relatively close to the current prices.

**Figure 3** Development of the Share Price and the Target Prices of O2



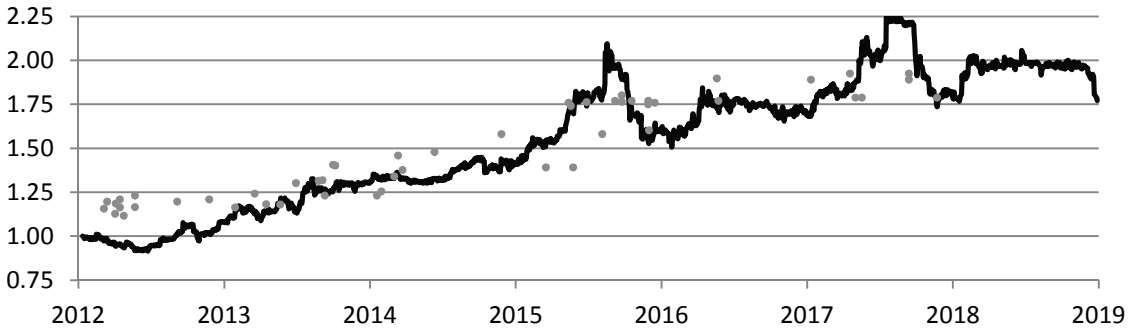

Source: our calculation based on Patria Finance: https://www.patria.cz/

**PEGAS**

As for the shares of PEGAS, see Figure 4, the analysts achieved the best results: $k$ is 0.82 and $d$ is 2.0%. The reason for this success is the fact that the company had a clear and predictable dividend policy (a regular slow growth of dividends) and informed about all its investment plans (construction of new plants). Also, the annual results did not include any major surprises. To predict a moderate price increase was a safe bet. In the summer of 2017, R2G Rohan Czech s. r. o. made a voluntary takeover bid (at the highest price in mid-2017) and in September it became the majority shareholder with nearly 89% of the shares. As the majority shareholder announced in advance, the company

completely stopped paying out dividends after the takeover bid and used the profit for investment and debt reduction.

**Figure 4** Development of the Share Price and the Target Prices of PEGAS

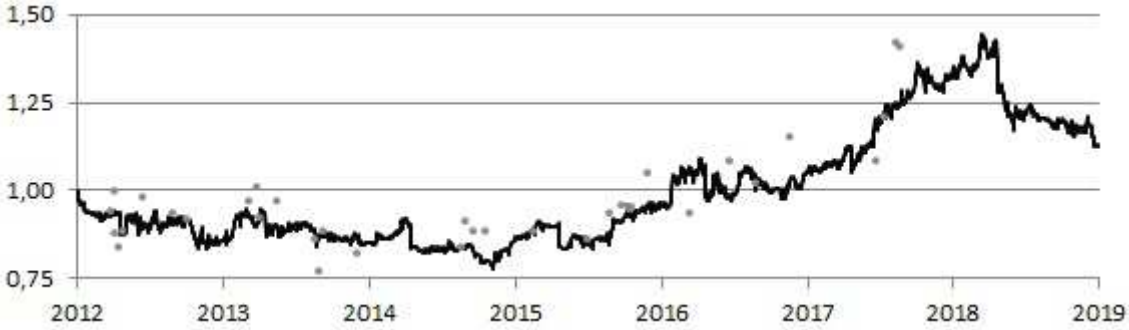



Source: our calculation based on Patria Finance: https://www.patria.cz/

**PM**

The stock analysts were least interested in the shares of PM that are shown in Figure 5. The predicted prices were often close to the current prices. The analysts' results can be described as average. This is greatly influenced by a small number of recommendations. In the case of a small number of recommendations, even a few recommendations that do not estimate the trend well may have a significant impact on the examined values of $k$ and $d$ . This is evident in the last unfulfilled prediction, which estimated an increase in the price by 15.9%, while the share price fell by 8.9% after a year.

**Figure 5** Development of the Share Price and the Target Prices of PM




Source: our calculation based on Patria Finance: https://www.patria.cz/

## 4 Conclusions

The results of the study have shown that the reliability of target price predictions of stock analysts is not too high for Czech stock companies traded on the Prague Stock Exchange. This confirms the conclusions reached by the authors of various studies about other stock exchanges. If the investors followed the analysts' recommendations, they would usually reach a positive yield, but often significantly lower than was predicted. The reason for this inaccuracy can lie in the optimism of stock analysts, which is reflected in a higher number of positive recommendations expecting price growth. The ratio of positive and negative recommendations was approximately 3:1. After all, this corresponds to the aforementioned, which is stated, for example, by (Jílek, 2009, p. 241). Lin and Wu (2016) have come to the same conclusion, pointing out that analysts tend to issue positive recommendations about companies. Similarly, Glezakos and Merika (2007) have found that 91% of the recommendations were positive and the analysts repeated the same recommendation in 40% of the cases (of which in 44.5% they repeated a positive recommendation).

For investors, analytical reports or comments justifying these prices are more valuable than specific target prices.

Another specialization of this research can be to examine short-term stock market responses to the publication of a new recommendation.

## Acknowledgments

The research project was supported by Grant SGS-2018-042 of the Faculty of Economics, the University of West Bohemia in Pilsen.

## References

Antônio, R. M., Ambrozini, L. C. S., Gatsios, R. C., Magnani, V. M. (2017). Analysts' Consensus and Target Price Accuracy: A Study in Latin America. *Brazilian Administration Review*, vol. 14(4). DOI: http://dx.doi.org/10.1590/1807-7692bar2017170036.

Bilinski, P., Lyssimachou, D., Walker, M. (2012). Target Price Accuracy: International Evidence. *In: European Financial Management Association 2012 Annual Meeting.* Retrieved from: https://www.efmaefm.org/0EFMAMEETINGS/EFMA%20ANNUAL%20MEETINGS/2012-Barcelona/papers/EFMA2012_0026_fullpaper.pdf.

Bradshaw, M., Huang, A. G., Tan, H. (2012). *Analyst Target Prices and Forecast Accuracy around the World.* Retrieved from: http://www.rotman.utoronto.ca/FacultyAndResearch/AcademicAreas/Accounting/-/media/Files/Programs-and-Areas/Accounting/AcademicPapers/HTan.pdf.

Damodaran, A. (2012). *Investment Valuation: Tools and Techniques for Determining the Value of any Asset.* New Jersey: John Willey & Sons Inc. (ed.)

Glezakos, M., Merika, A. (2007). The Impact Of Analysts' Recommendations: Evidence From The Athens Stock Exchange. *Journal of Applied Business Research,* vol. 23(2). DOI: https://doi.org/10.19030/jabr.v23i2.1403.

Gregoire, J., Marcet, F. (2014). Analysts' target price accuracy and investors' reaction: Chilean stock market evidence. *Revista Mexicana de Economía y Finanzas,* vol. 9(2), pp. 153-173.

Jílek, J. (2009). *Akciové trhy a investování*. Praha: Grada Publishing, a. s.

Kerl, A. G. (2011). Target Price Accuracy. *BuR – Business Research*, vol. 4(1), pp. 74-96.

Krch, P. (2015). The Investment Recommendations in the Czech Republic: An Appraisers Perspective. *Procedia Economics and Finance,* vol. 25, pp. 371-377.

Lin, M.-C., Wu Y.-Z. (2016). Interest conflicts, stock recommendations and investor attention. *International Review of Financial Analysis*. DOI: 10.1016/j.irfa.2016.11.002.

Ramnath, S., Rock, S., Shane, P. B. (2008). Financial Analysts' Forecasts and Stock Recommendations: A Review of the Research. *Foundations and Trends® in Finance,* vol. 2(4), pp. 311-421.

Říhová, P., Svoboda, M. (2015). Applicability of Dividend Discounted Models for Assessing the Company´s Value. In: *Innovation Management and Sustainable Economic Competitive Advantage: From Regional Development to Global Growth*. Norristown: International Business Information Management Association, pp. 1761-768.

Veselá, J. (2011). *Investování na kapitálových trzích*, 2nd ed. Praha: Wolters Kluwer.

# Experimental Design: Testing the Zero Yield Bias

**Ilja Schaab[1], Eric Frère[2], Alexander Zureck[3]**

[1] Masaryk University / FOM University of Applied Sciences
Department of Finance at Faculty of Economics and Administration
Leimkugelstraße 6, 45141 Essen, Germany
E-Mail: ilja.schaab@fom-net.de

[2] FOM University of Applied Sciences
Department of Finance at Faculty of Economics and Administration
Leimkugelstraße 6, 45141 Essen, Germany
E-Mail: eric.frere@fom.de

[3]FOM University of Applied Sciences/Masaryk University
isf Institute for Strategic Finance/Department of Finance at Faculty of Economics and Administration
Leimkugelstraße 6, 45141 Essen, Germany
E-mail: alexander.zureck@fom.de

***Abstract:*** *The various impacts of the European Central Bank's monetary policy induce a necessity for new research approaches as the established theories provide only limited explanations to the new cause and effect relationships. First empirical studies on the topic of an investor's risk stability in a low interest rate environment provided valuable insights for the portfolio theory and behavioral finance. According to the results, investors tend to allocate more funds into riskier assets when the interest rates are low. This paper proposes an experimental design which extends the differentiation between only a risk-free and a risky asset to a close-to-reality set-up. By presenting unlabeled asset classes with their key characteristics in different interest rate environments, the test subject gets the opportunity for a multidimensional assessment of the situation. The development of the six investment opportunities as well as their characteristics is explained in detail to provide transparency about the realistic set-up. The research based on this experimental design should provide deeper insights about the interrelation of the three dimensions of the triangle of finance and investing.*

*Keywords: Behavioral finance, portfolio theory, reaching for yield, unstable risk preferences, Zero Interest Rate environment*

*JEL codes: C90, G11, G40, E52*

## 1 Introduction

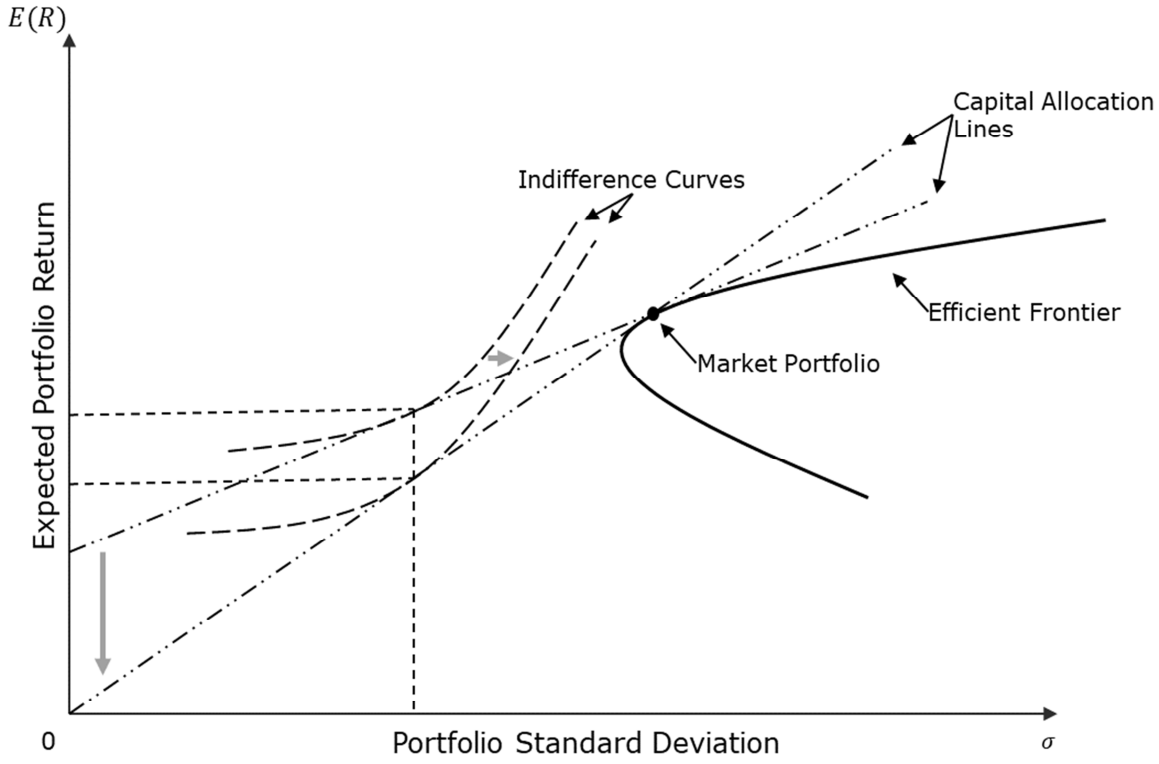
The financial crisis as well as the European debt crisis took their toll on the European economy and financial sector. To stabilize markets and achieve its primary objective of price stability, the European Central Bank had to implement unconventional countermeasures such as the asset purchase program (European Central Bank, 2019). But also the continuous lowering of key interest rates, which reached 0.00% in the main refinancing operation facility in March 2016, should help the stabilization process (European Central Bank, 2016). These supportive measures for the economy, however, represent a substantial challenge for investors.

Looking at the primary bond markets in the zero interest rate environment, depending on the duration, the investor is only able to gain the credit spread as investment return. In detail, in March 2019, the swap derived zero curves are below 0.00% up to a duration of approximately 5 years (Thomson Reuters, 2019c). The secondary market presents also an unfamiliar situation. In the course of the asset purchase program, the European Central Bank bought a total of approx. €2.6 trillion bonds which led to decreasing returns, scarcity of investment opportunities, and illiquidity in the secondary markets (Boermans and Keshkov, 2018, pp. 29–30; European Central Bank, 2019). These circumstances present private and institutional investors with the necessity to search for

adequate investment alternatives which fit their investment strategy and their defined risk-return requirements (see e.g. Neubauer, 2018, pp. 22–23).

At this point, the monetary policy of the European Central Bank induces the scrutiny of the theoretical discussion about the stability of risk preferences (see e.g. Baucells and Villasís, 2010, p. 209; Schildberg-Hörisch, 2018, pp. 148–150). The following figure 1 presents a simplified example including elements from the portfolio and the utility theory. Assuming that the efficient frontier stays stable despite current market developments, the decrease of risk-free interest rates should lead to a slope alteration in the capital allocation line. In this scenario, the investors return would decrease ceteris paribus which would result in the decrease of utility since the indifference curve moves accordingly. With a stable risk preference, the investors fund allocation between risk-free assets and the market portfolio should remain stable to maintain the risk exposure.

**Figure 1** Impact of Changing Risk-Free Rate on Indifference Curve and Return




Source: Own representation based on the summaries of Singal (2017a, 2017b)

However, with regard to the aforementioned search for investment alternatives and the popularity of alternative investments (Preqin, 2019, p. 5), the stability of risk preferences is at least labeled with a question mark. The empirical research to this topic stands at its beginning. Lian et al. (2018) conducted one of the first benchmark experimental studies on this topic. The authors found evidence that investors allocations to risky assets are significantly higher when interest rates are low. Their first proposed explanation is the reference dependence which states that investors perceive low interest rate environment returns as too low compared to their reference point from experience and therefore pursue riskier investments. The second explanation is the possible salience of risky asset returns in comparison to low interest rate instead of normal interest rate returns (Lian et al., 2018, p. 2). Ganzach and Wohl (2018, pp. 11–13) provided in a contemporaneous study consistent results and explanations.

The experimental designs of both studies were differentiating between a risk-free and a risky investment opportunity and providing return and volatility values for the test subjects. This paper proposes a more detailed experimental design to assess not only the

impact of a low interest rate environment on risk preferences but also to analyze the investment preferences regarding the primary asset classes in Germany. The further investigation of the zero yield bias is an essential component for the further development of the portfolio theory and the topic of behavioral finance.

## 2 Methodology and Data

### Experimental Design

The proposed experimental design will present the test subjects the opportunity to allocate wealth into selected asset classes. First, the allocation setting will be presented in a normal and in the next step in a zero interest rate environment. The asset classes will represent the primary vehicles for wealth allocation in Germany and will be shown not with their names but instead as unlabeled investment opportunities. This approach should prevent data biases due to individual experiences and prejudices and is a common approach in research for the examination of different alternative configurations (e.g. Hensher et al., 2005, p. 371). Instead of the name, the test subject will see different characteristics of the asset class which orient themselves at the triangle of finance and investment (liquidity – risk – return). Liquidity will be represented with the characteristic of average duration and premature availability. Return will be shown as average return in percent per year. Risk will be split into two characteristics. The first will assess the redemption value at the date of maturity and the second will show the probability of default in percent for the next 12-month period. The investment will not be shown as an absolute number but as a percentage of total available funds. With this approach every test subject should be able to adjust the experiment to the individual perception of an adequate portfolio (e.g. €10 k, €100 k, or €1 m). The both interest rate scenarios will only vary in the shown average returns so that the test subject's decision to reallocate or not to reallocate between asset classes is based only on this variation.

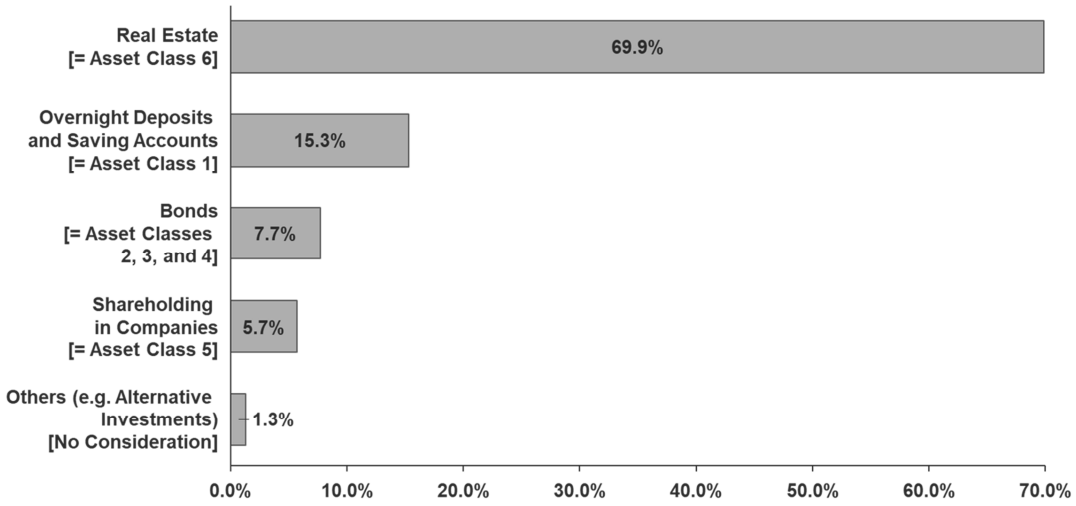
The asset allocation experiment will be followed by a question which aims at the reasons for a possible reallocation of available funds. The test subject has to choose his primary and secondary criteria for the decision or can alternatively declare that the decision cannot be described in such a way.

### Identification of Relevant Asset Classes

To determine relevant proxy asset classes, the experimental design takes the current wealth allocation in Germany into account. The determination process consisted of two steps. First, national data was used to identify top level wealth allocation (Statistisches Bundesamt, 2014, p. 16). Since this data included insurances as an investment class and also subdivided securities into stocks, bonds, and investment funds which as well included stock funds and bond funds, the second step was the recalculation of asset allocation based on the asset classification. Therefore, the investment in insurances was reclassified with the actual investments by insurance companies in Germany (Gesamtverband der Deutschen Versicherungswirtschaft e. V., 2018, p. 15) and all other assets were also assigned to the specific asset baskets.

The results of the recalculation are shown in the following figure 2. Real estates, overnight deposits and saving accounts, and bonds account for a total of 92.9% of the wealth in Germany. Those asset classes are followed by investments in company's shares with 5.7% and other assets with approx. 1.3%. Except the category of other assets, all other asset classes are included into the experimental design under the mentioned white label marks. The asset class of bonds is also sub-divided into three categories with regard to counterparty risk. Those three categories include governmental, corporate investment grade, and corporate non-investment grade (high yield) bonds since reallocation tendencies in favor of riskier bond categories are expected based on the introductory analysis.

**Figure 2** Overview of Wealth Allocation in Germany and Assignment of Asset Class Groups




Source: Own calculations based on Gesamtverband der Deutschen Versicherungswirtschaft e. V. (2018, p. 15) and Statistisches Bundesamt (2014, p. 16)

**Value Determination for Different Interest Rate Environments**

With the definition of relevant asset classes, it is possible to determine proxy values for the different characteristics in the next step. The following table 1 presents the summary of underlying periods as well as the results from average return calculations. The year 1999 is herein defined as the overall starting point of the analysis and represents the implementation of the euro as common currency. The time periods for bonds and deposits differentiate additionally between the period before the financial crisis and after the implementation of the zero key interest rate to model the different interest environments.

**Table 1** Asset Class Average Returns per Year

| **Asset Class** | **Normal Interest Rate Environment** | | **Zero Interest Rate Environment** | | **Sources** |
|---|---|---|---|---|---|
| | Assumption | Value | Assumption | Value | |
| **Overnight Deposits and Saving Accounts** | Average returns between 1999 and 2006 | 1.9% | Average returns since 2016 | 0.2% | Gesamtverband der Deutschen Versicherungswirtschaft e. V. (2018, p. 117) |
| **Governmental Bonds** | | 4.4% | | 0.3% | Deutsche Bundesbank (2019) |
| **Investment Grade Bonds** | | 4.8% | | 0.9% | LBBW Research (2019, 96); Thomson Reuters (2019c) |
| **Non-Investment Grade Bonds** | | 9.3% | | 5.4% | Bank of America Merrill Lynch (2019); LBBW Research (2019, p. 96); Thomson Reuters (2019c) |
| **Shareholding in Companies** | Average returns between 1999 and 2018 | 8.4% | Average returns between 1999 and 2018 | 8.4% | Thomson Reuters (2019a) |
| **Real Estate** | | 3.9% | | 3.9% | Thomas and Piazolo (2009) |

Source: Own calculations based on listed sources.

The overnight deposits and savings accounts in Germany are usually characterized by daily maturities. The redemption at maturity corresponds with the initial investment and due to the regulatory implemented coverage levels and the implied counterparty diversification, the probability of default is set at 0.0% (European Parliament and the Council of the European Union, 2014, p. 160).

In January 2019, the volume weighted duration of governmental bonds was 12.4 years (Deutsche Finanzagentur, 2019). The closest instrument approximation to this maturity is the 10-year governmental bond which also represents 44.6% of the total governmental indebtedness in Germany. Applying this instrument as proxy, the duration for the experiment is set at 10 years with premature availability including price risks. The redemption at maturity equals the initial investment and the probability of default is set at 0.0%. This assumption is based on the AAA external rating of Germany and the corresponding translation into default probabilities (S&P Ratings Global, 2018, pp. 8–9).

The return calculations for the investment grade and the non-investment grade corporate bond proxies are comparable. After the calculation of historical average swap derived zero curves, the corresponding average credit spreads are added for the total proxy return. The proxy duration is set at 5 years based on European market index approximations (LBBW Research, 2018, p. 13). The redemption equals also the initial investment and the premature availability is given with an exposure to price risks. The probability of default is calculated through the equally weighted rating class probabilities of default provided by S&P. For investment grade bonds with rating categories between AAA and BBB–, the value is set at 0.1% and for non-investment grade bonds with ratings between BB and B–, the value is set at 2.5% (S&P Ratings Global, 2018, p. 60). Bonds with substantial risks, starting at a rating category of CCC+ are neither part of the return nor the default calculation.

The German CDAX is used as proxy for the return calculation of shareholding in companies. Generally, the investment in a company's stock has no fixed duration. However, the application of a perpetual investment duration appears to be inappropriate for the experiment. Based on market data, the average duration will be set at 0.7 years with a daily availability under the exposure of price risks (Bundeszentrale für politische Bildung, 2018). The investment in a company bears also a redemption risk since the redemption volume depends on the price development during the investment phase. The probability of default is set at 0.7% based on model implied ratings and corresponding probabilities of default provided by Thomson Reuters (2019b).

Building proxy values for real estate investments is a more complex approach since there is no statistical market data available. For the average investment return per year, a portfolio of open real estate funds from Germany was used. This portfolio consisted of the 7 funds with the longest track record on the German market. For the average duration, the linear depreciation specification, which requires a period of approx. 33 years, is used (Einkommensteuergesetz, 2019, §7, Section 4). However, the investor is able to sell his asset any time with corresponding price risks. These risks are also valid for the redemption at maturity which depends on the price development during the investment phase. The model implied ratings of the Europe Real Estate Index constituents were used to assess the probability of default (Thomson Reuters, 2019b). From a business model perspective and with regard to perpetual land values, it is plausible that the implied probability of default with its value of 0.1% is lower than the corresponding value from investments in common company stocks.

## 3 Results

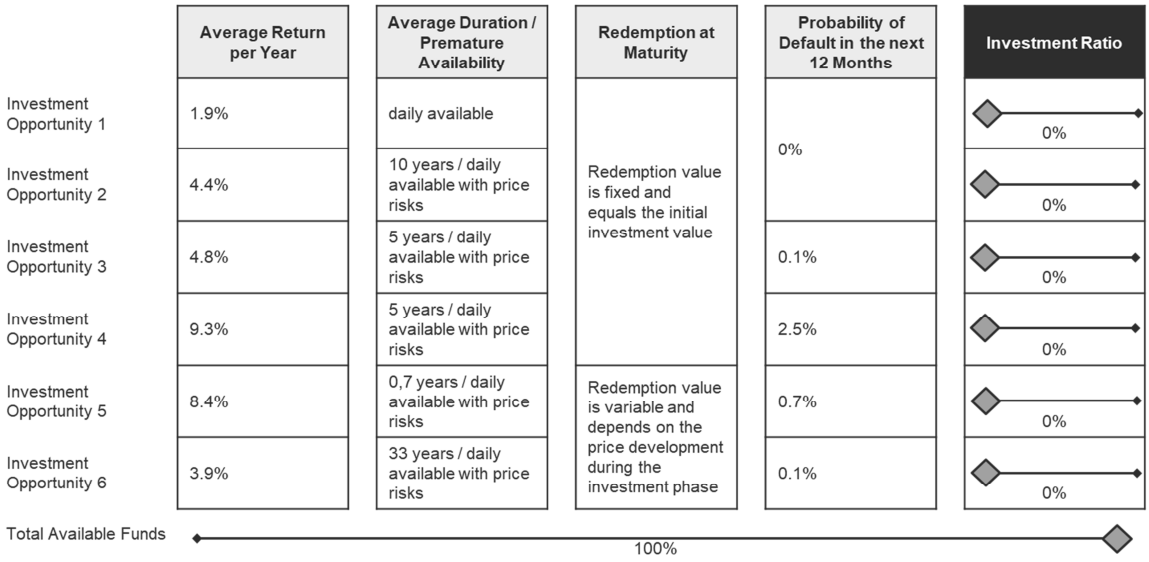
### Survey Design

The following figure 3 presents the proposed survey design based on the results from the preceding chapter. The upper part of the image presents the question set-up in the normal interest rate environment and the lower part shows the set-up in the zero interest rate environment.

**Figure 3** Survey Designs for Different Interest Rate Environments

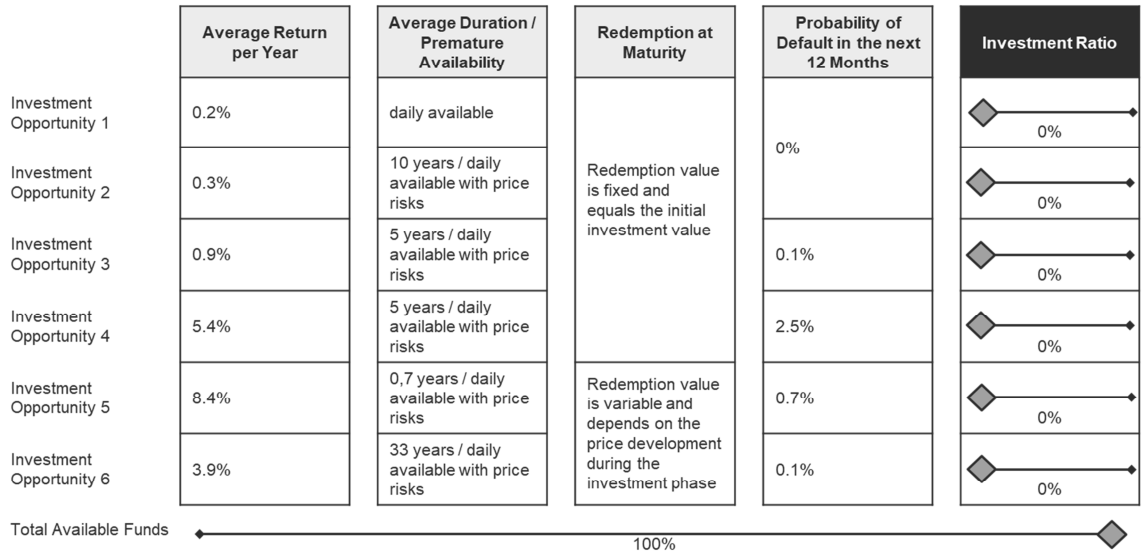
**Set-Up: Normal Interest Rate Environment**

**Imagine, the following 6 investment opportunities are available to you. How would you divide your available funds on a percentage basis if you had to choose between these alternatives?**




**Set-Up: Zero Interest Rate Environment**

**Imagine, the following 6 investment opportunities are available to you. How would you divide your available funds on a percentage basis if you had to choose between these alternatives?**




Source: own representation

## 4 Conclusion

The manifold impacts of the European Central Bank's monetary policy induce a necessity for new research approaches since the established theories provide only limited explanations to the new cause and effect relationships. First research on the topic of an investor's risk stability in the zero interest rate environment provided valuable insights for the portfolio theory and behavioral finance. This paper proposes an extension of the experimental design to deepen the insights on this topic. By presenting primary asset classes with their key characteristics in different interest rate environments, more specified results about the investor's risk preferences should be gained. Following the collegial discussion during the conference in Brno, the research team is planning to conduct a preliminary study ($n \approx 50$) to test the set-up and subsequently execute the study about the zero yield bias in September 2019 aiming at approx. 500 test subjects.

## References


Bank of America Merrill Lynch (2019). *ICE BofAML Euro High Yield Index Option-Adjusted Spread*. Retrieved March 2, 2019, from: https://fred.stlouisfed.org/series/BAMLHE00EHYIOAS.

Baucells, M., Villasís, A. (2010). Stability of risk preferences and the reflection effect of prospect theory. *Theory and Decision*, vol. *68*(1), pp. 193–211. DOI: https://doi.org/10.1007/s11238-009-9153-3.

Boermans, M., Keshkov, V. (2018). The impact of the ECB asset purchases on the European bond market structure: Granular evidence on ownership concentration. *DNB Working Paper*, No. 590. Retrieved from: https://www.dnb.nl/en/binaries/Working Paper No. 590_tcm47-375317.pdf.

Bundeszentrale für politische Bildung (2018). *Aktienbestand und Aktienhandel*. Retrieved April 6, 2019, from: http://www.bpb.de/wissen/5IAXN9,0,Aktienbestand_und_Aktienhandel.html.

Deutsche Bundesbank (2019). Zeitreihe BBK01.WZ3409: *Aus der Zinsstruktur abgeleitete Renditen für Bundeswertpapiere mit jährl. Kuponzahlungen / RLZ 10 Jahre / Monatsendstand*. Retrieved March 1, 2019, from: https://www.bundesbank.de/statistic-rmi/StatisticDownload?tsId=BBK01.WZ3409&its_csvFormat=de&its_fileFormat=csv&mode=its.

Deutsche Finanzagentur (2019). *Einzelaufstellung aller umlaufenden Bundeswertpapiere zum Monatsultimo (XLS).* Retrieved March 1, 2019, from: https://www.deutsche-finanzagentur.de/fileadmin/user_upload/institutionelle-investoren/xls/Einzelaufstellung_Bundeswertpapiere_dt.xlsx.

Einkommensteuergesetz (2019). Einkommensteuergesetz in the version of the notice of 8 October 2009 (BGBl. I p. 3366, 3862), which was last amended by Article 1 of the Act of 25 March 2019 (BGBl. I p. 357).

European Central Bank (2016). *Monetary policy decisions*. Retrieved January 26, 2019, from: https://www.ecb.europa.eu/press/pr/date/2016/html/pr160310.en.html.

European Central Bank (2019). *Asset purchase programmes*. Retrieved March 24, 2019, from: https://www.ecb.europa.eu/mopo/implement/omt/html/index.en.html.

European Parliament and the Council of the European Union (2014). Directive 2014/49/EU of the European Parliament and of the Council of 16 April 2014 on deposit guarantee schemes. *Official Journal of the European Union*, *L 173*, pp. 149–178.

Ganzach, Y., Wohl, A. (2018). A Behavioral Theory of the Effect of the Risk-Free Rate on the Demand for Risky Assets. *Journal of Behavioral and Experimental Economics*. Forthcoming. Retrieved from: https://ssrn.com/abstract=3206174.

Gesamtverband der Deutschen Versicherungswirtschaft e. V. (2018). *Statistisches Taschenbuch der Versicherungswirtschaft 2018*. Berlin.

Hensher, D. A., Rose, J. M., Greene, W. H. (2005). *Applied Choice Analysis*. New York: Cambridge University Press.

LBBW Research (2018). *High Yields bieten Chancen*. Stuttgart.

LBBW Research (2019). *Kapitalmarktkompass Februar 2019*. Stuttgart.

Lian, C., Ma, Y., Wang, C. (2018). Low Interest Rates and Risk-Taking: Evidence from Individual Investment Decisions. *The Review of Financial Studies*. Forthcoming. DOI: https://doi.org/10.1093/rfs/hhy111.

Neubauer, M. (2018). Anleger-Statistik: Rückkehr in die alte Welt? *Zeitschrift Für Das Gesamte Kreditwesen*, vol. 2018(16), pp. 22–24.

Preqin (2019). *Global Alternative Market Overview 2019*. Tokyo. Retrieved from: https://www.preqin.com/DownloadInterim.aspx?d=http%3A%2F%2Fdocs.preqin.com%2Fpresentations%2FCAIA-Japan-Seminar-and-Networking-Event-Global-Alternative-Market-Overview-2019-Mar-19-YYM.pptx.

S&P Ratings Global (2018). *2017 Annual Global Corporate Default Study And Rating Transitions*. Retrieved April 6, 2019, from: https://www.spratings.com/documents/20184/774196/2014+Annual+Global+Corporate+Default+Study/a4cffa07-e7ca-4054-9e5d-b52a627d8639.

Schildberg-Hörisch, H. (2018). Are Risk Preferences Stable? *Journal of Economic Perspectives*, vol. 32(2), pp. 135–154.

Singal, V. (2017a). Portfolio Risk and Return: Part I. In CFA Institute (Ed.), *Corporate Finance and Portfolio Management - CFA Program Curriculum - 2018 - Level I - Volume 4*, pp. 291–360. Wiley.

Singal, V. (2017b). Portfolio Risk and Return: Part II. In CFA Institute (Ed.), *Corporate Finance and Portfolio Management - CFA Program Curriculum - 2018 - Level I - Volume 4,* pp. 361–412. Wiley.

Statistisches Bundesamt (2014). *Fachserie 15, Heft 2, Wirtschaftsrechnungen - Einkommens- und Verbrauchsstichprobe Geld- und Immobilienvermögen sowie Schulden privater Haushalte*. Wiesbaden: Statistisches Bundesamt.

Thomas, M., Piazolo, D. (2009). Renditen und Risiken deutscher indirekter Immobilienanlagen. In H. Rehkugler (Ed.), *Die Immobilie als* Kapitalmarktprodukt, pp. 117–146. Munich: Oldenbourg Wissenschaftsverlag GmbH.

Thomson Reuters (2019a). *CDAX Performance Index - Average Returns per Year from 1999 to 2018*. Retrieved, from: https://eikon.thomsonreuters.com/index.html. (Accessed on April 1, 2019)

Thomson Reuters (2019b). *Credit Combined Implied Ratings Tool*. Retrieved from: https://eikon.thomsonreuters.com/index.html. (Accessed on April 1, 2019)

Thomson Reuters (2019c). *Curve Chart Tool: Eurozone - Zero Curve - Thomson Reuters Swaps Zero (Standard)*. Retrieved from: https://eikon.thomsonreuters.com/index.html. (Accessed on April 1, 2019)

# A Critical Analysis of Too Prominent to Fail in Times of Neymar

**Dennis Schmidt[1], Alexander Zureck[2], Martin Svoboda[3], Stephan Burmeister[4]**

[1] Masaryk University / FOM University of Applied Sciences
Department of Finance at Faculty of Economics and Administration
Herkulesstraße 32, 45127 Essen, Germany
E-mail: dennisxschmidt@web.de

[2]FOM University of Applied Sciences/Masaryk University
isf Institute for Strategic Finance/Department of Finance at Faculty of Economics and Administration
Leimkugelstraße 6, 45141 Essen, Germany
E-mail: alexander.zureck@fom.de

[3] Masaryk University
Department of Finance at Faculty of Economics and Administration
Žerotínovo nám. 617/9, 601 77 Brno, Czech Republic
E-mail: martin.svoboda@me.com

[4] Alumnus at FOM University of Applied Sciences
Department of Finance at Faculty of Economics and Administration
Herkulesstraße 32, 45127 Essen, Germany
E-mail: stephan-burmeister@hotmail.de

***Abstract:*** *Sales of football, the world's most popular sport increased worldwide by nine percent from 2009-2013. In times of revenue growth, however, spending has increased disproportionately. Media, fans and even scientists are wondering how the future financial situation of football companies will look like at a time when a club like Paris Saint-German is paying over EUR 200 million for player Neymar. The aim of the article is to analyze, if football companies have a higher survival rate. This serves as a basis for discussing whether football companies are "too big to fail". For this purpose, current article contributions and studies are analyzed with regard to the topic. In order to prevent the cycle of indebtedness on the football market, more regulation is needed. After the financial crisis from 2007 onwards, the excesses of the financial industry could be contained through increased regulation. In the football sector, UEFA is attempt-ing to impose stricter budget restrictions in the form of the "Financial Fair Plays". The transfer of Neymar in 2017 for more than EUR 200 million proves that the clubs can by-pass the FFP. As in the financial industry and the "too big to fail" doctrine, this is still based on subjective assumptions of the supporting organizations. It can be assumed that the increasing transfer sums will increase the systematic risks in the future. In addition, it must be determined whether football companies will eventually be "too big to save". An improved approach to financial fair play could force football companies to balance their economies, leading to a lower rate of bankruptcy on the football market.*

*Keywords: Football, too big to fail, UEFA, FFP, transfer sums*

*JEL codes: G30, G32, G40*

## 1 Introduction

More than a billion people have been following FIFA World Cup finals in 2014, according to FIFA. In private households, 695 million viewers watched the finale. This represents an increase in interest of 12 percent relative to the 2010 World Cup finals. These figures illustrate the global interest in football. In addition, football has not only developed into a sporting event, but also into an important economic sector (Nagy, 2012). Klimmer (2003) also points out the parallels that prevail in the characteristics between companies and football clubs. The spectator success dependent on the sporting success reflects the quality-dependent demand of the product produced. An ascent is equated with the development of new markets. Participation in an international competition represents an

internationalization. Continuous athletic performance can be seen as a constant quality standard of the company.

Georgievski and Zeger (2016) describe in their paper that the football market can be compared to the last financial crisis. In doing so, commonalities in increasing sales, salaries and expenses can be discovered. In addition, investments are made that cannot be financed by their own economic power. The media, the fans, and the scientific world discuss about the economic and especially the financial situation of football clubs, mainly after Paris Saint-Germain payed more than EUR 200m for Neymar.

The aim of this paper is to illustrate why the probability of default is lower for football clubs than for other companies, although they declare more often themselves insolvent.

It also explains the circumstances that cause football companies to increasingly face insolvency situations. In addition, it will be shown what effect the loss of a club on the league operation and the economic situation of the hometown has. This serves as a basis for discussing whether football companies are "too big to fail". This term has been used by several authors in relation to football companies (Franck, 2014; Franck and Lang, 2014; Georgievski and Zeger, 2016; Storm, 2012). It should be questioned whether the acceptance of the "too prominent to fail" would not be more appropriate. Budzinski and Müller (2013) and Budzinski (2014, 2017) called football companies as "too prominent to fail" in their papers. The consulting firm A. T. Kearney's study asked whether European football is "too popular to fail" (Rothenbücher et al., 2010). "Popular" and "prominent" are synonyms. Thus, this paper offers space for future research and discussion.

## 2 Methodology and Data

In this paper current article contributions and studies are analyzed with regard to the topic. Sales of the most popular sport in the world rose worldwide from 2009-2013 annually 9 percent (Collingnon and Sultan, 2014). In times of sales growth, the Expenditures however disproportionately increased. That's why football companies go in average more frequently into bankruptcy than companies from other sectors (Gallagher and Quinn, 2017). According to Beech et al. (2008), Kuper and Szymanski (2009) and Storm and Nielsen (2011) nevertheless show a higher survival rate.

The mentioned publications are summarized in table 1.

**Table 1:** Overview of some relevant publications

| Publication | Research question | Data | Metho-dology | Period | Market | Result |
|---|---|---|---|---|---|---|
| **Gallagher and Quinn (2017)** | Analyse financial efficiency of English football clubs. | 60 football clubs | Non-parametric efficiency analysis | Seasons 2003/ 2004 to 2016/ 2017 | England | Financial Fair Play breakeven regulation reduces average club efficiency. |
| **Beech et al. (2008)** | The circumstances in which English football clubs become insolvent. | 56 clubs have been identified as becoming insolvent | Literature recherche | 1986 to 2008 | England | Insolvent might be an emergent tactic rather than an intended tactic. |
| **Kuper and Szyman-ski (2009)** | Why soccer clubs almost never disappear? | 88 football clubs | Literature recherche | 1929 to 2008 | England | In most industries bad business goes bankrupt, but soccer clubs rarely do. |
| **Storm and Nielsen (2011)** | Why do only very few European professional football clubs go out of business even though they operate chronically close to the edge of financial failure? | European football markets | Literature recherche | 1929 to 2009 | Europe | Football clubs have an abnormally high survival rate. |

Source: Own representation

Media, Fans and scientists are wondering how the future financial situation of football companies at times, where a club like Paris Saint-German for the rights to the Player Neymar paid more than 200 million, will look like.

## 3 Results and Discussion

*Soft budget constraint – Optimistic budget planning in the football industry:*

In contrast to other companies, football clubs don't want to maximize their profits. They try to maximize the success. It normally leads to a maximization of sales (Giocoli, 2017; Grant, 2007). If the football club becomes unsuccessful, the probability of default increases. They missed the qualification and at the end, the result was insolvency (Brinkworth, 2013; Leach and Szymanski, 2015). The Glasgow Rangers are a good example for this. They won 54 times the Scottish Championship, but at the end the insolvency could not be avoided (Georgievski and Zeger, 2016).

Vöpel (2013) and Dimitropoulos (2014) argue that better corporate governance could lead to lower indebtedness. However, Andreff (2007) looks closely to clubs in France which, contrary to the objectives of corporate governance, have a power of decision-making that is centralized to one person. Thus, the CEO of a club is also the main owner as well as the patron and the most devoted fan in one person. His emotions as a fan and patron lead him to spend as a manager all he needs to engage star players, regardless of spending discipline and costs (Andreff, 2007; Burns, 2007). Gallagher and Quinn (2017) talk about destabilizing leadership levels and short-sighted financial management decisions.

Club owners benefits from increasing prestige and publicity which is higher with a successful team. Due to the gained legitimacy of the financier, his other businesses and businesses will benefit as well (D'Andrea and Masciandaro, 2016).

*Willingness to pay:*

Wicker et. al (2016) have created a Contingent Valuation Method, in which they have examined the willingness to provide financial support of match day visitors and non-visitors for sporting achievements of their German football club. In their study, they discuss on the financial support of fans through the acquisition of fan bonds. While they use in their study the fan loan for the increase of sporting success, Weimar and Fox (2012) debate the possibility of issuing a fan bond to improve the financial situation.

*Too big to fail:*

Vöpel (2013) denies a systemic relevance within league operations. Thus, the failure of one club would have no effect on other clubs. Budzinski and Müller (2013) agree with this, but also point out that the transfer system can lead to complex relationships between receivables and liabilities.

"Too prominent to fail" can also be found in the willingness to support. Thus, it is hard to explain that a club due to its size still receives funds granted to obtain the license for the league operation by a federal state (Dietl and Franck, 2007).

Weimar and Fox (2012) and Huth et al. (2014) noticed that football companies that issued a bond don't have capital expenditures that are comparable to those of the peer group. While Brewer III. and Jagatiani (2013) link the lower interest rates accepted by investors with the possible bail-out, emotional aspects are important for a football bond.

Another contradiction to "Too big to fail" can be found in a judgment of the Football Creditors Rule. For the Supreme Court, the economic consequences for taxpayers and the state are less important than the image of the league and the guarantee of an intact league system (Serby, 2014).

## 4 Conclusions

In fact, similarities between the financial industry and the football market can be identified and links to the 2007 financial crisis can be drawn. Thus, in the football market, as in the financial crisis at banks, socialized losses and profits privatized. The losses of the clubs are borne by the citizens and the public sector. However, only the players, consultants and managers benefit from the rising salaries and transfer fees (Franck and Müller, 2000; Kuper and Szymanski, 2009).

In order to prevent the cycle of indebtedness on the football market, more regulation is needed. After the financial crisis, increased regulation has helped to contain the excesses of the financial industry. In the football sector, UEFA is attempting to impose stricter budget restrictions in the form of the "Financial Fair Plays". Four out of five recent studies criticize this regulation as not limiting the problems of the football market (Franck, 2014; Madden, 2014; Peeters and Szymanski, 2013; Sass, 2012; Vöpel, 2013). The transfer of Neymar in 2017 for more than EUR 200 million proves that the clubs can bypass the FFP.

As in the financial industry and the "too big to fail" doctrine, this is still based on subjective assumptions by the supporting organizations. These can vary over time and be affected by global economic crises.

It can be assumed that the increasing transfer sums will increase the systematic risks in the future. Budzinski and Müller (2013) point out that there are complex relationships between receivables and liabilities by the transfer market. However, they believe that contagion effects would only be felt in special circumstances.

In addition, it must be determined whether football companies will eventually be "too big to save". Because of the high capital requirements, the number of potential business people, investors, federal states or municipalities that have the financial means and legitimacy to intervene decreases (Lago et al., 2006). An improved approach to financial fair play could force football companies to balance their economies, leading to a lower rate of bankruptcy on the football market.

## References


Andreff, W. (2007). Governance Issues in French Professional Football. In: Rodriguez P., Késenne S., Garcia, J. (eds). *Governance and Competition in Professional Sports Leagues*. Oviedo: Ediciones de la Universidad de Oviedo, pp. 55-86.

Beech, J., Horsman, S., Magraw, J. (2008). The Circumstances in which English Clubs becomes Insolvent. *CIBS working paper*, No. 4 (2008).

Brewer III., E., Jagatiani, J. (2013). How much did banks pay to become too big-to-fail and to become systemically important? *FRB of Philadelphia Working Paper*, 43 (2013), Nb. 1, pp. 1-35.

Brinkworth, S. (2013). Bondholders cry foul on football securitization. *International Financial Law Review*, 23 (2013), No. 3.

Budzinski, O. (2014). The Competition Economics of Financial Fair Play. *Ilmenau Economics Discussion Papers*, 19 (2014), No. 85.

Budzinski, O. (2017). Market-internal Financial Regulation in Sports as an Anticompetitive Institution. *Ilmenau Economics Discussion Papers*, 110 (2014).

Budzinski, O., Müller, A. (2013). Finanzregulierung und internationale Wettbewerbsfähigkeit: der Fall Deutsche Bundesliga. *Ilmenau University of Technologie*, Diskussionspapier, No. 82.

Burns, T. (2007). Structured Finance and Football Clubs: An Interim Assessment of the use of Securitisation. *The Entertainment and Sports Law Journal*, vol. 4(3).

Collignon, H., Sultan, N. (2014). *Winning the Business of Sports.* A.T. Kearney, 2014. Retrieved from: https://www.atkearney.com/documents/10192/5258876/Winning+in+the+Business+of+Sports.pdf/.

D'Andrea, A., Masciandaro, D. (2016). Financial Fair Play in European Football: Economics and Political Economy - A Review Essay (January 2016). *BAFFI CAREFIN Centre Research Paper*, No. 2016-15.

Dietl, H., Franck, E. (2007). Governance Failure and Financial Crisis in German Football. *Journal of Sports Economics*, vol. 8(6), pp. 662-669.

Dimitropoulos, P. (2014). Capital structure and corporate governance of soccer clubs. *Management Research Review*, vol. 37(7), pp. 658-678.

Franck, E. (2014). Financial fair play in European club football: what is it all about? *International Journal of Sport Finance*, vol. 9(3), pp. 193-217.

Franck, E., Lang, M. (2014). A Theoretical Analysis of the influence of money injections on risk taking in football clubs. *Scottish Journal of Political Economy*, vol. 61(4), pp. 430-454.

Franck, E., Müller, J. (2000). Problemstruktur, Eskalationsvoraussetzungen und eskalationsfördernde Bedingungen sogenannter Rattenrennen, *Schmalenbachs Zeitschrift für betriebswirtschliche Forschung,* vol. 52(1), pp. 3-26.

Gallagher, R., Quinn, B. (2017). *Regulatory Own Goals: The Unintended Consequences of Financial Regulation in Professional Football*, October 2017.

Georgievski, B., Zeger, S. (2016). Is English Football Facing a Financial Crisis, or are We Only Missing Better Regulation? *Journal of Tourism, Hospitality and Sports*, vol. 18.

Giocoli, N. (2017). Competitive balance in football leagues when teams have different goals. *International Review of Economics*, vol. 54, pp. 345-370.

Grant, W. (2007). An analytical framework for a political economy of football. *British Politics*, vol. 2, pp. 69-90.

Huth, C., Gros, M., Kühr, C. (2014). Fananleihen deutscher Fußballunternehmen – Eine empirische Untersuchung des Anlageverhaltens der Zeichner. *Corporate Finance*, vol. 1, pp. 7-16.

Klimmer, I. (2003). Profifußballunternehmen an der Börse: Analyse des Wirkungszusammenhangs zwischen sportlichen und wirtschaftlichen Erfolg im Berufsfußball. *Beiträge aus Wissenschaft und Forschung Sportökonomie Uni Bayreuth – Edition Wissenschaft und Praxis: Schriftreihe des Vereins der Sportökonomie Uni Bayreuth e.V.*

Kuper, S., Szymanski, S. (2009). *Why England Loses, Why Germany and Brazil Win, and Why the US, Japan, Australia, Turkey – and Even Iraq – are Destined to Become the Kings of the World's Most Popular Sport*. New York, Nation Books.

Lago, U., Simmons, R., Szymanski, S. (2006). The financial Crisis in European Football: An Introduction. *Journal of Sports Economics*, vol. 7(1), pp. 3–12.

Leach, S., Szymanski, S. (2015). Making Money out of foot-ball. *Scottish Journal of Political Economy*, vol. 62(1).

Madden, P. (2014). *Does Break-Even Regulation of Soccer Clubs Make Sense?* (No. 1405). Economics, The University of Manchester.

Nagy, Z. (2012). Financing Methods in Professional Football. *Working Paper Series*, Óbuda University, Keleti Faculty of Business and Management, No. 1201 (2012).

Peeters, T., Szymanski, S. (2014). Financial fair play in European Football. *Economic Policy*, vol. 29(78), pp. 343–390.

Rothenbücher, J., Mesnard, X., Rossi, L., Hembert, E., Lucero, M. (2010). *EU Football Sustainability Study: Is European Football Too Popular to Fail?* A.T. Kearney, 2010. Retrieved from: https://www.atkearney.com/documents/10192/651284/Is+European+Football+Too+Popular+to+Fail/682120f8-15a1-4bba-a946-786457d8e61b.

Sass, M. (2012). Long-term competitive balance under UEFA Financial Fair Play regulations. *Faculty of Economics and Management – Working paper series*, 05 (2012).

Serby, T. (2014). British Football club insolvency: regulatory reform inevitable. *International Sports Law Journal*, vol. 14(14), pp. 12-23.

Storm, R., Nielsen, K. (2011). *Professional team sports clubs: cases of soft budget constraints in capitalist economies.* Danish Institute for Sports Studies, pp. 1-26.

Storm, R. (2012). The need for regulating professional soccer in Europe: A soft budget constraint approach argument. *Sport Business and Management*, vol. 2(1), pp. 21-38.

Vöpel, H. (2013). Is FFP really justified? An economic and legal assessment of UEFA's FFP rules. *HWWI Policy Paper*, vol. 79.

Weimar, D., Fox, A. (2012). Wann sind Unternehmen Vergleichbar? – Eine Analyse der Multiplikatormethode am Beispiel von Fußballunternehmen. *Corporate Finance*, vol. 7, pp. 1-46.

Wicker, P., Whitehead, J. Mason, D., Johnson, B. (2016). Public support for hosting the Olympic Summer Games in Germany: The CVM approach. *Urban Studies*, vol. 54(15), pp. 3597-3614.

# Critical Investigation of the Effects of Series Extensions on the Stock Price of the Provider

**Dennis Schmidt[1], Alexander Zureck[2], Stefanie Gradetzki[3], Gennadij Seel[4]**

[1] Masaryk University / FOM University of Applied Sciences
Department of Finance at Faculty of Economics and Administration
Herkulesstraße 32, 45127 Essen, Germany
E-mail: dennisxschmidt@web.de

[2]FOM University of Applied Sciences/Masaryk University
isf Institute for Strategic Finance/Department of Finance at Faculty of Economics and Administration
Leimkugelstraße 6, 45141 Essen, Germany
E-mail: alexander.zureck@fom.de

[3] FOM University of Applied Sciences
Department of Finance at Faculty of Economics and Administration
Herkulesstraße 32, 45127 Essen, Germany
E-mail: st.gradetzki@web.de

[4] Masaryk University / FOM University of Applied Sciences
Department of Finance at Faculty of Economics and Administration
Herkulesstraße 32, 45127 Essen, Germany
E-mail: gennadij.seel@fom-net.de

***Abstract:*** *The desire of audiences to consume content in a series format, independent of time and place has increased in recent years. Technological advancement has helped this trend progress. In this paper, series are considered as goods whose sales are linked to the degree of viewers' attention. Thus, the good series operate on two interconnected levels, an economic and an emotional. The decision to invest in the production of another season of a series is intended to increase the number of subscriptions and the associated revenues. Capital market participants are influenced by various emotional biases when making investment decisions under uncertainty. In the context of an event study, it is examined whether announcements of season extensions have a significant influence on the share price of the respective provider. The results show that investors react with a changed investment behavior. Furthermore, findings from the film industry are transferred to series production.*

*Keywords: Quality-TV, Movie Business, Streaming, Behavioral Finance, Priming*

*JEL codes: G14, G32, G41*

## 1 Introduction

The consumption of audiovisual media has changed dramatically over the past 35 years. In the 1980s, audiovisual media were still consumed on a linear basis, which means that users were not yet able to choose the start and end of the offer themselves. Today, audiovisual content is consumed wherever an Internet connection exists. On the one hand, this change is based on technical progress, as the technical barriers to offers from the streaming area are increasingly overcome. On the other hand, the recipients desire to independently consume offers from the entertainment sector has come to the fore (Nitschke, 2005 and Schlütz, 2016). Therefore, it is not surprising that one of the growth markets with a massive impact on the traditional value chains of linear television, the online distribution of media content, such as digitized series or feature films. The rapid and great success of the series provider Netflix proves that a clear focus on the needs of consumers and an innovative pricing model can be achieved despite increasing competition increasing sales. In Germany, two out of five Internet users are already streaming films and series via paid providers (bitkom, 2018). Each recipient has a memory, a feeling or a thought that he associates with the consumption of television series. In addition, recipients also know what they like about series and what they

perceive as less good. Series are in a field of tension, because on the one hand they can be described as art and on the other hand they are a commodity that has to refinance itself. This transfer of a cultural asset to a marketable product can only succeed if recipients are emotionally bound to the series due to the fulfillment of certain quality characteristics (Schlütz, 2016). This study is based on two well-known research areas. Previous research has investigated which series characteristics are decisive in classifying them as quality series with a high emotional binding factor. Furthermore, there are various studies focusing on films as investment projects. These findings from the film industry will be transferred to series in the course of the investigations in this paper. The present study combines these two research directions and focuses on the connection between the economic and the behavioristic level in relation to series.

In the context of this study it is analyzed whether an emotional connection between serial fans as investors and the entrepreneurial decision consists of another project, in the form of a production of another part of a series. It is checked whether shareholders express their consent or rejection to the investment decision made by changing the shares they hold. Furthermore, it is examined whether a general behavior of shareholders can be derived based on this entrepreneurial decision.

## 2 Literature Review and Hypotheses Development

In order to concretize the research hypotheses, first, a review of empirical literature in this field is necessary.

The development of series over the past 15 years has been from a simple entertainment form to a product with a high-quality factor. This was due to the technical innovations and the concomitant change in serial viewing. Therefore, this branch of research can be described as still very young. Movies are large investment projects with high production costs. Series can be assigned to a similar product group. Since films can look back on a longer history, in terms of production and marketing of these films, they will also take a closer look at films and their results.

De Vany and Walls (1999) have analyzed the film industry in terms of their risk potential. For this purpose, films were examined in 2015, which were published between 1984 and 1996. As factors, the production costs, genre, criteria, composition, turnover, and profits in the US and Canada are analyzed by multiple linear regression. It has been proven that earnings and profits are extremely skewed, fat-ended and have infinite variances.

Elberse (2007) uses an event study to investigate whether casting roles with well-known and successful actors is crucial to the success of films. The impact of 1,200 announcements on the behavior of HSX participants (Hollywood Stock Exchange) was examined. The HSX is a popular online market simulation in which players / dealers predict box-office revenue. It has been demonstrated that HSX prices are significantly responsive to stellar casting decisions.

Einav and Ravid (2009) investigated in another event study, whether the postponement of movie launches has an impact on the stock price of the producing film studio. 302 calendar changes were analyzed by 25 different film studios. There was evidence of negative abnormal significant returns. The abnormal returns on shifts to a date not yet specified were less negative than on actual new launch dates. Furthermore, it could be shown that the extent of the reaction of the stock market to the announcements is significantly related to the production costs of the film, but not to the later revenues of the film.

Bock (2013) has determined quality features in their study and analyzed which series have to be fulfilled in order to be successfully marketed. With the help of a three-part empirical study, it was demonstrated on the basis of which factors German viewers receive US primetime series.

The study focuses on the three following hypotheses (see table 1), which are tested respectively with the event study methodology.

**Table 1** Research Hypotheses

| No. | Hypothesis |
|---|---|
| *H1* | Seasonal extensions of a series have a significant impact on the return performance of the respective provider. |
| *H2* | Shareholders respond to the announcement of staggered renewals with a reduction in their stake. |
| *H3* | The announcement of the second season has a positive significant influence on the yield development of the respective provider. |

Source: Own representation

## 3 Empirical Analysis

### Methodology

The focus of this study lies on the critical analysis of stock prices of series suppliers. Investigations on the capital market offer the advantage that stock prices, in contrast to balance sheet or earnings ratios, cannot be optimized, even within the scope of the legal options. The influence of supply and demand is theoretically possible but requires an enormous capital investment. In the context of Behavioral Finance, courses continue to offer the advantage that certain reactions to a behavior-influencing information can be seen directly in the course of the share price (Zureck, 2016).

From the information available, only the publication date of the press release, but not the exact date of the announcement of the season extension, can be determined. Therefore, for the present study, the returns are calculated on the basis of the daily closing prices.

The following return definitions are used in this event study:

The logarithmic returns are calculated, as these, in contrast to discrete returns, tend to be more normally distributed and more robust (Pauser, 2007).

$$R_{it} = ln(P_{it}) - ln(P_{it-1}) \quad (1)$$

The expected rate of return is defined as the rate of return that would have been expected without the occurrence of the event under investigation. The calculation of these results in the present study using the market model. The market model assumes a linear relationship between the return on investment and the return on a market portfolio. The market model is thus a regression model. Using the least-squares method, the parameters $\alpha_i$ and $\beta_i$ can be estimated efficiently. The $\alpha_i$ stands for the risk-adjusted excess return of an investment compared to its benchmark. Thus $\alpha_i$ measures the part of the price development which can be explained by the selection of the share and not by the general market risk. The dependency of the stock on its benchmark is disengaged by $\beta_i$. It measures the sensitivity of a stock to changes in the overall market. The stochastic disturbance $\varepsilon_i$ comprises all random fluctuations of a value paier. Due to the small influence of the disturbance $\varepsilon_i$ on the overall result, the consideration of this can be neglected. The market return $R_{mt}$ is represented by a benchmark index (Hackl, 2013). The market model has the structure shown in formula 2:

$$E(R_{it}) = \alpha_i + \beta_i R_{mt} + \varepsilon_i \quad (2)$$

Seasonal extensions are usually announced in the same month of each year. In order to avoid overlapping effects between the individual seasons, a shorter estimation period of 200 trading days is chosen in this paper. The event window is chosen according to the recommendation of Pauser with 10 trading days before and after the event. The event day is the reference point for the determination of the other time slots and denotes the "day 0" (t = 0). All other points in time are labeled according to their timing relative to the event day.

The abnormal returns are calculated by taking the difference between the actual and expected daily returns of a security (Zureck, 2016).

$$AR_{it} = R_{it} - E(R_{it}) \tag{3}$$

To verify that the abnormal returns calculated for the event period statistically deviate from zero, the simple t-test procedure is used. The procedure assumes that the abnormal returns are normal-distributed. However, the t-test behaves robustly with respect to deviations from the normal distribution (Hawliczek, 2008). The t-test examines the extent to which two empirically averaged values differ from each other. Correspondingly, the null hypothesis H0 to be tested is that the abnormal return on a given day ARit is zero. The test statistic for a security i on day t is calculated as shown in formula 4 (Zureck, 2016):

$$t_{ARit} = \frac{AR_{it}}{\sqrt{\frac{\sum_{t=-200}^{t=-11}(AR_{it} - \overline{AR})^2}{200-m}}} \tag{4}$$

The statistical significance of the abnormal returns is checked individually for each event using the p-value. The p-value is used to check whether the null hypothesis can be rejected (p-value ≤ significance level) or maintained (p-value ≥ significance level). The p-value is calculated as shown in formula 5. This is based on the assumption that the returns are normal-distributed with n-p-1. Where n is the length of the observation period and p the number of explanatory variables in the regression (Zureck, 2016).

$$p_{it} = 2 * min\left[P\left(T_{n-p-1} \geq t_{ARit}|H_0\right), P\left(T_{n-p-1} \leq t_{ARit}|H_0\right)\right] \tag{5}$$

In order to catch any rumors that may arise in the run up to the season extension, the accumulated abnormal returns for the event period are also examined. Furthermore, it also takes into account that the dissemination of the new information may take some time. Thus, upstream and downstream effects are taken into account around the time of the announcement (Pauser, 2007). The accumulated abnormal returns are calculated for the period [-10; 10], based on the abnormal Ta yields as calculated in formula 6:

$$CAR_{it} = \sum_{t=1}^{n} AR_{it}. \tag{6}$$

The review of statistical significance for accumulated abnormal returns is the same as for abnormal daily returns using p-values. The significance test is based on that for the abnormal returns and is calculated as shown in Formula 7 (Zureck, 2016):

$$t_{CAR_{it}} = \frac{CAR_{it}}{\sqrt{\frac{\sum_{t=-200}^{t=-11}(AR_{it} - \overline{AR})^2}{200-m}}} \tag{7}$$

**Data and Variables**

The relevant event in this investigation is the announcement of a season extension. Using the described method of an event study, a total of 33 events were defined and examined. The basis for the 33 analyzed announcements of scale extensions are four providers and eight series. Investigations were made from Season 2 of the respective series. Viewers will become fans of this during the first season of a series. Accordingly, the emotional attachment to a series is built up in the course of each first season. As part of a study based on its own algorithms, Netflix was able to analyze exactly which episode of the first season binds viewers to it. As a key sequence, the one was defined, according to which at least 70% of the audience saw the entire season to an end (Heise, 2015 and Netflix Media Center, 2016). The analyzed events are in the period from 19.04.2011 to 13.01.2018. Further announcements regarding scale extensions of the investigated series

after this period are not considered. In addition, only events that took place after the initial public offering of the respective provider were examined.

The announcement day of a season extension was largely determined by the series portal Serienjunkies.de. Some event days have been verified using media reports and reports on the providers' websites. Serienjunkies.de is a German specialist portal for successful TV series, with a focus on American TV series. In addition to up-to-the-minute news, the industry service also provides content, recessions, start dates and background information on various series (Serienjunkies, 2018). 32 announcements were made on trading days. An announcement will be made over the weekend. In this case the next trading day was used as the event day.

The stock prices and the market index come from the financial information service Bloomberg. The recognized Bloomberg database is used in many scientific analyzes related to the capital market and provides well-founded capital market data (Zureck, 2016). In order to calculate the returns, closing prices were used which are already adjusted for dividend distributions and capital measures (eg. capital increases, share splits). The market index used was the S & P 500. It is considered an indicator of the development of the entire US stock market. Three of the four companies are included in the S & P 500. Since the influence of the three companies on the entire index is too small, it is justifiable not to adjust this to the companies investigated (Finanzen.net, 2018).

## 4 Results and Discussion

Table 2 gives an overview of the test results. The number of significant p-values for the entire event period [-10; 10], the event window before the announcement [-10; 1], the announcement day [0] and the event window from the announcement [0; 10]. The test was carried out at the usual significance levels of ten, five and one percent (Fahrmeir et al. 2016). In addition, it indicates how many announcements regarding season extensions of the respective series were examined.

**Table 2** Number of significant results for the returns

| | | | p-values, returns | | | |
|---|---|---|---|---|---|---|
| **Series** | **Investigated Announce-ments** | **Level of significance** | **[-10; 10]** | **[-10; 1]** | **[0]** | **[0; 10]** |
| **Better Call Saul** | 3 | 10% | 2 | 2 | 3 | 3 |
| | | 5% | 2 | 2 | 3 | 2 |
| | | 1% | 2 | 2 | 3 | 2 |
| **The Walking Dead** | 6 | 10% | 4 | 5 | 5 | 3 |
| | | 5% | 4 | 4 | 5 | 3 |
| | | 1% | 4 | 2 | 3 | 3 |
| **House of Cards** | 3 | 10% | 3 | 3 | 1 | 3 |
| | | 5% | 3 | 3 | 1 | 3 |
| | | 1% | 3 | 2 | 1 | 3 |
| **Narcos** | 2 | 10% | 2 | 2 | 2 | 2 |
| | | 5% | 2 | 2 | 2 | 2 |
| | | 1% | 2 | 2 | 2 | 2 |
| **Orange is the new Black** | 4 | 10% | 4 | 4 | 2 | 3 |
| | | 5% | 4 | 4 | 1 | 3 |
| | | 1% | 3 | 0 | 1 | 3 |
| **Stranger Things** | 2 | 10% | 2 | 2 | 1 | 2 |
| | | 5% | 2 | 2 | 1 | 2 |
| | | 1% | 2 | 2 | 0 | 2 |
| **Game of Thrones** | 6 | 10% | 6 | 5 | 5 | 5 |
| | | 5% | 6 | 5 | 4 | 5 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | 1% | 5 | 2 | 3 | 5 |
| **American Horror Story** | 7 | 10% | 6 | 5 | 7 | 7 |
| | | 5% | 6 | 4 | 5 | 7 |
| | | 1% | 6 | 3 | 5 | 4 |
| **cumu-lated** | **33** | **10%** | **29** | **28** | **26** | **28** |
| | | **5%** | **29** | **26** | **22** | **27** |
| | | **1%** | **27** | **15** | **18** | **24** |

Source: Own representation

First of all, it can be seen that there are significant results for all event periods and for the announcement day. The absolute number of significant events is consistently highest at a ten percent level of significance. Furthermore, a significant number of significant values can also be detected at the other two significance levels. For the entire event period, 27 significant values can be detected at a significance level of one percent, which corresponds to 81.82%. In all series except Better Call Saul, The Walking Dead and American Horror Story, announcements for all seasons are significant at a ten percent level of significance for the entire event window. For the series House of Cards, Nar-cos and Stranger Things, the announcements for all reviewed seasons for the entire event period are still significant at a significance level of one percent. The announcement day is significant for all reviewed seasons of the series Better Call Saul and Narcos at the lowest level of significance. Each scale extension being scored is significant in at least one of the scored event windows or the announcement day at a ten percent level of significance. For eight seasons, each announcement day and every event window examined is significant at one percent significance level. In summary, there is a sufficiently large number of significant results to confirm the hypothesis H1. Investors are reacting to the announcement of a scale extension with a change in investment behavior.

Furthermore, it was examined whether a positive or negative abnormal return could be achieved in the mentioned event windows and on the announcement day. The results are shown in Table 3.

**Table 3** Absolute returns

| | | **Absolute returns in %** | | | |
|---|---|---|---|---|---|
| **Series** | **Season** | **[-10; 10]** | **[-10; 1]** | **[0]** | **[0; 10]** |
| **Better Call Saul** | 2 | 1.74 | 2.57 | -2.24*** | -0.81* |
| | 3 | -10.60*** | -3.83*** | -4.32*** | -6.79*** |
| | 4 | 11.63*** | 20.11*** | 6.78*** | -5.39*** |
| **The Walking Dead** | 4 | -10.92*** | -15.86*** | 2.95*** | 5.13*** |
| | 5 | -7.39 | 1.14** | -1.33** | -8.59 |
| | 6 | 6.01*** | -5.94* | 0.77** | 12.33 |
| | 7 | -3.71*** | -8.42** | -0.11 | 4.36*** |
| | 8 | 1.68 | -5.34 | 2.42*** | 7.14 |
| | 9 | -14.05*** | -11.24*** | -2.23*** | -2.85*** |
| **House of Cards** | 3 | 37.36*** | 44.70*** | -1.38 | -4.76*** |
| | 4 | 50.66*** | 1.00*** | -0.28 | 47.37*** |
| | 5 | -26.81*** | -15.67** | -7.10*** | -10.72*** |
| **Narcos** | 2 | -17.21*** | -9.70*** | -4.70*** | -7.37*** |
| | 3+4 | 7.36*** | 2.81*** | 2.42*** | 4.54*** |
| **Orange is the new Black** | 2 | 20.36** | -7.69** | 0.70 | 27.21 |
| | 3 | 2.34*** | -8.07** | 1.48 | 10.33*** |
| | 4 | 39.90*** | 19.80** | -1.89* | 20.27*** |
| | 5+6+7 | -25.48*** | -21.09** | -7.05*** | -3.79*** |
| **Stranger Things** | 2 | 6.05*** | 3.45*** | 0.41** | 2.61*** |
| | 3+4 | -1.47*** | -3.88*** | 0.08 | 2.39*** |

| | | | | | |
|---|---|---|---|---|---|
| **Game of Thrones** | 2 | 7.59*** | 8.71*** | -1.61** | -0.96*** |
| | 3 | 0.67*** | -5.35** | 0.29 | 6.17*** |
| | 4 | 1.32** | -0.43*** | -1.40*** | 1.72 |
| | 5+6 | 0.10*** | 0.03 | 0.51* | 0.07*** |
| | 7 | 4.84*** | 2.92** | 2.23*** | 1.93*** |
| | 8 | 3.83*** | 2.38** | 1.23*** | 1.45*** |
| **American Horror Story** | 2 | -23.60*** | -17.95*** | 14.05*** | -5.69** |
| | 3 | 7.63*** | 13.32** | -7.87*** | -5.69** |
| | 4 | -28.83*** | -12.16*** | -2.76*** | -16.71*** |
| | 5 | -2.03*** | -6.87 | -1.19* | 5.02** |
| | 6 | 1.00 | 0.04 | 1.38* | 0.96*** |
| | 7 | 22.73*** | 14.28* | 2.57*** | 8.49*** |
| | 8+9 | 36.33*** | 21.32*** | -3.17*** | 15.20*** |
| *** = 10% Level of significance; ** = 5% Level of significance; *** = 1% Level of significance** | | | | | |

Source: Own representation

Both positive and negative absolute significant returns can be proven for all event windows and the announcement day. In the entire event window, 54.54% of the returns are positive, 33.33% are negative and 12% are not significant. In the event window from the day of the announcement almost half of the returns are positively significant and one third are negatively significant. On the announcement day and in the event window before the announcement, the negative significant returns are likely to predominate. However, it cannot generally be deduced from the results available how investors react. Therefore, the hypothesis H2 can neither be confirmed nor rejected.

The announcements of the second seasons of the respective series also show a differentiated picture. Only for the Stranger Things series can positive returns be demonstrated for all three event windows and the announcement day. For the second season of Narcos, there are negative significant returns for all three event screens and the day of the announcement. The announcement of the second season's production of American Horror Story resulted in a negative significant return of -23.60% for the entire event window. Finally, the hypothesis H3 is rejected.

## 5 Conclusions

The central question of this paper builds on the theoretical findings. It is examined whether the announcement of the season extension of a series demonstrably influences the share price of the respective supplier. To this end, three hypotheses are set up and reviewed by means of an event study. The first hypothesis can be confirmed because of the significant amount of significant results. The study results show that staggering a series in a series leads to a change in investors' investment behavior in relation to the stock of the provider. The uniqueness of the series and films together leads us to believe that investors are more likely to respond to uncertain large-scale projects by reducing their shares. This assumption was further supported by the generally limited ability of the market to properly estimate projects from the film industry in advance. Based on these findings, the second hypothesis was formulated that shareholders respond to the announcement of staggered prolongations with a reduction of their shares. The detailed analysis shows that although there are many similarities between films and series, the absolute returns for series are not entirely negative. This is justified by the fact that the series providers, in contrast to the film studios, have established their channels as real brands. Furthermore, due to the high quality of the series and the associated strong connection, investors have a rather positive expectation of the future when it comes to the continuation of a series. The second hypothesis can thus neither be confirmed nor rejected. The starting point for the last hypothesis is the realization that investors build the emotional bond with a series as they receive the first season. From this, the third hypothesis was derived that the announcement of the respective second season of a

series has a positive significant influence on the yield development of the respective provider. Again, the present results show a differentiated picture, which is why this hypothesis is finally rejected. In summary, however, it can be stated that shareholders build a greater emotional bond to series than to films.

## References


Bock, A. (2013). *Fernsehserienrezeption, Produktion, Vermarktung und Rezeption US-amerikanischer Prime-Time-Serien*. Wiesbaden: Springer Fachmedien.

bitkom (2018). *Zwei von fünf Internetnutzern bezahlen für Serien und Filme*. Retrieved from: https://www.bitkom.org/Presse/Presseinformation/Zwei-von-fuenf-Internetnutzern-bezahlen-fuer-Serien-und-Filme.html.

De Vany, A., Walls, W. D. (1999). Uncertainty in the Movie Industry: Does Star Power Reduce the Terror of the Box Office. *Journal of Cultural Economics*, vol. 23(4), pp. 285–318.

Elberse, A. (2007). The Power of Stars: Do Star Actors Drive the Success of Movies? *Journal of Marketing*, vol. 71 (October 2007), pp. 102–120.

Einav, L., Ravid, S. A. (2009). Stock market response to changes in movies' opening dates. *Journal of Cultural Economics*, vol. 33(4), pp. 311–319.

Fahrmeir, L., Heumann, C., Künstler, R., Pigeot, I., Tutz, G. (2016). *Statistik, Der Weg zur Datenanalyse*, 8th ed. Berlin, Heidelberg: Springer Spektrum.

Finanzen.net (2018). *S&P 500*. Retrieved from: https://www.finanzen.net/index/S&P_500.

Hackl, P. (2013). *Einführung in die Ökonometrie*, 2nd ed. München: Pearson.

Hawliczek, J. W. (2008). *Kapitalmarktfaktor Moral?: Kursimplikation ethisch relevanter Aspekte auf dem Kapitalmarkt*. Wiesbaden: Gabler.

Heise online (2015). *Netflix-Studie über Serien: Wann Zuschauer zu Fans werden*. Retrieved from: https://www.heise.de/newsticker/meldung/Netflix-Studie-ueber-Serien-Wann-Zuschauer-zu-Fans-werden-2824277.html.

Netflix Medien-Center (2016). *Immer noch angefixt und Netflix weiß warum, Netflix enthüllt in einer neuen Untersuchung, wann Zuschauer auf der ganzen Welt Serien wie The Get Down, Narcos, Stranger Things und vielen mehr verfallen*. Retrieved from: https://media.netflix.com/de/press-releases/youre-still-hooked-and-netflix-knows-why.

Nitzschke, T. (2005). *Präferenzmessung in der Online Medien-Distribution: Sharing-Verhalten und individuelle Zahlungsbereitschaft für Filme im Internet.* Wiesbaden: Deutscher Universitäts-Verlag/GWV Fachverlage GmbH.

Pauser, S. H. (2007). *M&A in der Bauindustrie, Werteffekte und Erfolgsdeterminanten*. Wiesbaden: Deutscher Universitäts-Verlag.

Serienjunkies (2018). *Hilfe zum Serienportal Serien-junkies.de.* Retrieved from: https://www.serienjunkies.de/docs/faq.html.

Schlütz, D. (2016). *Quality-TV als Unterhaltungsphänomen, Entwicklung, Charakteristika, Nutzung und Rezeption von Fernsehserien wie The Sopranos, The Wire oder Breaking Bad*. Wiesbaden: Springer Fachmedien.

Zureck, A. (2016). Eine kapitalmarktorientierte Analyse der Ökonomisierung des Fußballs im Kontext der Behavioral Finance. Retrieved from: https://is.muni.cz/th/e5nlc/Doktorarbeit.

# Risk Taking and Corporate Governance in the New Bank Regulatory Requirements

**Eugenia Schmitt**

FinRiskConsult
Hammersbacher Str. 18, 81377 Munich, Germany
E-mail: eugenia.schmitt@finriskconsult.de

***Abstract:*** *The financial crisis (2008) and the sovereign debt crisis (2011) have revealed that excessive risk-taking and unethical corporate cultures constitute risks for the global financial system. Apparently, globally significant financial institutions need to change some of their fundamental ethical norms and behaviours. Large information asymmetries, opaqueness and complexities characterize the banking sector. Hence, to establish an effective corporate governance is a crucial determinant of success or failure as well as for maintaining financial stability. New macroprudential capital requirements have been phased-in, in successive steps across the 28 European Union (EU) countries starting in 2014. The Capital Requirements Regulation (CRR) and the Capital Requirements Directive (CRD IV) have introduced a new macroprudential framework transposing the Basel III agreement in the EU. Stricter rules on capital adequacy, as well as new corporate governance and remuneration rules were enclosed. Banks should be encouraged to take acceptable levels of risks while minimizing the likelihood of bankruptcy. The principal-agent theory shows that the presence of imperfect information may be represented as moral hazard caused by the existence of distorted incentives between the principal and the agent. There is also a possibility that regulated banks develop risk-taking incentives due to high capital requirements impact to profit. An effective process to identify and manage behaviour must be developed to avoid negative incentives. Besides the rational calculation there is a variety of information and mental processes as emotions, moral and professional rules of conduct or social norms to make financial decisions which should be taken into account. This article gives a brief overview over the effect of corporate governance for European banks which are much less analyzed as US banks, identifies key limitations and discusses the option for the guidance from organizational psychology, decision-making and management studies.*

*Keywords: Corporate governance, banks, regulation, risk-taking, moral hazard*

*JEL codes: G32, G21, G28, G32, G41*

## 1 Introduction

The financial crisis demonstrated the importance of effective risk management (RM) as well as corporate governance (CG), not only for the banks themselves, but also for the financial system as a whole. In Europe, 13 of 30 largest banks needed a bailout. Indirectly, they have helped the banks that were linked to them via the interbank market. (Schoenmaker and Peek, 2014). But people are the critical factor in the banking business. They create the risk systems, make analyses and decisions and also, they may or may not be tempted to act in their own interest.

Even if weaknesses in corporate governance at banks in a narrow sense were not the main cause of the financial crisis it is argued that monitoring failures such as inadequate supervision and control of the board, insufficient RM, incentive failures as inadequate remuneration formats for directors and traders as well as accountability failures have contributed to uncontrolled and excessive risk-taking. (Hopt, 2013, Kotz and Schmidt, 2017, p. 30): ”It was apparently not the legal (or ownership) structure but business models that fragilized banks – had they been public or private.”)

### Why is the CG in Banks special?

Since banks play an important role in the society corporate governance need to be sturdy to capture the complexity and opaqueness of the banking business. Traditional CG deals

with principal-agent problems between managers and shareholders but there are five main aspects making CG of banks special (Kress, 2018, Kotz and Schmidt, 2017, p. 4, 5):

- banks are highly leveraged with short-term debt by holding of little equity to absorb potential losses, which expose banks to liquidity risk and bank runs. These issues can trigger sudden liquidity and solvency crises,
- large information asymmetries regarding loan quality and the maturity mismatch (the bank funds are of shorter maturity than the assets they hold) cause that the creditors of the banks cannot protect themselves against risk-shifting (increase of the benefit of shareholders because of excessive risk-taking at the expense of creditors) and are exposed to the post-contractual moral hazard of the banks (Gann and Rudolph, 2011),
- lack of external transparency of banking transactions and difficulty in monitoring: trading positions and associated risk profiles can often be easily changed in real time,
- explicit or implicit government support: On the one hand it provides incentives for banks to take excessive risk, because bank shareholders participate only in the upside of their risk-taking decisions. On the other hand, it reduces incentives for depositors and other creditors to monitor a financial institution's risk-taking. Too big to fail (TBTF) has been a serious problem in the past crisis,
- banks are considered as a critical part of the state infrastructure. Hence, interconnectedness and contagion cause that the instability of some banks may cause systemic distress.

Hence, bank managers face diverse types of risk. In the financial crisis became apparent that boards of banks did not fulfil its key role to make use of monitoring over senior management as well as they failed to identify, understand, and challenge risk-taking practices. Regulators have responded by putting more regulations in place which are motivated by the lessons learned. The aim is to reduce the moral hazard problems and the contagion and systemic effects in the financial system. It creates incentives and restrictions for what banks can do or may want to do. Hence, it is a part of the governance regime of banks. (Kotz and Schmidt, 2017). CG as a specific discipline evolved rapidly (Lofquist, 2018). For the understanding of the governance system in banks the national context is important.

**Europeanisation of regulatory requirements after 2009**

In Europa CG consists of two components - improved harmonization, which means that the national legislation is replaced by binding common EU legal instruments and a new regulatory and supervisory framework. The creation of the European Banking Authority (EBA) and the Single Supervisory Mechanism (SSM), located in the European Central Bank (ECB), which is supposed to implement the single rule book in a consistent way across member states, plays a key role. Before 2008, the regulatory in EU based on guiding principles of self-regulation by soft law where the leading role was the supervisory authority of the respective country. Since 2009 a new framework was constituted: The "Europeanisation", which is the process to align the laws of the member states, i.e. it denationalizes banking politics. It shows two important improvements (European Central Bank, 2019):

1. **Basel III** (currently about to evolve into Basel IV) are setting of tougher prudential rules. Requiring banks to hold more capital increases the cost of their risk-taking decisions. Following, the Basel capital framework, which require risk-based capital seems to be a step to the right direction. In Europe, these rules have been implemented through the Capital Requirements Regulation **(CRR)** and the Capital Requirements Directive **(CRD IV)** where new rules for CG are contained. The aim is increasing the effectiveness of risk oversight by boards, improving the status of the RM function, ensuring monitoring by supervisors of risk governance and additional transparency

requirements. The incentives for more self-insurance on the side of banks should mitigate the conflict between equity and debt holders.

2. **Banking Union:** it is the new institutional set-up of supervision and bank resolution in the Euro Area.

Two of the most important internal governance mechanisms which support the comprehensive RM framework are the establishment of an independent Chief Risk Officer (CRO) and RM Committee (RMC). They role is an oversight responsibility for all risks undertaken by the bank.

The macroprudential capital requirements have been applied in successive steps across the 28 European Union (EU) countries starting in 2014 to parents and subsidiaries of systemically important banks. (Dautović, 2019). EBA expects all capable authorities in EU and financial markets participants to whom the guidelines apply to comply with them (unless otherwise stated) which means that they dominate actual bank governance practice. CG and the supervision of banks is complex and very special. There is no a universally standard for determining a good governance, especially because the CG in banks is characterized by conflict of interest between various interest groups which are given the capital structure (Hopt, 2013) (Note: Shareholders are always stakeholders in a corporation, but stakeholders are not always shareholders.):

- **Stakeholders** are bound to the company for a longer term and for reasons of greater need, while shareholders can sell their stocks and have no need for long-term binding with the bank. Stakeholders and shareholders often have competing interests depending on their relationship with the financial institution,
- **Shareholders** has a financial interest in the bank's profitability and are more willing to take risks, because their participation on the gain is theoretically unrestricted. Shareholders are owners of the company, have the right to affect the management of a company but they are not liable for bank's debt. Hence, they may be prone to excessive risk-taking because their benefits can be increased at the expense of creditors (risk-shifting) (Gann and Rudolph, 2011),
- **Management:** There are two views on the risk appetite of management: the one shows the tendency to risk aversion due the lack of diversification, especially for banks with higher capital ratios, because more risk increases the variance of returns which in turn can amplify the probability of significant losses on bank's equity (Dautović, 2019). The second one shows the risk willingness due its equity-based compensation (Hopt, 2013),
- **Debtholders** cannot participate in the profit opportunities of high-risk investment projects; on the contrary, they are confronted with the default risk of the expected loss of their loans. They are therefore in conflict with the shareholders. Hence, they are risk-averse and interested in debt governance. (Gann and Rudolph, 2011),
- **Supervisors** are risk-averse and interested in maintaining financial stability and in particular in preventing systemic crises (Hopt, 2013),
- **Tax Payers:** the agency conflicts between bank claimants and tax payers rely on the deposit guarantee schemes and lender of last resort (Kotz and Schmidt, 2017).

But also hidden incentives behind regulatory actions can appear. Moral hazard can occur in a similar way in more regulated banks (Dautović, 2019). These banks can have incentives to take more risk as a consequence of the negative effect of higher capital requirements on profits. This danger may possibly emerge in the current phase of low to negative interest rates. Hence, the question arises if the increase of risk behavior of banks can be prompted by stricter regulatory requirements. In contrast, Gehrig and Iannino (2018) find out, that in a low-growth environment incentives for risk-taking arise, and consequently contagion risk as well as exposure to systemic risk increase. Following, they state, that "*the current regulatory framework, Quantitative Easing, through its effect on interest rates, contributes to undermining the stability and soundness of the European banking system. Interestingly, these concerns do not affect*

*the most systematically risky banks, which are tightly supervised in the first place*." (Gehrig and Iannino, 2018, p. 33.)

These trade-offs require careful balancing. CG attempts to balance the interests of the various stakeholders within a company and because of that, it is important to examine the effectiveness of the new CG requirements in banks.

The remainder of the paper is structured as follows: Section 2 provides an overview of literature and hypotheses on CG in banks while Section 3 discusses the literature findings for European CG, especially the board structure, risk-taking and risk governance and finally Section 4 provides the concluding remarks.

## 2 Methodology and Data

The purpose of this paper is to review prior literature on CG under the new regulatory requirements for European banks, with the focus on Germany, that investigates the relationship between CG structures and board risk-taking. It contributes to the literature on banks' CG by trying to identify results about a number of key governance mechanisms, as the effectiveness of bank boards: the age, gender and education structure of boards, and the risk governance. Thus, this paper may also be relevant in terms of policy implication to improve governance arrangements in banking. Directions for future research of CG and risk governance on bank stability in Europa will be outlined. For this reason, the explanatory manner is more suitable than a normative. The methods of description, analysis, synthesis and deduction are used.

**Related literature**

The study is closely related to the empirical studies on CG in banks and RM notably on the effects of bank risk-taking, where two views to the CG can be distinguished:

1. **Anglos-Saxon view:** Most literature deals with CG from this perspective which places the shareholder-manager conflict of interest in the foreground, where a "good" governance in most cases means the interest of shareholders (Kotz and Schmidt, 2017).

2. **European view:** Many European authors interpret the concept of a good governance more broadly, following the connection of firms in incomplete contracts with agency conflicts – in interest of a wider set of stakeholders. (Gann and Rudolph, 2011, Kotz and Schmidt, 2017).

In the present paper, the European understanding of CG will be focused, where CG of banks is more widely defined. It also takes into account the organizational characteristics necessary for decision-making. (von Werder, 2009)

To reconsider the governance regimes of the Anglo-Saxon countries seems to be important for setting of effective CG in banks too. For example, Fahlenbrach and Stulz (2009) and Beltratti and Stulz (2012) find no evidence that banks where CEOs incentives were better aligned with interests of their shareholders performed better during the crisis. But in contrast, considering stock returns and return-on-equity they performed even worse. It looks like the boards took more risks to increase shareholder value. That contradicts the widespread view that managers took more risks because they were motivated by the remuneration system only.

There are various incentives for banks to decide to take on risk, as some studies show: Falato and Scharftstein (2016) underline the pressure from the equity markets for risk-taking at banks. Laeven and Levine (2006) show that risk-taking is related to the governance and ownership structure of the firm. Fahlenbrach and Stulz (2011) explain that risk-taking is tied to incentive compensation.

**The German Kontext**

Most of German banks were not severely hit by the crisis. Two specialized private banks, Hypo Real Estate and Industrie-Kreditbank, the two big banks Deutsche Bank and

Commerzbank and the four Landesbanks experienced large losses, because of their risky investments and off-balance sheet activities in the years before the crisis. The local savings and cooperative banks stayed unharmed. They were not involved to risky activities because of their traditional business model relying on customer deposits and client relationships.

Even when banking systems have been restructured since 2000, the German CG system is still stakeholder oriented, and it is correspondingly organized. In Germany the three-pillar structure of banking prevail: privately owned banks, publicly (municipally) owned savings banks and mutually held cooperatives. German banks still have "Hausbank-relations" with their corporate clients. Non-bank financial institutions also are closely associated with banks. The role of the state is relatively strong in German banking. Because it may cause moral hazard, questions to what extent the government should play an active ownership role arose. (For the overview of the empirical literature on this topic see Behr and Schmidt, 2015). On the other hand, diversified legal and ownership structure can provide protection of risks. The new German law and plans at the EU to separate between commercial and investment banking activities to a certain degree is threat to established business models of (especially) large banks. Most German banks have already redesigned processes, products and among other things, compensation systems (Behr and Schmidt, 2015).

The term CG in German literature refers to three aspects: the management of a company, the supervision and the relationship between the three governing bodies - management board, supervisory board and owner - among themselves and with regard to the stakeholders. A gap in the literature is represented by the investigations of other forms of banking such as savings banks and cooperative banks in Germany. Interesting is the question whether the existing standard CG structure is suitable for these banking forms. Landesbanken f. e. are not applying the code, they set their own CG guidelines.

## 3 Results and Discussion of the recent research on the European and German banking system

Because an effective risk culture and RM play a decisive role in banks' risk-taking, CRD IV set stricter rules for Boards of Directors, CRO and Committees to prevent excessive risk-taking. For setting of appropriate policies and improving governance arrangements in banking, the effects of the new regulatory framework on banks' risk-taking need to be analyzed. Incentives for the board and effects of remuneration on risk assumption have been well studied in the literature. However, other factors and psychological patterns are also important in team decision-making. These have not yet been sufficiently investigated. There is a little amount of research on these topics for European financial institutions and the existing literature is still mixed. In the following the main findings of the current studies for European banks will be outlined.

**Socioeconomic characteristic of the board structure: diversity, age and education**

The board is a central player in bank governance, it is the key decision-making body, which has two main roles: monitoring and advising. Its roles have to ensure that

- the RM framework is appropriately designed, adapted and implemented and
- it is an integral part of banks decision-making culture: "*to supervise bank executives so that they make decisions in line with the best interests of shareholders (the principal-agent problem), but also bearing in mind that risk-taking is in consonance with the bank's risk appetite and its long-term stability (the principal-regulator problem).*" (Vallelado and Garcia-Olalla, 2018).

After the financial crisis the effectiveness of board was questioned because of they failed to identify and understand the risk-taking, which was a failure in behaviour, attitude and in some cases in competence. The CRD IV includes rules to promote diversity in board composition. The prevailing view is that more diverse boards are more innovative. There are different aspects of diversity as f. e. age, education and gender diversity.

The gender gap still persists in the financial institutions: Globally, women hold less than 20% of board seats of banks. (IMF, 2018) (The European Commission proposes a 40% participation rate for under-represented gender in non-executive directors by 2020.) Some of prior studies support the notion that inclusion of female directors contributes to board effectiveness. In contrary, by reviewing of literature Pletzer et al. (2015) found that female represented in boards make no difference in performance. This topic is still controversial discussed, little is known about the effect of executive board composition on risk-taking.
Berger et al. (2012) analyzed German bank executive teams (1994-2010) and find, that younger executive directors and board with higher proportion of female cause increased risk-taking. They interpret this result by possible differences in experience and in initial conditions. Boards including more member with a PhD degree take less risks. This is in line with the result of Vallelado and Garcia-Olalla (2018).

Arnabolidi et al. (2018) evaluate the role of reforms that aim at promoting diversity on bank performance of EU listed banks. They found, that gender diversity per se seems to have a risk-increasing effect, but greater presence of female directors on board reduces bank risk when it is legally reinforced. Looking on the effect of stock returns, they found, that in countries more open to diversity, reforms decrease bank risk. They also show, that the bank risk increases, when flexibility in introducing reforms is not allowed by regulators. (More to this topic see Bohren and Staubo (2015) who state that introducing of gender quotas is negatively associated with performance.)

These results are in line with the IMF (2018) research, which finds that, greater gender diversity of boards leads to lower risk when it is legally imposed by CG codes. Hence, banks with higher female proportion on their board have a greater distance-to-default on average. Following, if the board consists of proportionally more women, it may have a stabilizing effect.

Brogi and Lasagio (2018) examine via multiple regression banks in Eurostoxx index regarding seven bank board features: independence, size, dedication, tenure, CG quality, external perspective, competence and diversity. They found, that CG curbs risk-taking, large banks are safer. CG quality increase, consistent with the agency theory, with independence (positive relationship between solvency and independency), diversity and expertise of the board, which is associated with bank soundness.

These results support the need for supervising bank CG, because it does impact risk-taking. To my known, there is no similar research regarding different banking groups in Germany. This area remains open for further research. Regulation could focus on few relevant CG as to board characteristics, f. e. independence, size, psychological aspects of decision-making and group dynamics.

**Risk Management and Risk Governance**

Risk failures are usually a result of poor governance. The German CG Codex (DCGK) require that a RM system must be established and contains a series of regulations dealing with RM. The post-crisis bank CG do not render the broad stakeholder perspective to RM and vice versa RM do not translate the approaches into the strategic management. The boards role in risk management is i. a. risk oversight of critical risks and risk decisions, which means a continual process of questions, sound decisions, feedback and review (Berger et al., 2018). Because of the communication across of both sections is important for an effective CG, an additional specialist is needed.

Stein and Wiedemann (2018) introduced risk governance as the corporate function that is directed towards the overall regulation of risk management to enable banks to control the risk-related complexity and to send clear ethical signals to all stakeholders concerning risk-related sustainability. *"RG cannot replace RM or CG but it could complement them in the sense of a meta-level monitoring and advising functionality. In the end, top management becomes more competent in terms of risk-related decisions which are expected to increase corporate effectiveness in terms of sustainability, long-term survivability, and value creation by fostering the overall risk robustness of the*

*company.*" (Stein and Wiedemann, 2018, p. 103.) The intention is the integration of stakeholder-oriented risk considerations.

**New regulatory requirements: Help or obstacle?**

Because of a huge amount of new and complex regulatory requirements, there are voices that it is difficult if not impossible to monitor the impact of the new rules and compliance of the banks to the requirements. There also are concerns about the slowing down of economic recovery as a result of stringent lending standards and high capital requirements. On the other side, there is a need of establishing new processes regarding risk governance as a link between RM and CG. The CG of banks should not rely only on the adaptation of executives' and shareholders' interests, but also on interests of debtholders and other stakeholders - it needs to be complemented by depositor or creditor governance.

The question for the further research is how to reform bank CG to constrain potentially undesirable risk-taking by banks, especially because there is not one single CG structure that fits all banks.

## 4 Conclusions

The financial crisis showed the need for more regulation and supervision of banks. But by now, there are signs of overregulation. In addition to the positive effect of better capitalization of banks, they may also have a negative effect in terms of risk-taking. Due to high requirements, banks may seek to take more risks in order to achieve better performance. Risk governance as a part of CG seems to be an important issue because it supports the sustainability and viability of the business model. A good CG does not necessarily mean less risk-taking. Rather, it means to take on an appropriate risk for profitable projects. More in-depth insights into the risk-taking and behavioural aspects of decision process as effects of the regulatory requirements should be considered, especially for European financial institutions. Deeper work needs to be done on this topic, connecting with literatures on organizational psychology, decision-making, demographics, and governance. In the end, everything depends on the people.

## References


Arnaboldi, F., Casu, B., Kalotychou, E., Sarkisyan, A. (2018). *Board diversity reforms: Do they matter for EU bank performance?* Retrieved from: https://www.cass.city.ac.uk/__data/assets/pdf_file/0010/437977/WP-CBR-03-2018.pdf.

Behr, P., Schmidt, R. H. (2015). The German banking system: Characteristics and challenges. *SAFE White Paper, No. 32, Goethe University Frankfurt, SAFE- Sustainable Architecture for Finance in Europe*. Frankfurt a. Main. Retrieved from: http://nbn-resolving.de/urn:nbn:de:hebis:30:3-391178.

Beltratti, A., Stulz, R.M. (2012). The credit crisis around the globe: why did some banks perform better? *Journal of Financial Economics,* vol. 105(1), pp. 1–17.

Berger, A. N., Kick, T., Schaeck, K. (2012). Executive board composition and bank risk taking. *Deutsche Bundesbank Diskussion Paper*, No 03/12.

Bohren, O., Staubo S. (2016). Mandatory gender balance and board independence. *European Financial Management,* vol. 22, pp. 3–30.

Brogi, M., Lagasio V. (2018). Better safe than sorry. *Will new rules on bank Corporate Governance prevent excessive risk taking?* Retrieved from: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3215820.

Dautović, E. (2019). Has regulatory capital made banks safer? Skin in the game vs moral hazard. *ESRB Working Paper Series in Law*, No 91. Retrieved from: https://www.esrb.europa.eu/pub/pdf/wp/esrb.wp91~4c70a46630.en.pdf?bbd045daedc55e2c2aeec688bbd6bd6c.

European Central Bank (2019). *Banking union*. Retrieved from: https://www.bankingsupervision.europa.eu/about/bankingunion/html/index.en.html.

Fahlenbrach, R., Stulz, R. M. (2011). Bank CEO Incentives and the Credit Crisis. *Journal of Financial Economics*, vol. 99(1), pp. 11–26.

Falato, A., Scharfstein D. (2016). The Stock Market and Bank Risk-Taking. *National Bureau of Economic Research, Working Paper 22689*. Retrieved from: https://www.nber.org/papers/w22689.pdf.

Gann, P., Rudolph, B. (2011). *Handbuch Coroporate Governance in Banken*. Anforderungen an das Risikomanagement. Beck. pp. 601-627.

Gehrig, T., Iannino, M. C. (2018). Did the Basel process of capital regulation enhance the resiliency of European Banks? *Bank of Finland Research Discussion Paper 16/2018.*

Hopt, K. J. (2013). Corporate Governance of Banks and Other Financial Institutions after the Financial Crisis. Retrieved from: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2212198.

Kotz, H.-H., Schmidt, R. H. (2017). Corporate governance of banks: A German alternative to the "standard model". *SAFE White Paper, No. 45, Goethe University Frankfurt, SAFE - Sustainable Architecture for Finance in Europe.* Frankfurt a. Main. Retrieved from: http://nbn-resolving.de/urn:nbn:de:hebis:30:3-438869.

Kress, J. C., (2018). Board to Death: How Busy Directors Could Cause the Next Financial Crisis. *Boston College Law Review*, vol. 59(3), pp. 877-929. Retrieved from: http://lawdigitalcommons.bc.edu/bclr/vol59/iss3/3.

IMF (2018). Women in Finance: A Case for Closing Gaps. *Staff Discussion Note/18/05*. Retrieved from: https://www.imf.org/en/Publications/Staff-Discussion-Notes/Issues/2018/09/17/women-in-finance-a-case-for-closing-gaps-45136.

Lagasio, V. (2018). Corporate governance in banks: Systematic literature review and metaanalysis. *Corporate Ownership & Control*, vol. 16(1), pp. 113-126. DOI: http://doi.org/10.22495/cocv16i1c1art1.

Laeven, L., Levine, R. (2006). *Corporate Governance, Regulation, and Bank Risk Taking.* Retrieved from: https://www.researchgate.net/publication/267566498.

Lofquist, M. W. (2018). *Europeanisation of Banks' Corporate Governance.* Retrieved from: http://ssrn.com/abstract=2845867.

Pletzer, J., Nikolova R., Kedzior K., Voelpel S. (2015). Does Gender Matter? Female Representation on Corporate Boards and Firm Financial Performance—A Meta-Analysis. *PLoS One,* vol. 10(6). Retrieved from: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130005.

Schoenmaker, D., Peek, T. (2014). The State of the Banking Sector in Europe. *OECD Economics Department Working Papers 1102*. Paris: OECD.

Stein V., Wiedemann A. (2018). Risk Governance: Basic Rationale and Tentative Findings from the German Banking Sector. In: Idowu S., Sitnikov C., Simion D., Bocean C., eds., *Current Issues in Corporate Social Responsibility. CSR, Sustainability, Ethics & Governance.* Springer, Cham, pp. 97-110. DOI: https://doi.org/10.1007/978-3-319-70449-4_7.

Vallelado, E., Garcia-Olalla, M. (2018). *Bank Boards in Europe: trade-offs in Size, Composition and Turnover.* Retrieved from: https://www.researchgate.net/publication/326555569_Bank_Boards_in_Europe_Trade-Offs_in_Size_Composition_and_Turnover_Regulation_Governance_and_Performance.

Von Werder, A. (2009). Ökonomische Grundfragen der Corporate Governance. In Hommelhoff et al., eds., *Handbuch Corporate Governance*, 2nd ed., Stuttgart: Schäffer-Poeschel, pp. 3-37.

# Prediction of Electricity Prices, Comparison of Germany and the Czech Republic

**Pavel Sedláček, Elena Láncošová**

Masaryk University
Faculty of Economics and Administration, Department of Finance
Lipová 41a, 602 00 Brno-Pisárky, Czech Republic
E-mail: 369947@mail.muni.cz

***Abstract:*** *The aim of this paper is to analyze time series that might have an impact on prices of energy commodities. Analysis and econometric modelling reveal which time series are corelated and how and the difference of Czech and German commodity exchange markets. This is input for further modelling of forecasting tool for electricity future prices prediction in near future. Selected time series are electricity and gas prices, contracted quantity per day, oil prices, coal prices, prices of emission allowances, weather (temperature and sunlight defining the consumption of energies), prices of electricity on day ahead market, currency exchange rate (EUR/CZK and EUR/USD) and correlation of particular week day. For the predicted value was chosen price of electricity on EEX for Germany and Czech Republic. The product is future "Cal+1" (product delivery is in next year) and time series were selected for period 1/2015-12/2018.*

*Keywords: electricity, futures, prices, prediction,*

*JEL codes: C58, O13, P18, Q41, Q47*

## 1 Introduction

For all companies trading electricity as well as for electricity producers, the most convenient product (to avoid risk of price differentials) is future year baseload (BL cal+1), which means future contract of electricity every day of the following year in certain amount of MWh. In order to gain profits, companies purchasing electricity employ professionals qualified to forecast the market trend in following days based on their knowledge. They decide, whether to purchase today, or whether it is better strategy to wait and gain profit. This opinion is based on fundamental and technical analysis, but not on exact model or prediction tool.

To fulfill the aim of this paper, we have chosen as predicted values prices of electricity in Czech Republic and Germany on EEX and the prediction is based on time series from January 2015 to December 2018. Selected time series are electricity prices of BL cal+1 on electricity commodity markets in Germany, Poland, France, Slovakia, Czech Republic, Italy, Hungary and contracted quantities per day. Those data were chosen to determine the level of correlation and eventual delay of price trends of the markets. Other time series chosen are data of energy "substitutes" - gas (NCG cal+1 and NCG cal+2), LGO (light gas oil), oil, coal and uranium. We have also selected prices of emission allowances, information about daily electricity production by source and prices on day ahead market to outline the point of view of electricity producers. Also exchange rates of CZK/EUR and EUR/USD, weather data (temperature, sunshine and wind), day of week, stock exchange indexes (PX and DAX representing the trends in economies), and stocks prices of ČEZ and EON (Czech and German electricity trading and distributing companies) were chosen.

## 2 Methodology and Data

As stated in chapter 1, our dataset consists of high number of time series predictors. In such settings as is often the case in financial markets, several drawbacks like multicollinearity, autocorrelation, missing values, necessity to detect high number of irrelevant variables and the most problematic of all, debatable stationarity, are to be expected. Therefore, methods for feature pre-selection were chosen in such a way that each method would leverage different characteristic of our data.

Because of high variety of methods used, we will not bore the reader with their widely known formulas but rather discuss their strengths and weaknesses directly implied by those formulas and relevant for this paper. Appropriate parameter values were determined through 5-fold cross validation.

Lasso and ridge were both chosen for being linear in its inputs, feature which they share with ARIMAX models chosen for prediction model specification.

Ridge shrinks less those variables that are in direction of higher multivariate variance. This estimation approach allows for stable estimate in presence of multicollinearity but since said variance is computed based on eigenpairs, it does not account for dependent variable and in presence of high number of irrelevant predictors, it might actually shrink wrong direction. Lasso employs modified least angle algorithm so it does not suffer from this drawback but might be unstable when faced with multicollinearity.

Both methods fare better when applied to standardized input which is problematic in many real-world time series settings where stationarity is difficult to reach. Therefore, last method considered for feature preselection are Random Forests (Pedregosa, 2011) because of for their endurance against different scales, multicollinearity and autocorrelation thanks to random sampling from data common to all bagging algorithms. Also, as a CART based method, RF are able to deal with missing observations by surrogate splits.

Their main disadvantage in our settings is that unlike Ridge and Lasso, RF are non-linear in nature and therefore are likely to favor slightly different predictors than ARIMAX used later for prediction model specification.

**Table 1** Methods used in this paper

| Purpose | Method | Complexity criterion |
|---|---|---|
| **Predictor engineering** | PCA | Variance |
| **Predictor preselection** | Lasso | 5-fold CV error |
| | Ridge | 5-fold CV error |
| | RF | 5-fold CV error |
| **Lag determination** | ARIMAX | AIC |
| **Model specification** | ARIMAX | AIC |

Source: Own methodology

Since multicollinearity is to be expected in financial markets setting, Principal Components Analysis (PCA) was employed to orthogonalize some of the predictors exhibiting high correlation and to engineer new predictors with potentially higher prediction power (Hastie, 2003).

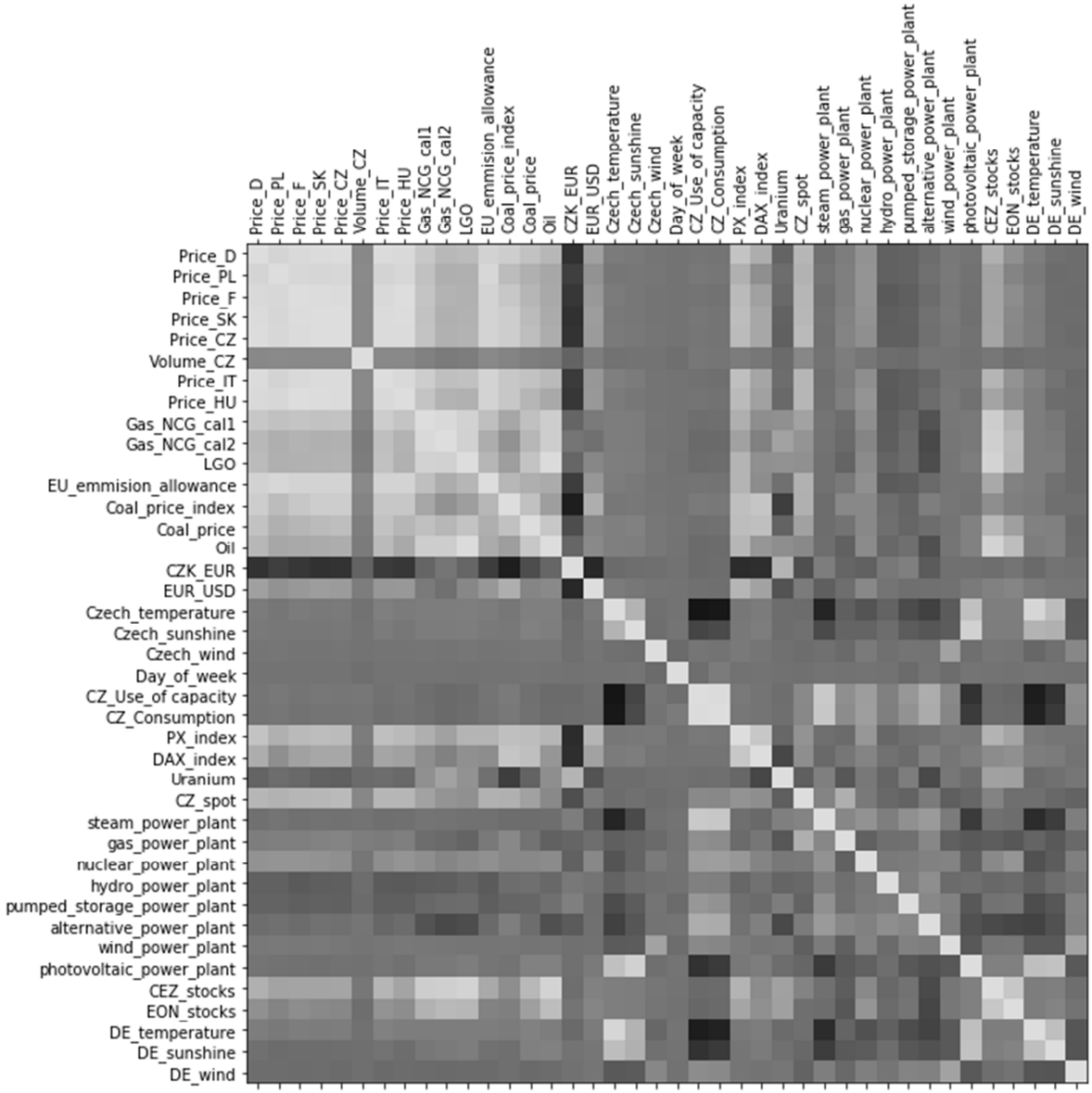
Having significantly reduced our feature space through use of before mentioned methods, ARIMAX (Hyndman, 2019) was employed to assess variable relevance more finely. It was chosen for its ability to take full advantage of non-trivial link between past and present values of observed variables as well as for its interpretability and transparency common to all linear models. Assessment of relevance of individual variables including newly engineered features and estimation of optimal dependent variable lag (AR part) and error term lag (MA part) were of interest. AIC, p-values, correlation analysis, overall model stability and domain knowledge were all used as guides toward optimal prediction model.

Finally, prediction on strictly independent test sample was created, accurately assessing model's prediction abilities to be expected in future years.

## 3 Results and Discussion

In order to satisfy stationarity assumption, one day differences of all variables were used thorough whole analysis. Figure 1 therefore depicts correlations between movements in our predictors. It offers us several insights.

**Figure 1** Correlation Matrix of All Variables Considered




Source: Own computation

The most notable one is strong positive correlation between movements in prices of electricity in European commodity energy markets suggesting tight relationship between Czech and German electricity market. We can also see that all of these prices are negatively correlated with Czech Euro exchange rate.

Indicators of nature seem to have no relationship to most predictors except for consumption, photovoltaic and wind power plant production and use of capacity, therefore they are unlikely to perform well in predicting movement in prices.

We can also observe few of the well-known correlations, for example correlation between prices of electricity, gas, coal and emission allowance.

On the other hand, one could be surprised by lack of correlation between electricity volume and price and also minor correlation of national stock market indexes and electricity prices (can be explained as economy is flourishing, expected consumption of energies is increasing causing higher prices).

As we have seen in Figure 1, German and Czech markets seem to be influenced by similar price determinants. Therefore, it would be interesting to see how deep does this similarity reach. In order to answer this question, two predictive models were estimated, one for Czech market and one for German market. Same methods for feature preselection, PCA, manual feature selection and optimal lag determination were applied.

Table 2 contains specification of resulting model both for German and Czech market.

We can see that Czech electricity prices are strongly influenced by Czech electricity price from yesterday while German prices are not. Coefficient of AR part alone would suggest that if price today grew by 1, tomorrow it will drop by 0.5. However, this straightforward interpretation is rather imprecise in full ARMAX environment, since MA part does not depend only on past values of dependent variable but also on values of all other variables in the model.

Also, it is possible to see that the latency of Czech market is quite short while MA part is surprisingly strong and lasting in German market where price dependence reaches as far as one week. It could mean that German prices reflect some unknown, additional price determinant acting in a systematic way which is possible to capture in MA part of the model while for Czech prices this additional information is either not present or not systematic enough to be captured.

One can be surprised by high p-value of GAS NCG cal1, but it is important to remember that unlike coefficient value which is direct result of projection of dependent variable into column space of rest of variables, p-value is a hypothesis test relying on strong and often unrealistic assumptions. In our case Gas NCG cal2 was statistically significant but this was not in accordance with financial markets behavior, therefore it was replaced by GAS NCG cal1 leading to a more stable model. However, this determinant is important only for Czech market.

The high impact of alternative power plant production on tomorrow electricity prices can be interpreted as lack of energy. Those power plants are being ready to produce energy in case of lack in the grid, there is regular subsidy for them for not producing and only staying in standby mode (usually from gas or other source with immediate production and low costs for activation and deactivation). Nevertheless, this relationship seems to hold again only in Czech settings.

Rest of the price determinants, LGO, EU emission allowance and Coal price index are shared by both Czech and German market but all of them have smaller impact on Czech prices than German prices judging from absolute value of the coefficient.

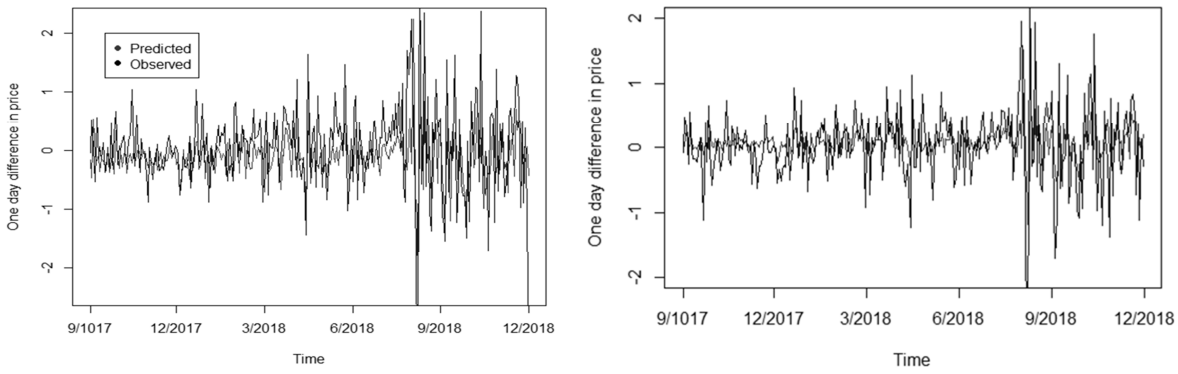
**Table 2** Electricity price determinant in Czech and German market

| | **Czech** | | **German** | |
|---|---|---|---|---|
| **Predictor** | **Coefficient** | **P-value** | **Coefficient** | **P-value** |
| **AR 1** | -0.471 | 0.003 | Not significant | |
| **MA 1** | 0.266 | 0.125 | -1.0904 | 0 |
| **MA 2** | Not significant | | 0.1088 | 0.194 |
| **MA 3** | Not significant | | -0.0118 | 0.947 |
| **MA 4** | Not significant | | -0.0776 | 0.158 |
| **MA 5** | Not significant | | 0.0838 | 0.043 |
| **Gas NCG cal1** | 0.015 | 0.864 | Not significant | |
| **LGO** | -0.006 | 0.017 | -0.0022 | 0.278 |
| **EU emission allowance** | 0.570 | 0 | 0.3753 | 0 |
| **Coal price index** | 0.110 | 0 | 0.0595 | 0 |
| **Alternative power plant** | 0.007 | 0.009 | Not significant | |

Source: Own computation

Figure 2 shows development of electricity prices from September 2017 until December 2018 and our prediction. It is easy to see that Czech market is more volatile than German market, possibly explaining one-week latency of German market and only one day long latency of Czech market. In addition, in both cases we can observe significant increase in volatility since August 2018. One of the main reasons of volatility increase is uncertainty about Brexit, where enormous amounts of speculative money were invested in EU emission allowance market.

**Figure 2** Predicted Values versus Reality for Czech (left) and German (right) Market




Source: Own computation

In order to assess relevance and credibility of created models, performance evaluation is performed on future, testing data. These observations were not used in model estimation; therefore, such accuracy can be reached by any investor applying this model to Czech or German market. Table 3 shows that we are able to correctly predict 59.2% of price changes of Czech market and 59.6% of German market.

**Table 3** Confusion matrix for Czech (left) and German (right)

| | | **Observed** | |
|---|---|---|---|
| | | **Observed** | |
| **Predicted** | | Decrease | Increase |
| | Decrease | 49 | 36 |
| | Increase | 75 | 115 |
| **Predicted** | | Decrease | Increase |
| | Decrease | 95 | 87 |
| | Increase | 25 | 68 |

Source: Own computation

## 4 Conclusions

We have figured out, that electricity prices predictability for both Czech and German market is comparable at 59%, however in case of the Czech market, we are able to predict increase in price more accurately at 73%. Those predictions are nowadays more valuable than ever due to rising prices and volatility on energy markets.

The main difference between Czech and German market consists in latency length; Czech prices are largely connected to one-day long history while German prices are influenced by a history up to one week. At the same time, Czech prices are mainly related to past values of determinants while the German price mechanisms seems to be more complex.

## Acknowledgments

The support of the Masaryk University internal grant No. 2156 is gratefully acknowledged.

## References

Greene, W. H. (2000). *Econometric Analysis*. Prentice Hall Inc.

Hastie, T. R., Tibshirani, R., Friedman, J. H. (2003). *The elements of statistical learning: data mining, inference, and prediction*. Corrected ed. New York: Springer.

Hyndman, R., Athanasopoulos, G., Bergmeir, C., Caceres, G., Chhay, L., O'Hara-Wild, M., Petropoulos, F., Razbash, S., Wang, E., Yasmeen, F. (2019). *forecast: Forecasting functions for time series and linear models.* Software, R package.

Flášar, P., Fousek, J., Jícha, T., Kabele, R., Kanta, J. et al. (2016). *Trh s elektřinou: úvod do liberalizované energetiky*, Asociace energetických manažerů.

Pedregosa, F., Varoquaux, G., Gramfort, A., Michel, V., Thirion, B. et al. (2011). *Scikit-learn: Machine Learning in Python*. JMLR 12.

# Economic Effects of IFRS 16 Implementation

**Jaroslav Sedláček**

Masaryk University
Faculty of Economics and Administration, Department Finance
Lipová 41a, 602 00 Brno, Czech Republic
E-mail: sedl@econ.muni.cz

***Abstract:*** *This paper is devoted to the economic effects of implementing the IFRS 16 Lease standard, which came into force on 1 January 2019. The new standard limits off-balance sheet accounting and lease reporting for asset lessees. The aim of the research is to characterize the development tendencies on the world, European and Czech leasing market and to determine the market shares of the operational leasing of lessees, accounting and reporting under IFRS as well as to identify and evaluate the volumes of hitherto unreported leases broken down by business lines of companies. In order to evaluate the expected effects of the implementation, the aggregated data of Czech industrial enterprises reported by companies in 2017 were used. The comparison between Czech and international rules measured the undervaluation of assets and liabilities of Czech lessees and the economic effects assessed using financial analysis indicators. The differences between the two approaches should be taken into account when assessing the financial and revenue situation of companies using leasing, in order to avoid the wrong decisions of management and investors.*

*Keywords: IFRS 16, Czech accounting standards, operating and financial leasing, accounting statements, right-of-use asset, off balance sheet leases, financial analysis*

*JEL codes: M21, M41, G32*

## 1 Introduction

Leasing as a source of long-term investment financing began to be used in the US in the middle of the last century and gradually expanded to other market economies. It has been used in the Czech territory since the end of the 1960s to finance industrial goods for households through specialized companies and later also for businesses and institutions. In the area of foreign trade, the role of emergency alternatives for the direct purchase of machinery and equipment played a role. Banks[11] and their leasing companies contributed significantly to the leasing development at that time. The global growth in the leasing business was interrupted by the 2009 financial and economic crisis, with the restoration of the initiated trend in the years to following.

According to Leaseurope's survey[12], the European leasing market's business growth was 9.15% per annum. In the last 9 years, the UK, France and Germany reported the largest shares in the European leasing market, followed by the countries of Central, Northern and Eastern Europe, as shown in Tab. 1. The Czech leasing market also behaves similarly, with average annual growth of 2.23%. The behavior of the markets is conditional on the relationship between the two parties involved in debt financing of investments and services and the assessment of the benefits obtained over disadvantages. The user decides between the two forms of debt financing, i.e. between a loan and leasing. In the case of credit financing, the user receives the funds necessary to acquire the necessary assets and becomes the legal and economic owner of the assets. These assets enter their financial statement and are gradually consumed. In the case of leasing, the owner is usually the leasing company that can report the assets in its balance sheet or pass them on to the user for reporting in its balance sheet. The obligation to report an asset in the statement depends on the specific leasing finance

[11] The first leasing contract was concluded between ČSOB and the Austrian company Österreichische Leasing Wien in 1982.

[12] Leaseurope (European Federation of Leasing Associations) covers 47 member associations representing leasing and renting vehicles from 34 countries, with a 94% share of the European leasing market.

accounting model. The advantage of leasing compared to bank loans or bond financing is mainly its flexibility, lower risk and easier availability.

**Table 1** Development of the transactions of company Leaseurope in the European leasing market

| Item (in bill. €) | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|---|---|---|---|---|
| Germany | 40.7 | 43.8 | 47.6 | 45.0 | 46.9 | 49.8 | 53.2 | 55.0 | 58.7 |
| France | 33.4 | 36.4 | 39.6 | 39.0 | 37.5 | 40.2 | 43.6 | 47.8 | 51.7 |
| UK | 33.2 | 34.9 | 38.1 | 44.7 | 48.5 | 60.8 | 76.9 | 73.8 | 101.3 |
| Austria, Benelux, Switzerland | 25.2 | 24.8 | 30.8 | 30.2 | 28.5 | 30.0 | 34.9 | 36.2 | 37.4 |
| Italy | 28.3 | 29.8 | 27.4 | 18.5 | 16.5 | 18.0 | 19.5 | 22.8 | 26.6 |
| Nordic Europe | 18.7 | 21.3 | 22.5 | 28.7 | 28.7 | 30.1 | 32.6 | 37.4 | 36.0 |
| Greece, Portugal, Spain | 15.3 | 17.0 | 12.5 | 10.3 | 9.0 | 12.9 | 15.2 | 16.8 | 19.1 |
| CEE | 14.6 | 16.1 | 16.8 | 16.5 | 17.8 | 20.1 | 30.8 | 33.7 | 36.5 |
| Russia | 0.0 | 0.0 | 18.1 | 19.6 | 18.5 | 13.6 | 8.2 | 10.1 | 16.7 |
| Total | 209.4 | 224.1 | 253.4 | 252.5 | 251.9 | 275.5 | 314.9 | 336.6 | 383.0 |

Source: Leaseurope (2018)

In international terms, leasing is understood as a contract that gives the customer the right to control the use of the identified asset over a period of time in exchange for consideration. The right to control utility is a criterion for dividing the lease into operative and financial. This corresponds to two asymmetric accounting models that apply to both the lessor and the lessee. The new standard, which came into force on 1 January 2019 was adopted by the European Commission and is binding for the accounting for leases in the financial statements of both parties to the contract.

The standard is based on the characteristics of the asset that the lessee which benefits from the asset and has the right to control the use of the asset accounts for it and reports on it in the balance sheet. From an economic point of view, the leasing contract is the same as the purchase of the right to use the asset with the cost paid in installments. In fact, the use of an operating lease accounting model allows only for short-term rental (for 12 months or less) or low-value assets (e.g. personal computers or small office furniture) According to Czech accounting regulations, the right to use the asset cannot be provided to the lessee, which leads to a different presentation of the finance lease, which is reflected in the value of the lessee's assets and their economic result.

The aim of our research was to assess the impact of these changes in accounting policies on the financial situation and profits or losses of lessees on the world, European and Czech leasing market. To evaluate the economic impacts using economic indicators on the sample of selected business corporations (Altman, 1968; Damodaran, 2000).

## 2 Methodology and Data

The new standard defines the principles for the recognition, measurement, presentation and disclosure of leases in order to ensure that lessees and lessors provide relevant information that represents these transactions fairly (IFRS Foundation, 2018). In their studies, large accounting and auditing firms report that the introduction of IFRS 16 in companies that have significant off-balance sheet leasing can be expected to increase leasing assets and financial liabilities. As a rule, the book value of a lease asset decreases faster than the book value of the lease obligation. This will result in a decrease in the

recognized equity compared to the previous lease accounting model (KPMG, 2016). These impacts are similar to the effects on reported equity capital that arise from financing the purchase of an asset, either through a previously concluded lease or through a loan. The key financial indicators derived from the lessee's assets and liabilities will also change logically.

The starting point of the research was to identify the differences arising from the introduction of the new standard and to assess their impact on the financial position of the companies and the reported profits or losses. The effects of changes in the financial position of companies will be manifested differently for companies that account for and compile financial statements in accordance with international standards and that follow Czech national standards. In the Czech territory, where the change will be relevant only for companies traded on public markets, it is highly probable that the current differences between national and international approaches will also be eliminated as a result of the global financial reporting harmonization. We will therefore focus primarily on assessing the situation of companies trading on the global and European leasing markets and secondarily on companies operating on the Czech leasing market. To measure economic effects after the introduction of the new accounting model, the financial statements of selected companies and the classical ratio indicators of financial analysis will be used (Oxelheim, 2003; Wagenhofer, 2003; Levy and Sarnat, 1999; Samuelson and Nordhaus, 1992). In assessing the right to use with the lessee, the time value of cash flows, including the initial direct costs incurred by the lease, and the estimated costs of dismantling the asset in question, its removal, bringing the asset to its original condition or putting the asset under the terms of the lease agreement are respected. For discounting lease payments, either the default interest rate of the lease (if applicable) or the lessee's incremental interest rate is used.

To assess the significance of the economic effects of the change in accounting, we compare the shares affected by the newly requested method in the leasing markets in the global, European and national dimensions (Bokpin, 2009; Brealey et al., 2006).

## 3 Results and discussion

The standard which was approved by the European Commission for use in the European Union already in November 2017 distinguishes leasing from a service contract based on whether the lessee can control the leased asset and capture all leases in the balance sheet. For the lessor, the International Accounting Standards Board (IASB) retained the original asymmetric lease accounting models (i.e., different accounting and presentation for finance and operating leases). The introduction of a single model for both types of leasing results in an increase in the balance sheet total in the lessee's balance sheet of the right-of-use asset against the lease obligation. In the profit and loss statement, costs are recognized as interest on the lease obligation in financial costs and as a depreciation (straight-line) on the right-of-use asset, reducing tax and depreciation (EBITDA). In the statement of cash flows, total expenditure is divided into the payment of the principal (reported in the financial activity) and interest (Svoboda and Bohušová, 2017; Malíková et al., 2018). Prior to the introduction of the standard, the International Accounting Standards Board published the results of an analysis of expected effects on listed companies that used the model for accounting for off-balance sheet leasing (IFRS 16 Leases, 2016). According to the analysis, more than 14,000 listed companies out of about 30,000 registered) disclose off-balance sheet leasing information in their latest annual reports. The current value of future off-balance sheet leases is estimated at USD 2.19 trillion. Further analysis showed that 1,145 of these companies account for more than 80% of the present value of the total off-balance sheet leasing. After the exclusion of financial institutions, the sample contained 1,022 with a volume of USD 1.66 trillion, representing 76% of the value of all off-balance sheet leasing of the listed companies. Industrial sector results are summarized in Tab. 2, which measures future payments for off balance sheet leases (FPL) to total reported assets (TA).

The conclusions of the analysis showed that in some industrial sectors, the transition to the new standard will significantly affect the value of total assets by non-financial long-term assets from the leases and liabilities of companies by long-term financial liabilities. The summary of leasing costs and depreciation will be higher than the direct off-balance sheet lease cost under IFRS 17 in the first half of the lease due to the straight-line depreciation and interest expense as the lease liabilities decrease. Similarly, the indicators of financial analysis will change in the area of activity, debt, activity and liquidity. The importance of the economic effects of the change in accounting increases depending on the use of off-balance sheet leases by the lessee. According to the IASB's analysis, the new standard may subsequently lead to similar changes in the national accounting policies used by smaller companies in preparing the financial statements.

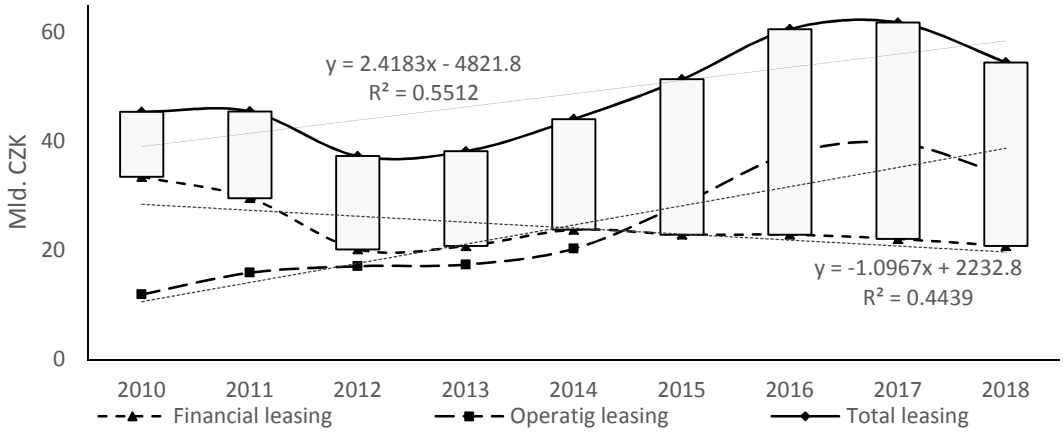
**Table 2** The use of off-balance sheet leases by listed companies throughout the world (within industry sector)

| Industry sector (in millions of US$) | No. of companies | Total assets | FPL undiscounted | FPL/TA undiscounted | FPL discounted | FPL/TA discounted |
|---|---|---|---|---|---|---|
| **Airlines** | 50 | 526763 | 151549 | 28.8 % | 119384 | 22.7 % |
| **Retailers** | 204 | 2019958 | 571812 | 28.3 % | 431473 | 21.4 % |
| **Travel and leisure** | 69 | 403524 | 115300 | 28.6 % | 83491 | 20.7 % |
| **Transport** | 51 | 585964 | 90598 | 15.5 % | 68175 | 11.6 % |
| **Telecommunications** | 56 | 2847063 | 219178 | 7.7 % | 172644 | 6.1 % |
| **Energy** | 99 | 5192983 | 400198 | 7.7 % | 287858 | 5.5 % |
| **Media** | 48 | 1020317 | 71743 | 7.0 % | 55765 | 5.5 % |
| **Distributors** | 26 | 581503 | 31410 | 5.4 % | 25092 | 4.3 % |
| **Information technology** | 58 | 1911316 | 69870 | 3.7 % | 56806 | 3.0 % |
| **Healthcare** | 55 | 1894933 | 72149 | 3.8 % | 54365 | 2.9 % |
| **Others** | 306 | 13958223 | 401703 | 2.9 % | 306735 | 2.2 % |
| **Total** | 1022 | 30943502 | 2195510 | 7.1 % | 1661787 | 5.4 % |

Source: IFRS 16 Leases (2016)

Similar economic impacts on financial position and economic results will be seen in companies trading on the European leasing market and reporting under IFRS. Moreover, the Czech leasing market has experienced a faster increase in operating leases over the past nine years compared to total leases. The regression line (see Figure 1) shows a negative slope, showing the development of financial leasing.

**Figure 1** The comparison of the development of leasing on the Czech market




Source: report of the Czech Leasing and Financial Association (2018)

During the reporting period, the share of operating leases in financial leasing increased by 4.5 times. In Czech law, leasing is defined as a contract under which the lessee is liable to use the asset for consideration. In addition, in the case of a finance lease, the user (lessee) is entitled or obliged to acquire title to the provided property during or after its termination. Legal ownership thus takes precedence over both economic ownership and accounting, which does not allow an asset to be recognized in the lessee's balance sheet, including the transfer of existing risks arising from use (Sedláček, 2017; Hasprová et al., 2018). Companies that follow the CAS cannot use the financial lease accounting model (under IFRS 16), which distorts the value of total assets and liabilities in the financial statement of companies. The potential undervaluation of assets and debts reported by companies on the Czech leasing market could reach up to CZK 33.7 billion. To measure the economic impact of this undervaluation, we will use aggregated data reported by industrial companies in the Ministry of Industry and Trade of the Czech Republic (MIT, 2018) in 2017. The main differences caused by off-balance sheet reporting of finance leases are shown in Tab. 3.

**Table 3** Expected changes in the financial statements of Czech lessees in accounting for leases under IFRS 16 (in the industrial sector)

| Item (in millions of CZK) | CAS | IFRS 16 | Differences |
|---|---|---|---|
| **Total assets** | 6741.0 | 6865.1 | - 124.1 |
| **Lease assets** | 0.0 | 124.1 | - 124.1 |
| **Total liabilities** | 3788,8 | 3912.9 | - 124.1 |
| **Lease liabilities** | 61.8 | 185.9 | - 124.1 |
| **Equity** | 2952.2 | 2952.2 | 0.0 |
| **Revenues** | 6911.0 | 6911.0 | 0.0 |
| **EBITDA** | 1081.1 | 1104.7 | - 23.6 |
| **Depreciation and amortization** | 576.9 | 591.9 | - 15.0 |
| **EBIT** | 504.2 | 512.8 | - 8.6 |
| **Interest expense** | 46.7 | 55.3 | - 8.6 |
| **EBT** | 457.5 | 457.5 | 0.0 |
| **Taxes** | 92.2 | 92.2 | 0.0 |
| **EAT** | 365.3 | 365.3 | 0.0 |

Source: Effect Analysis MIT (2018)

The negative difference expresses how large the undervaluation of reported items arises for lessees when accounting for CAS according to IFRS 16. Conversely, overvaluation expresses a positive difference. An increase in the value of assets and liabilities in the

lessees' statements will cause an increase in their total liabilities (Total liabilities / Equity), Revenues / Total assets and Current assets / Current liabilities. Although the change is now only visible in companies traded on public markets, differences in reporting can significantly impact the overall economic assessment of companies and investor and management decisions.

## 4 Conclusions

After the financial and economic crisis, which hit the global economy in 2009, leasing market activities resumed and the volume of trades started to increase. The analysis confirmed the highest annual growth of the UK leasing market by 33.88% between 2009 and 2017, followed by the CEE countries by 27.77% and Northern Europe by 9%. The introduction of a new lease accounting and reporting model will have a significant impact on industries with a high proportion of off-balance sheet leasing, such as airline, business, travel and leisure. The process of regression functions revealed the opposite trend in the development of trades on the Czech market, where since 2015 the volume of operating leases exceeds 24% to 80% financial leasing. The potential underestimation of assets and debts reported by companies on the Czech leasing market could reach up to CZK 33.7 billion.

The measurement of the economic effects of this underestimation was done on aggregated data reported by companies in the industry sector in 2017. Total assets are reported by Czech industrial companies in a value lower by 1.84% and total debts at a value lower by 3.27%. The undervaluation is reflected not only in other items in the profit and loss account of Table 3, but also in financial indicators such as debt, turnover, current liquidity, etc. These differences need to be taken into account when assessing the financial and revenue situation determined on the basis of Czech accounting when compared with companies that follow the new IFRS standard. Appropriate reporting corrections will allow better comparability of calculated indicators and reduce the risk of mismanagement by both management and investors.

## Acknowledgement

The paper is the result of the specific research no. MUNI/A/1110/2018: Non-financial information and its relevance for measuring performance.

## References

Altman, E. I. (1968). Financial ratios, discriminant analysis and the prediction of corporate bankruptcy. *The Journal of Finance,* vol. 23(4), pp. 589–609.

Czech Leasing and Financial Association (2018). *Výroční zpráva 2017.* Retrieved from: https://www.clfa.cz/data/dokumenty/546-vyrocni-zprava2017.pdf.

Hasprová, O., Brabec, Z., Rozkovec, J. (2018). Intangible assets disclosed by public universities in Czech Republic. *Journal of International Studies*, vol. 11(1), pp. 67-79. DOI: 10.14254/2071-8330.2018/11-1/5.

Bokpin, G.A. (2009). Macroeconomic development and capital decisions of firms – Evidence from emerging market economies. *Studies in Economics and Finance*, vol. 2, pp. 129–142.

Brealey, R. A., Myers, S. C., Allen, F. (2006). *Principles of Corporate Finance.* Boston: McGraw-Hill.

Damodaran, A. (2000). *Corporate finance: Theory and practice.* New York: John Wiley & Sons. Inc.

IFRS 16 Leases (2016). *Effect analysis IFRS 16*. Retrieved from: https://www.ifrs.org/-/media/project/leases/ifrs/published-documents/ifrs16-effects-analysis.pdf.

IFRS Foundation (2018). *IFRS 16 Leases.* Retrieved from: https://www.ifrs.org/issued-standards/list-of-standards/ifrs-16-leases/.

KPMG (2016). *IFRS 16 Leases*. Retrieved from:https://home.kpmg/content/dam/kpmg/pdf/2016/01/leases-first-impressions-2016.pdf.

Leaseurope (2018). *Leaseurope statistics*. Retrieved from: http://www.leaseurope.org/index.php?page=stats-surveys.

Levy, H., Sarnat, M. (1999). *Capital Investment and Financial Decision*. Praha: Grada Publishing.

Malíkova, O., Brabec, Z., Rozkovec, J. (2018). Financial reporting of intangible assets–evidence on information and communication companies in the Czech Republic. *Journal of International Studies*, vol. 11(2), pp. 327-340. DOI: 10.14254/2071-8330.2018/11-2/22.

MIT (2018). *Analytical materials, statistics*. Ministry of Industry and Trade. Retrieved from: http://www.mpo.cz/en/guidepost/analytical-materials-statistics/.

Oxelheim, L. (2003). Macroeconomic Variables and Corporate Performance. *Financial Analysts Journal,* vol. 59(4), pp. 36-50.

Samuelson, P. A., Nordhaus, W. D. (1992). *Economics.* 14th Ed. New York: McGraw-Hill.

Sedláček, J. (2016). Comparison of valuation of financial instruments according to the international and Czech accounting standards in the context of performance reporting. *Financial Assets and Investing*, vol. 7(1), pp. 33-49.

Svoboda, P., Bohušová, H. (2017). Amendments to IAS 16 and IAS 41: Are There Any Differences between Plant and Animal from a Financial Reporting Point of View? *Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis,* vol. 65(1), pp. 0327–0337.

Wagenhofer, A. (2003). *Bilanzierung und Bilanzanalyse.* 14th Ed. Vienna: Linde.

# Record Keeping for Individual Entrepreneurs in the Czech Republic

**František Sejkora[1], Petra Hromuľáková[2]**

[1] University of Pardubice
Faculty of Economics and Administration
Institute of Business Economics and Management
Studentská 95, Pardubice 530 02, Czech Republic
E-mail: frantisek.sejkora@upce.cz

[2] University of Pardubice
Faculty of Economics and Administration
Institute of Business Economics and Management
Studentská 95, Pardubice 530 02, Czech Republic

***Abstract:*** *The role of individual entrepreneurs is irreplaceable in every market economy. This group of entrepreneur's acts as a competitor in relation to monopolistic market players, as they are usually quicker and more agile in response to changes in demand. The entrepreneurial activity of individuals can be recorded according to current Czech legislation on the basis of accrual accounting or tax accounting. Both systems serve to capture information about the business and subsequently become an important basis for decision-making. The article uses scientific methods mainly analysis, synthesis and comparison for recognition of these two systems. The questionnaire survey examines the administrative complexity of these systems and the factors that affect entrepreneurs in selecting a system of recording of economic transactions. In choosing a system the most important factors include tax optimization, legislative regulation and administration costs. Respondents are aware of the benefits of tax accounting and accrual accounting. Data do not provide a statistically significant difference in responses between respondents.*

*Keywords: Tax Accounting, Accrual Accounting, Entrepreneur, Comparison.*

*JEL codes: M 41*

## 1 Introduction

Before asking whether to keep accrual accounting or tax accounting, there are a number of start-ups as well as functioning business entities. Business activity is recorded in any case, but some subjects may voluntarily decide whether to keep tax accounting or accrual accounting based on certain criteria. On the other hand, certain entities are required by law to direct accrual accounting. Tax accounting differs from accrual accounting in many ways. Differences can be found mainly in the area of legislation, the form of recording of economic phenomena, in the temporal distinction between individual systems and differences in the determination of tax base and tax liability. The ability to choose of tax accounting as a factor in the decision on legal form is examined by the authors (Bergner and Heckemeyer, 2017).

Tax accounting are similar to canceled single-entry accounting, but its content is relatively simplified. Legislative regulation of tax accounting passed from accounting regulations into the Income Tax Act, specifically into §7b. The aim of tax accounting is therefore to provide the necessary data to determine the income tax base and is intended for entities that are not entities.

According to (Cardová, 2010) the key feature of tax accounting is that it is based on a monetary basis. This means that it captures economic operations only at the time of cash flow movements. Pursuant to Section 7b of the Income Tax Act, the main task of tax accounting is to provide information on income and expenditure, that is, the actual inflow or outflow of funds in the cash register or on the current account of a business entity. (Pilátová, 2016) emphasizes that income and expenses of monetary and non-monetary nature, precisely defined by the Income Tax Act, are recorded in tax accounting.

If the tax accounting are kept on an ongoing basis, it has another meaning as it provides an overview of the state and movement of the entrepreneur's assets and liabilities. Tax accounting are suitable for economic decision-making and create an overview of the financial condition of the entrepreneur (Dušek and Sedláček, 2016). However, the specific form of tax accounting is not stipulated by any regulation or order, but in terms of defining the content of individual components of assets and liabilities in tax accounting, reference is made to accounting regulations. As a result, tax accounting represent lower administrative costs, lower knowledge requirements, and the possibility to optimize economic results. The importance of tax and accounting compliance costs is examined by authors (Keasey and Short, 1990), (Blaufus et al., 2014).

The authors (Bergner and Heckemeyer, 2017) state that, most European countries provide simplified, cash-based rules of tax accounting for small firms that considerably deviate from their general accrual accounting rules.

The basic and fundamental legal regulation for accrual accounting is Act No. 563/1991 Coll. on the Accounting. The law requires entities to keep accounting books in a complete, correct and conclusive manner so that they fairly and faithfully portray the facts that are the subject of the book. Furthermore, they are implementing decrees that extend certain provisions of the Act and Czech Accounting Standards, which elaborate in detail the provisions of the Decrees.

Accrual accounting as a whole, providing information on the status and movement of assets, sources of financing, costs and revenues related to the determination of economic results. An important advantage of accounting against tax records is the fact that it provides much more detailed information about business performance. The author (Waniak, 2017) investigate whether tax accounting is a barrier to access financing resources. The tax base is determined in the accounting as the difference between revenues and costs. Entities are required to record facts using accounting documents. These facts, which are the subject of accounting, are identified in accounting cases and recorded in the books, 1) general ledger - where accounting cases are recorded in kind, 2) diary - where accounting cases are arranged chronologically.

The aim of this paper is to identify factors influencing respondents in the selection of a suitable system for recording economic phenomena. The partial goal is to find out what the importance of respondents attach to the choice of system when starting a business and what benefits they see in keeping tax accounting and accrual accounting. Furthermore, it is examined whether the answers of the groups of respondents differ.

## 2 Methodology and Data

For the purposes of quantitative data acquisition, a questionnaire survey was conducted using mail correspondence. The questionnaire was intended for two groups of respondents from the Vysočina Region. The first group of respondents consisted of entrepreneurs; the second group consisted of accountants. In terms of the number of respondents addressed, the authors were led by an effort to ensure a sufficient sample representativeness. A total of 87 respondents answered the questionnaire, of which 38 were entrepreneurs and 49 were public accounting. The aim of the questionnaire survey is to determine the factors influencing respondents in choosing the appropriate system for recording economic phenomena. A total of eight factors were identified in the questionnaire survey. Respondents had the opportunity to add a factor not listed. This option, no respondent used. The individual factors were evaluated using the 0 - 3 point scale, when the respondent was asked to choose whether the importance level for the given factor was high (3) or none (0). To test the importance of individual factors, a t-test was used to test the bilateral hypothesis that the mean value of the factor was 1.5.

In addition, research questions were set: 1) the importance of respondents to choosing the system at start-up, 2) what main advantages they see in keeping tax accounting, and 3) what main advantages they see in accrual accounting.

At the same time, the following hypotheses were set in the evaluation of selected questions:

H1: The importance of selecting a registration system when starting a business is equally important for both groups of respondents.

H2: The perception of the advantages of tax accounting is comparable for both groups of respondents.

H3: The perception of the priority of accrual accounting is comparable for both groups of respondents.

To evaluate hypotheses was tested using a goodness of fit test using Pearson's chi-square a significance level of α = 0.05.

## 3 Results and Discussion

Factors influencing the respondent in selecting the system for recording economic phenomena were based on theoretical basis. The following table 1 provides the order of the individual factors from the most significant to the least significant, including descriptive characteristics.

**Table 1** The factors influencing respondent when making decisions about selecting the system

| | Level of importance (%) | | | | | | |
|---|---|---|---|---|---|---|---|
| **Factor** | None 0 | Low 1 | Medium 2 | High 3 | Averag | t-test | p-value |
| **Possibilities of tax optimization** | 8,1% | 13.7% | 20.7% | 57.5% | 2,28 | 7.4 | 0.00 |
| **Legislative regulation** | 8.0% | 11.5% | 27.6% | 52.9% | 2,25 | 7.4 | 0.00 |
| **Administration costs** | 6.9% | 18.4% | 19.5% | 55.2% | 2,23 | 6.9 | 0.00 |
| **Difficulty in determining the trading result** | 8.1% | 12.6% | 37.9% | 41.4% | 2,13 | 6.3 | 0.00 |
| **Administrative complexity in identifying trading operations** | 11.5% | 21.9% | 36.8% | 29.9% | 1,85 | 3.3 | 0.00 |
| **Providing detailed information about business performance** | 14.9% | 19.5% | 31.0% | 34.5% | 1,85 | 3.1 | 0.00 |
| **The relationship between trading result and performance** | 19.6% | 22.9% | 29.9% | 27.6% | 1,66 | 1.3 | 0.19 |
| **Existence of limitation of system use** | 18.5% | 37.9% | 22.9% | 20.7% | 1,46 | 0.4 | 0.71 |

Source: authors' calculation

The data in the table shows that respondents consider a wide range of factors when choosing a system and there is no factor that would not be relevant to the respondent. These factors can be divided into two groups, factors that directly impact costs and

factors that affect administrative burdens. The most significant of the eight factors that have been investigated, respondents have identified the following as the most significant factors: Possibility to optimize tax base, Legislative regulation, Administration cost and Difficulty in determining the trading result. Conversely, the least significant and statistically insignificant factors are: The relationship between trading result and performance and the existence of limitation of system use.

Table 2 provides the answers to the first research question: What importance do the respondents attach to the choice of system when starting a business. The answers to this question also served to evaluate the first hypothesis.

**Table 2** The frequency of answers to the research question number 1 and testing hypothesis H1

| Answer | **A novice entrepreneur with no experience should contact the experts and their advice** | **A novice entrepreneur can do with tax accounting** | **Significant, inappropriate selection can cost considerable money in the future** | **I do not see a fundamental difference between systems** | **Total** |
|---|---|---|---|---|---|
| **Entrepreneur** | 27 | 3 | 7 | 5 | 42 |
| **Accountant** | 29 | 5 | 11 | 0 | 45 |
| **Total** | 56 | 8 | 18 | 5 | 87 |

Source: authors' calculation

The frequency of responses suggests that a start-up entrepreneur should take into account the system to record economic phenomena. The most unambiguous response was the answer: A novice entrepreneur with no experience should contact the experts and their advice on 64.4% of the answers. The second most common answer with 20.7% was the possibility that: Significant, inappropriate choices can cost considerable funds in the future.

At the same time, the answers were used to evaluate Hypothesis 1. To compare the significance level with the ch-square ($\chi^2_3 = 6.36$, p=0.09) test value, the null hypothesis was not rejected

Table 3 provides the answers to the second research question: What are the main advantages of tax records.

**Table 3** The frequency of answers to the research question number 2 and testing hypothesis H2

| **Answer** | **Less time for processing** | **less demanding on knowledge and management** | **I do not see significant advantages of tax accounting over accrual accounting** | **I can not judge** | **Total** |
|---|---|---|---|---|---|
| **Entrepreneur** | 18 | 13 | 6 | 9 | 46 |
| **Accountant** | 20 | 16 | 4 | 1 | 41 |
| **Total** | 38 | 29 | 10 | 10 | 87 |

Source: authors' calculation

Most responses received the answer: Less time for processing time of 43.7% and lower demands on knowledge and management with 33.34% answers. 22.9% of respondents fail to assess or see any advantages over accounting.

At the same time, the answers were used to evaluate Hypothesis 2. To compare the significance level with the ch-square ($\chi^2_3$ = 6.95, p=0.07) test value, the null hypothesis was not rejected.

Table 4 provides the frequency of answers to the third research question: What are the main advantages of accounting against tax records.

**Table 4** The frequency of answers to the research question number 3 and testing hypothesis H3

| Answer | accounting enables reliable comparison with other companies | provides reliable information to manage your business | I can not judge | I do not see significant advantages of accrual accounting over tax accounting | Total |
|---|---|---|---|---|---|
| **Entrepreneur** | 9 | 24 | 2 | 3 | 38 |
| **Accountant** | 14 | 30 | 1 | 4 | 49 |
| **Total** | 23 | 54 | 3 | 7 | 87 |

Source: authors' calculation

The most frequent answers were: provides reliable information to manage your business (62.1% answers) and accounting enables reliable comparison with other companies with a lower level of knowledge and administration with 26.4% answers.

At the same time, the answers were used to evaluate Hypothesis 3. To compare the significance level with the ch-square ($\chi^2_3$ = 0.85, p=0.83) test value, the null hypothesis was not rejected.

## 4 Conclusions

Entrepreneurs are aware of the importance of deciding what method of recording economic phenomena, when starting a business activity to choose.

The factors influencing the choice of the system are predominantly financial factors, where respondents prefer the possibility of optimizing the tax base and administration costs. In keeping tax records, the scope for tax optimization is primarily in the form of deferral of tax liability greater than bookkeeping. This applies mainly to the areas of frontloading, acquisition of intangible assets and payments of advances received. When maintaining tax records, payment of these items becomes tax expense at the moment of payment, regardless of the moment of actual consumption. The costs are also related to the administrative costs associated with the chosen form of registration. It is clear that the accounting in terms of the extent of knowledge and the extent of recording economic phenomena will be more costly from the tax records.

Respondents are aware of the main advantage of tax accounting, which consists primarily in time savings in processing and lower demands on knowledge and management of administration. In the case of accrual accounting, respondents consider the main advantage to be reliable information needed to manage the company and the possibility of reliable comparison with other companies. Data did not provides a statistically significant difference in responses between the two groups.

## References

Act No. 563/1991 Coll., on the Accountancy, as amended.

Act No. 586/1992 Coll., on the Income Tax, as amended.

Bergner, S. M., Heckemeyer, J. H. (2017). Simplified Tax Accounting and the Choice of Legal Form. *European Accounting Review,* vol. 26(3), pp. 581-601.

Blaufus, K., Eichfelder, S., Hundsdoerfer, J. (2014). Income Tax Compliance Costs of Working Individuals: Empirical Evidence from Germany. *Public Finance Review,* vol. 42(6), pp. 800-829.

Cardová, Z. (2010). *Daňová evidence a účetnictví individuálního podnikatele.* 2. vyd. Praha: Wolters Kluwer ČR.

Dušek, J., Sedláček, J. (2016). *Daňová evidence podnikatelů 2016*. Praha: GRADA Publishing.

Keasy, K., Short, H. (1990). The Accounting Burdens Facing Small Firms: An Empirical Research Note. *Accounting and Business Research.* vol. 20(80), pp. 307-313.

Pilátová, J. (2016). *Daňová evidence: komplexní řešení problematiky daňové evidence pro OSVČ: daň z přidané hodnoty, daň silniční, daň z nemovitých věcí, sociální pojištění, zdravotní pojištění.* Olomouc: ANAG.

Waniak, H. (2017). Does simplified accounting limit small and micro companies' access to bank financing? *Accounting and Management Information System,* vol. 16(2), pp. 340-359.

# Long-Term Social Care – The Problem of Sustainable Financing in Slovakia

**Ľudomír Šlahor[1], Mária Kmety Barteková[2], Janka Gasperová[3], Dagmar Palátová[4]**

[1] Comenius University in Bratislava
Faculty of Management, Department of Economics and Finance
Odbojárov 10, 820 05 Bratislava, Slovakia
E-mail: ludomir.slahor@fm.uniba.sk

[2] Comenius University in Bratislava
Faculty of Management, Department of Economics and Finance
Odbojárov 10, 820 05 Bratislava, Slovakia
E-mail: maria.bartekova@fm.uniba.sk

[3] Comenius University in Bratislava
Faculty of Management, Department of Economics and Finance
Odbojárov 10, 820 05 Bratislava, Slovakia
E-mail: gasperova.j@gmail.com

[4] Comenius University in Bratislava
Faculty of Management, Department of Economics and Finance
Odbojárov 10, 820 05 Bratislava, Slovakia
E-mail: dagmar.palatova@fm.uniba.sk

***Abstract:*** *Demographic changes challenge Slovakia in various perspectives and in various ways. Future trends, especially the growth of the elderly population, are expected to affect significantly the provision and sustainability of long-term social care (LTSC), i.e. services that support the care dependent person in carrying out activities of daily life (bathing, clothing, eating, shopping, cooking, etc.) or support the informal carer in carrying out these tasks. Looking into the future, the formulation of a sustainable LTSC policy will increasingly become the major focus for social policy. Several barriers to access the LTSC occurred in the Slovak LTSC system. Main of them are financial barriers, geographic barriers and organizational barriers. Financing system of the Slovak LTSC is mixed. Long term social care is funded from two sources, differed by type of provided LTSC. The scope of this paper will be restricted to addressing the most important questions concerning financial sustainability with respect to collective and individual arrangements and public and private responsibilities. This paper will highlight the common challenges regarding financing LTSC in Slovakia and builds on examples from several EU countries to discuss the different financing schemes for LTSC, the trade-offs associated with each option and recent trends.*

*Keywords: demographic ageing, long-term social care, sustainable financing*

*JEL codes: I13, I18, I19*

## 1 Introduction

Demographic changes has placed social care systems of all countries worldwide under increased pressure and raised concerns regarding the sustainability of current financing schemes. In the recent years, Slovakia also has come to recognize the need for LTSC as a crucial point and has been involved in the debate on how to finance social protection.
The Slovak Republic has one of the fastest ageing populations in the OECD. Table 1 shows an overview of the demographic development in Slovakia until 2060 (Ministry of Finance of the Slovak Republic, 2017). The population size will start falling from 2020 and the growth will be negative until the end of the projection period. Currently, the share of the elderly persons (65 and over) in the working-age population is one fifth. However, in 2060 the share of elderly persons in the working-age population will reach almost 60 %. Life expectancy in Slovakia will increase substantially. The old dependency ratio will increase by 38 % in the time period between 2016 and 2060; this change is

projected to be the second least favorable in the European Union. Based on this scenario Slovakia will change from the youngest country in the EU in 2016 to the 8th oldest by 2060.

**Table 1** Main demographic variables evolution

| | 2016 | 2020 | 2030 | 2040 | 2050 | 2060 |
|---|---|---|---|---|---|---|
| **Population (thousand)** | 5´431 | 5´462 | 5´461 | 5´368 | 5´255 | 5´105 |
| **Old age dependency ratio (pop65/pop15-64)** | 21,0 | 24,9 | 32,9 | 39,7 | 51,5 | 59,4 |
| **Ageing of the aged (pop80+/pop65+)** | 21,5 | 20,2 | 23,7 | 31,7 | 30,6 | 37,5 |
| **Men – Life expectancy at birth** | 73,7 | 74,6 | 76,8 | 78,9 | 80,8 | 82,6 |
| **Women – Life expectancy at birth** | 80,7 | 81,4 | 83,2 | 84,8 | 86,3 | 87,8 |

Source: Ministry of Finance of the Slovak Republic (2017) (Institute for Financial Policy)

For the future the relevance of LTSC will grow as the number of elderly citizens in Slovakia will increase dramatically, in absolute numbers but also in relation to people younger than 65 years (European Commission, 2017). This is the result of the baby boom generation approaching retirement, but also of falling mortality rates, resulting in an increase of life expectance. Steep population ageing will expose the pension system to strong fiscal pressures in the next few decades.

**Table 2** Long-term projection for age-related spending, % of GDP

| | Total age-related spending | | Gross public pension spending | | Health care spending | | Long-term care spending | |
|---|---|---|---|---|---|---|---|---|
| | **2016** | **2060** | **2016** | **2060** | **2016** | **2060** | **2016** | **2060** |
| **Czech Republic** | 18,2 | 25,2 | 8,2 | 11,6 | 5,4 | 6,6 | 1,3 | 2,8 |
| **Hungary** | 19,0 | 21,9 | 9,7 | 11,1 | 4,9 | 5,8 | 0,7 | 1,1 |
| **Poland** | 20,4 | 22,2 | 11,2 | 11,1 | 4,3 | 5,2 | 0,5 | 1,2 |
| **Slovenia** | 21,9 | 28,8 | 10,9 | 15,2 | 5,6 | 6,8 | 0,9 | 1,8 |
| **Slovakia** | **18,9** | **22,2** | **8,6** | **9,9** | **5,6** | **7,0** | **0,9** | **1,5** |
| **EU28** | 25,0 | 26,8 | 11,2 | 11,3 | 6,8 | 7,7 | 1,6 | 2,7 |

Source: European Commission (2017)

Long-term care (a range of services and assistance for people who, as a result of mental and/or physical frailty and/or disability over an extended period of time, depend on help with daily living activities and/or are in need of some permanent nursing care) spending expenditure in Slovakia is projected to increase from 0.9 % of GDP in 2016 to 1.5 % GDP in 2060 (Gerbery and Bednárik, 2018). An overall increase of 0.6 GDP p.p. over the projection horizon is smaller than in EU28. There is an important gap in providing long-term care of seniors, people with disabilities and people with chronic diseases because

the Slovak legislation does not define the term "long-term care" as a combination of social and health care (the provision of medical services and products by health professionals to patients, inside or outside healthcare facilities, to assess, maintain or restore their state of physical and mental health) services provided on a regular and long-term basis according to the specific needs.

These two systems of care are strictly divided: medical care (geriatric clinics, medical and nursing facilities for the long-term ill, nursing care homes, and nursing care agencies) is legally and also formally primary provided by the state and is under the auspices of The Ministry of Health of the Slovak Republic, social care (cash benefits, provision of social services including care of seniors, the people with disabilities and with chronic diseases) is partly provided by the state, regions municipalities, charity and private institutions and is under the auspices of The Ministry of Labour, Social Affairs and Family of the Slovak Republic. The health system is responsible for the care provided by health professionals, while services related to supporting the care-dependent person in the activities of daily life are organized by the social sector.

The Slovak social insurance system does not provide a long-term social care insurance that covers full costs. However, it is supplemented by other parts of public financing and foresees out-of-pocket (direct payments for healthcare goods and services from the household primary income or savings made by the user; this includes both direct payments without any reimbursements and cost-sharing with third-party payers) contributions of beneficiaries.

A social assessment of the beneficiary's personal situation is the basis for any intervention in the field of long-term social care in Slovakia. It determines their degree of dependence and thus the extent of the need for assistance. Access to benefits requires a grouping into one of six grades of need of long-term care on an individual assessment of the need of care. Slovakia's LTSC provides benefits for care at home and for care homes. For care at home, the LTSC scheme offers a wide range of benefits: cash benefits for informal care and benefits in kind for various nursing and personal assistance services. Informal care, i.e. care performed by informal and mostly unpaid carers (e.g. family members or friends), plays an important role in Slovakia, but is not examined in this paper.

Section 2 briefly describes the long-term social care system in Slovakia, section 3 discusses methodology used in this paper and the main sources of data. The main results and discussion is a part of section 4. Section 5 concludes.

## 2 Brief Description of the Long-Term Social Care System in Slovakia

Institutional settings and local and regional differences strongly affect effective access to LTSC services and benefits in Slovakia. The fragmentation of provisions between healthcare services and social services often leads to a lack of coordination between entities which affects waiting periods and administrative procedures. Homecare services and community-based LTSC (the range of non-residential care services) are the most difficult to access, since they are underdeveloped in many regions in Slovakia. Moreover, the sector is characterized by a low level of income, poor working conditions with high levels of strain, high workloads, insufficient training, lack of decent rest time and in some cases lack of support and autonomy and high psychosocial risks.

Long-term care in Slovakia consists of three forms: institutional care in nursing homes, formal care (i.e. services provided by licensed providers, either in the home or outside the home of the care dependent person; providers can be public, profit-seeking or not-for-profit organizations and the care professionals can be employees or self-employed) provided at home, and informal care at home.

Institutional care is offered by homes for seniors, social services homes and day care centers. Home care services are provided by professional workers who work for public or private providers. Informal care is provided by family members, who can claim the nursing allowance. Social services are provided mainly by self-governing local and

regional authorities and financed from local taxes, which are supplemented by recipient's payments. Cash benefits are paid either to the caregiver or the care recipient. They are funded from general taxation.

LTSC encourages care at home, nevertheless, the most frequent form of long-term social care in Slovakia is represented by residential social services, provided in external institutional settings (MacAdam, 2015). In 2018, there were 58´350 residential places in the social services facilities that were used for long-term care. A majority of clients were elderly people of pensionable age. Residential social services providing long-term social care include homes for seniors (494 facilities and 19´157 clients), homes for adults with multiple disabilities (282 facilities and 7´230 clients), specialized facilities (95 facilities, 5´150 clients), homes for people with mental and behavioral disorders (70 facilities, 3´850 clients), hoes for physically disabled adults (25 facilities, 595 clients). The system also includes day care centers, which are not intended to provide long-term care in the strict sense. Home care services for dependent persons are delivered by public and non-public actors. In 2016, home care services were provided by 5´590 municipal workers to 13´155 persons and by 173 private providers to 3´594 clients.

Expenditure on home care provided by municipalities was 35.3 mil. EUR in 2016, revenues from payments for home care services was 6.2 mil. EUR. The growing volume of revenues was caused by an increased number of service recipients, whose total payments of fees rose by 12 % (OECD, 2019). Despite this development, a huge gap between expenditures and revenues still exists and has to be covered from budgets of municipalities (Rentková, 2018). This persistent gap represents one of the big challenges for the sustainability of long-term social care services in Slovakia. Moreover, taking into account the variability in financial capacities between municipalities, it may contribute to regional differences in access to these services.

Fees for long-term social services are set by public providers (municipalities, self-governing regions) and non-public providers, taking into account eligible costs and revenues from financial subsidies that were provided in previous year. The Act on Social Services defines a minimum amount of income that must remain at a service recipient's disposal after deducting fees for services.

A social and health assessment of the applicant's personal situation is the basis for any intervention in the field of long-term care. It determines their degree of dependence and thus the extent of need for assistance. Provision of financial benefits relies on assessment of their income situation. Benefits in kind are related to the grade of care as follows (care grade II. to VI.): 96 EUR / 216 EUR / 288 EUR / 408 EUR / 504 EUR. In case of institutional care in nursing homes, beneficiaries may be less interested in the amount of benefits received, but rather in the amount of co-payments they need to pay out of pocket (Act No. 551/2010).

In Slovakia, there is a high incidence and expansion of informal care, mainly due to the lack of accessible formal LTSC facilities, the poor quality and the high cost of LTSC as well as the traditional model of intergenerational and familiar relations.

Despite cultural changes, new attitudes and relative progress in the distribution of caregiving tasks, women in Slovakia continue to take responsibility for and carry out the bulk of caregiving. Women are indeed more likely than men to assume care responsibilities for elderly family members with long-term needs: in Slovakia, women represent more as 80 % of the informal caregiving population. The low employment rate of older women, aged 54-64, may reflect the fact that women are more likely than men to assume care responsibilities for elderly or dependent family members with long-term care needs. The decreasing availability of intra-family care, the dwindling family size and the increased mobility of young couples, is creating a lively debate about "who" is to provide LTSC for elderly parents in Slovakia.

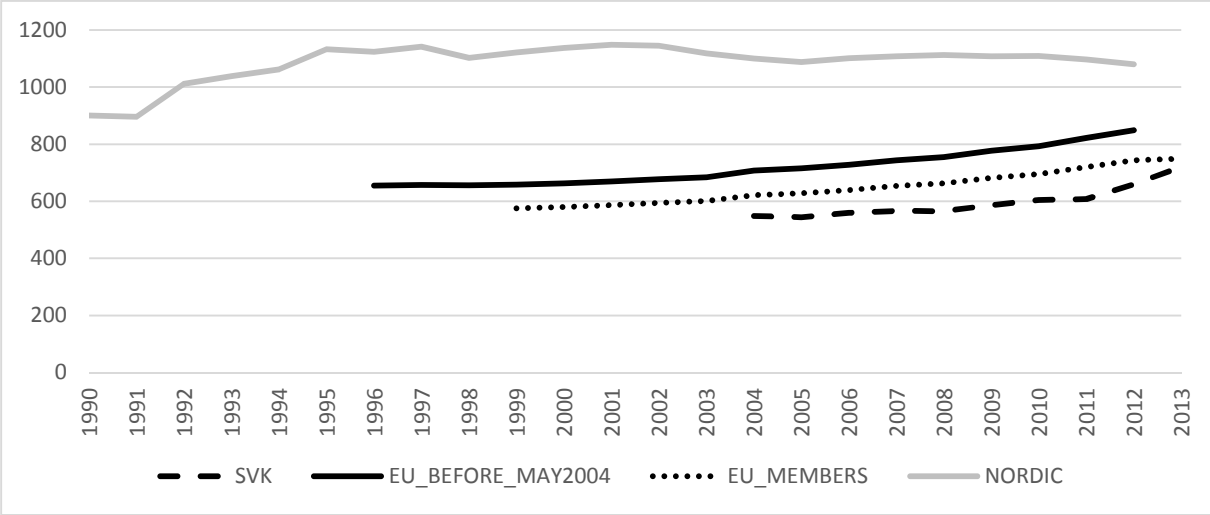
Persons (such as relatives, spouses, friends and others) who care for long-term dependent people can claim nursing allowance which is paid directly to caregivers in the form of a social transfer (Wilner, 2016). Nursing allowance is income-tested in relation to

the care recipient's income. In 2016, the average monthly number of nursing allowance recipients was 54´666, the average monthly sum of the allowance was 136.70 EUR. Amounts of the nursing allowance are quite low, exposing carers to vulnerable living conditions. Provision of long-term care may be combines with paid work, on condition that earnings from work do not exceed twice the subsistence minimum for an adult person. Severely disabled persons aged between 6 and 65 years who are dependent on personal assistance are entitled to personal assistance allowance. Dependence on personal assistance is defined according to a list of daily activities which require the assistance of other persons.

## 3 Methodology and Data

According to EUROSTAT data, 1.3 % of the population of Slovakia reported using home care services in 2014, compared with 4 % in the EU as a whole. Unfortunately, as there is no similar information on the use of other long-term care services, it is very difficult to estimate the size of the total population of service recipients. Information on the accessibility of long-term services is also insufficient. Although access to residential long-term care has been a subject of public discussion for a long time, systematic empirical evidence is still lacking. As figure 1 shows, the number of beds in nursing and residential long-term care facilities in Slovakia has grown over recent years (but the country still lags behind the European average and the Nordic countries).

**Figure 1** Beds in Nursing and Residential Care Facilities, per 100´000 Population




Source: World Health Organization (2019)

Some indices of limited accessibility can be obtained from statistics published by self-governing regions that relate to facilities under their auspices. Unfortunately, not all regions conduct this exercise. Collecting such data more systematically remains a big challenge both at regional and national level.

Indicators to measure access, adequacy and financial sustainability are available in most countries. However, the quality of LTSC is a multidimensional phenomenon which remains very difficult to grasp and data are often available only on an ad-hoc basis and often do not cover the quality of care (World Health Organization, 2019). LTSC is expensive and could strain the financial resources. In order to guarantee that everyone in need for care will receive appropriate care and also to limit expenses on social welfare, numerous European countries have reacted by creating new or modifying existing financing arrangements for long-term care, but the different approaches vary in accordance with national traditions and specific challenges.

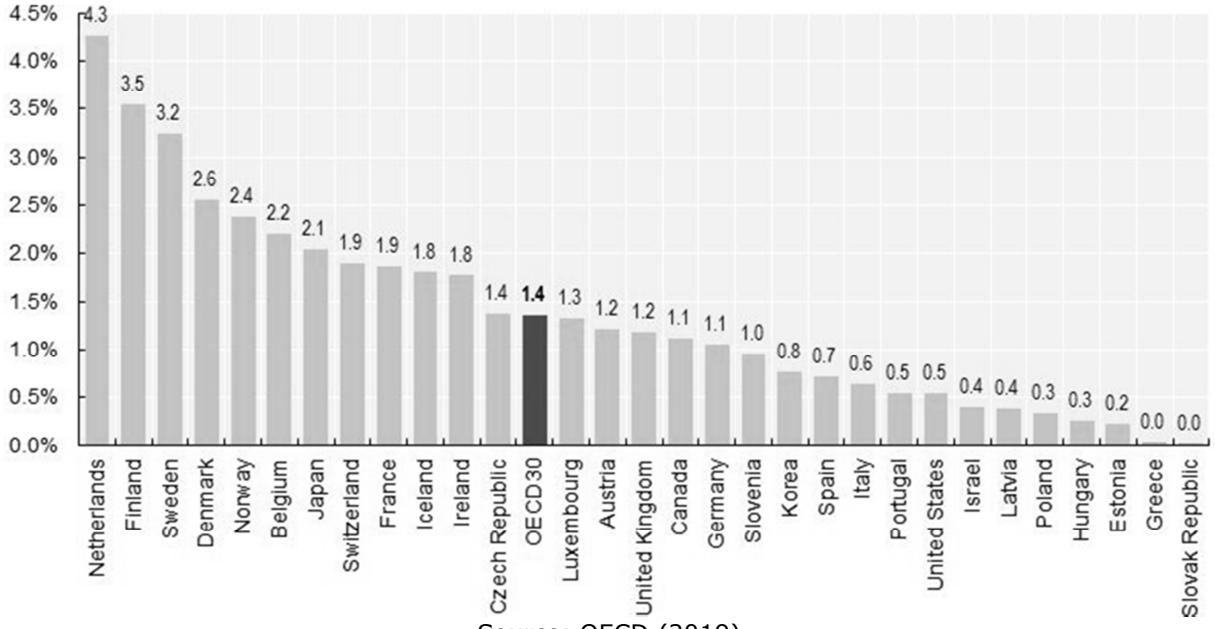
While liberal and social democratic (Nordic countries, for example) countries tend to integrate services into the existing system, conservative welfare states of Bismarckian type rather create a new scheme as in Austria, Germany, Luxembourg and Netherlands.

As Sweden has one of the highest spending from all EU countries, the Swedish government tries to contain expenditure by concentrating care on the most severe cases. Tax-financed benefits may also be given as cash allowances as the "Pflegegeld" in Austria demonstrates, which is not means-tested. In England, a dual system provides nursing benefits to some individuals in need of care by the "National Health Service" and some social care by local authorities. Germany provides benefits through the means-tested social welfare system, operated by local authorities. Home and community-based services are most developed in the Scandinavian countries and some continental countries (e.g. Austria, Germany, France, Belgium, the Netherlands). By contrast, those in need of LTSC in Southern (e.g. Spain, Portugal, Cyprus, Greece, Malta) and Eastern European countries (e.g. Slovakia, Czech Republic, Poland, Romania, Slovenia, Bulgaria, Baltic states) and the UK face insufficient availability of home care (care provided at the home of a person in need of care) provision or provision often targeted at persons with a high degree of dependency (European Commission, 2018).

One of the consequences of the priority given to home care and community-based provision has been that the availability of residential care (i.e. care provided in a residential setting for elderly people living in accommodation with permanent caring staff) has been decreasing in several European countries over the past 25 years (Rothgang and Engelke, 2009). Nordic countries indeed report a significant process of deinstitutionalization and emphasis on the development of home care. In Southern Europe, however, there is a clear trend towards increasing the number of LTSC beds for people aged over 65, due to changes in labour market structure (more women working), increase in the pensionable age and changes in the family structure (European Commission, 2014).

One of the major issues for any system now is to provide sufficient resources, but also to keep expenditure affordable for the national economy. Therefore it is useful, first, to identify the amount of resources spent on LTSC at the moment and, second, to get an idea about future developments. Starting with the former, one has a huge data problem. As there is no common definition of long-term care and respective long-term care expenditures, there are big differences between certain sources. Respective comparative figures for several EU countries are provided by EUROSTAT, the OECD and the European Commission. Unfortunately, these figures differ considerably. For Slovakia, European Commission calculates LTC spending of 0.9 % of GDP for 2016 (table 2), while OECD speaks of approximately 0.0 % for the same year (figure 2).

**Figure 2** Public Spending on Long-term Care in 2016 as a % of GDP




Source: OECD (2019)

Along with the diverse situations in EU countries, some additional factors make EU policy coordination challenging:

- The complexity of LTSC; the mix of health and social care, further complicated by the lack of sufficient coordination between the two; the mix of formal and informal care.
- Monitoring difficulties, due to the informal nature of most LTSC services, an absence of EU agreed outcome indicators and reasonably comparable data.

Demand for long-term care is expected to rise, thanks in part to ageing populations and increasing prevalence of long-term conditions such as dementia. However, the availability and affordability of long-term care services varies dramatically between OECD countries. Public spending on long-term care ranges from more than 4.3 % of GDP in the Netherlands to less than half a percent of GDP in countries such as Israel, Latvia, Poland, Hungary, Estonia, Greece, and Slovakia. This variation – a factor of ten and more – is much greater than for health spending. It reflects large differences in the balance between formal provision and informal care (informal care is provided by informal carers, such as relatives, spouses, friends and others, typically on an unpaid basis and in the home of care recipient) and the share of costs that people are expected to pay out of pocket. Understanding the impact of these differences is crucial to designing long-term care policies that give people the protection and support that they need.

## 4 Results and Discussion

The lack of financial sustainability in long-term social care in Slovakia is a fact recognized by all relevant stakeholders. In order to ensure greater financial stability, higher public subsidies are planned, based on a positive prognosis for economic development. From the year 2018 the state provides financial contributions to providers of social service facilities, which are intended to counter low wages in the sector. Furthermore, health and social long-term care are increasingly connected, through the increasing use of health insurance resources. Higher financial contributions from clients are seen as another way to stabilize the system.

The draft background document to the planned Act on long-term care and support for the integration of disabled persons sets out some contours for financing a new, integrated system of long-term care. It is proposed to establish integrated accounts of the financial resources devoted to long-term care in health insurance agencies. It should collect resources from the state budget and health insurance agencies in order to increase effectiveness facilitate control of their use.

LTSC is labour-intensive, relying heavily on informal care. However, in future, the demand for formal care in Slovakia is likely to further increase as a result of:

a) The reduced availability of informal carers (in most cases they are women) resulting from changing family patterns, notably the increase in the number of single households,
b) The growing participation of women in the labour market
c) Increased workforce mobility (there is quite a large category of carers who work in Austria, Germany and Switzerland in order to earn higher income)
d) Expected further increases in the retirement age.

The development of home care and semi-residential (semi-residential care is care provided in an institutional setting for care-dependent persons who do not permanently reside in the institution; it includes centers where the frail elderly can be cared for only during the day, or during the night) services should be a priority in Slovakia. This should be supported by appropriate funding for these types of provision in order to ensure their accessibility and affordability.

The development of home-based services should go hand in hand with strong prevention and rehabilitation policies, to ensure that people can continue to live for as long as possible in their own home if they so wish. Home care should be available to all persons with LTSC needs and not only to the most care-dependent elderly. Efforts to better

integrate health and social services are essential in ensuring adequate home care. The country should consider investing more in training of people who provide home care and community-based care in order to improve the quality of this type of care.

For future projections of the sustainability of LTSC in Slovakia several factors have to be considered, as the development of age-related dependency ratios, care arrangements and unit costs, but also the macro economic performance of the country. In the long-term, keeping the government budget of the Slovak Republic balanced must provide adequate buffers against future shocks and more fiscal room for manoeuvre, assuming that rising ageing-related costs are fully contained, for example through higher tax revenues or spending cuts. Expenditure on health and social care is projected to rise by around 3 % of GDP by 2060; without measures to offset these costs, the state debt-GDP ratio will increase above the debt ceiling (50 – 60 % of GDP in the long-term). Backtracking on the pension reform and capping the statutory pension age at 64 will increase the debt even further.

## 5 Conclusions

Public expenditure on long-term care is dependent on several factors that affect the demand and supply of these services. Main factors include the dependency status of the population, the model of LTC provision, i.e. organization and financing of the system, which shape the mix between formal, paid care and informal care, and availability of human resources. The rate of economic growth also plays a role, as does the progress in medical science and the development and use of new technologies.

Slovakia is confronted with financial sustainability challenge, linked to population ageing and increasing public spending for long-term social care. To be sustainable long-term social care system needs to be affordable, fair and flexible and there is a big need of a comprehensive approach to long-term social care system in Slovakia. Financial sustainability is hampered by the aforementioned horizontal fragmentation of care between health and social entities. The lack of a clear financial strategy by local or regional entities or a bias towards a certain type of care may also lead to unpredictable LTSC spending in Slovakia. In addition, the capacity of local budgets to pay for benefits – especially labour-intensive social services – is rather low. The residential facilities under the responsibility of the local authorities receive the lowest proportion of state subsidies (5.0 % in 2018).

A matter of fact is, that financial sustainability and LTSC adequacy are inextricably linked. If the system is financially unsustainable it can endanger the adequacy of LTSC provision, leading to underfinancing and spill-over effects for other social protection spending (e.g. hospitals). Vice-versa, if a system does not provide adequate care, this may jeopardies financial sustainability, the employment of both professional and informal carers and the quality of care. This may in turn result in serious reliance on state budget.

## References

Act No. 551/2010 amending the Act No. 448/2008 on social services and modifications of other relevant Acts and amending the Act No. 447/2008 on financial compensation of serious physical disablement and modification of other relevant Acts.

European Commission (2014). *Long-term care – the problem of sustainable financing.* Retrieved from https://ec.europa.eu/social/main.jsp?catId=1024&langId=en&newsId=2097&moreDocuments=yes&tableName=news.

European Commission (2017). *The 2018 Ageing Report*. Retrieved from: https://ec.europa.eu/info/sites/info/files/economy-finance/ip065_en.pdf.

European Commission (2018). *Challenges in long-term care in Europe: a study of national*
*policies 2018.* Retrieved from: https://ec.europa.eu/social/main.jsp?catId=738&langId=en&pubId=8128&furtherPubs=yye.

Gerbery, D., Bednárik, R. (2018). *ESPN Thematic Report on Challenges in long-term care:*
*Slovakia 2018*. Retrieved from: https://ec.europa.eu/social/BlobServlet?docId=19867&langId=en.

Ministry of Finance of the Slovak Republic (2017). *Country fiche on 2018 pension projections of the Slovak republic.* Retrieved from: https://ec.europa.eu/info/sites/info/files/economy-finance/final_country_fiche_sk.pdf.

OECD (2019). *Economic Surveys: Slovak Republic 2019*. Retrieved from: http://www.oecd.org/economy/surveys/Slovak-Republic-2019-OECD-economic-survey-overview.pdf.

MacAdam, M. (2015). Program of Research to Integrate the Services for the Maintenance of Autonomy: A system-level integration model in Quebec. *International Journal of Integrated Care*, vol. 15(6), pp. 1-14.

Rentková, K. (2018). Regional innovation strategies applied in Slovak Republic. In: *Proceedings of the ENTRENOVA*. Zagreb: University of Zagreb, pp. 320 – 326.

Rothgang, H., Engelke, K. (2009). *Long-term care: How to organise affordable, sustainable long-term care given the constraints of collective versus individual arrangements and responsibilities*.Retrieved from: https://ec.europa.eu/social/BlobServlet?docId=8465&langId=en.

Wilner, L. (2016). Worker-firm matching and the parenthood pay gap: Evidence from linked employer-employee data. *Journal of Population Economics*, vol. 29(4), pp. 1–33.

World Health Organization (2019). *Beds in nursing and residential care facilities, per 100 000*. Retrieved from: https://gateway.euro.who.int/en/indicators/hlthres_23-beds-in-nursing-and-residential-care-facilities-per-100-000/visualizations/#id=27682&tab=graph

# Does the Linkage between Agricultural Business Insurance and Use of Debt Exist? Empirical Evidence from Polish Farm Businesses

**Michał Soliwoda[1], Agnieszka Kurdyś-Kujawska[2]**

[1] Institute of Agricultural and Food Economics – NRI
Department of Agricultural Finance
Świętokrzyska 20, 00-002 Warsaw, POLAND
E-mail: michal.soliwoda@ierigz.waw.pl

[2] Koszalin University of Technology
Faculty of Economics, Department of Finance
Kwiatkowskiego 6e, 75-343 Koszalin, POLAND
E-mail: agnieszka.kurdys-kujawska@tu.koszalin.pl

***Abstract:*** *The objective of this paper is to investigate into the linkage between participation in agricultural business (crop/livestock) insurance programs and debt ratios (mainly debt-to-assets and debt-to-equity ratio). Our methodological approach was based on previous empirical studies on the role of determinants of purchase of agricultural insurance. We used a farm-level data from Farm Accountancy Data Network (FADN) for 2009-2015 (after significant changes in Polish law on agricultural insurance). We performed a Mann-Whitney U test between insured and non-insured farm businesses. Additionally, we used chi-squared test for data in contingency tables in order to indicate dependencies between agricultural insurance participation and use of liabilities, long-term and short-term credits and loans. Our findings were mostly consistent with previous studies. Farm business that use crop/livestock insurance (about 20% in FADN sample) were characterized by higher debt ratios (Debt-to-Assets, Debt-to-Equity) and the share of long-term liabilities in total liabilities. Our findings may be useful insurers and financial institution that offer various credits for rural inhabitants. The use of crop/livestock insurance is important variable from the perspective of credit scoring. Further research will refer to dynamic processes, including credit risk migration of farmers and credit signaling in agriculture. Particular attention should be paid in two types of farms: "field crops" and "mixed" that are sensitive to risk related to crop production.*

*Keywords: agricultural insurance, credit, farm households*

*JEL codes: Q14, Q18*

## 1 Introduction

A vast literature deals with determinants of demand on crop insurance, in particular in the U.S and Canada – countries that have provided complex subsidised systems of agricultural insurance (Atwood et al., 1996, Sherrick et al., 2015). Debt ratio may increase the level of risk aversion of farmers (Sulewski and Kłoczko-Gajewska, 2014). Ifft et al. (2015) found that crop insurance programme participation (the U.S.) lead to an increase in use of short term farm debt, but not long term debt that was consistent with risk balancing behavior and current trends in the farm sector. In Central and Eastern Europe countries (CEECs) there is a limited number of empirical research on the relationship between agricultural insurance protection and financial risk. This article sheds some light on a link between use of crop/livestock insurance and the financial risk of agricultural holdings.

The objective of this paper is to investigate into the linkage between participation in crop/livestock insurance programs and debt ratios (mainly debt-to-assets and debt-to-equity ratio). We formulate the following hypothesis: there is a statistically significant relationship between purchase of crop/livestock insurance and use of debt and the level of financial leverage in agricultural holdings

The remainder of this paper is following. The next section reviews a current literature on a nexus between farm credit and agricultural insurance. Then we describe data and

methodology for an empirical part. The next section describes and discusses results. Our paper concludes with remarks and recommendations, identifying avenues for the future research.

## 2 Literature review on the nexus between agricultural credit and crop/livestock insurance

Crop/livestock insurance is regarded as one of the tools for risk management in agricultural holdings. Use of crop/livestock insurance reduces the uncertainty of running a business and stabilizes family farm incomes, while affecting the growth and allocation of financial and material assets of farmers. In particular, participation in agricultural insurance programme has an impact on many aspects of farm management, including financial decisions, because it affects the total income of farms and the variability of farm incomes (Ifft and Jodlowski, 2017). Financial decisions are key decisions that are made by the owners of farms with regard to the structure of sources of financing agricultural activities. These decisions concern lending and allocation of funds required to undertake both, current and long-term investment activities. Financing business operations with debt and maintaining the level of cash flows appropriate for repayment of debt, as well as meeting other financial liabilities, is associated with the occurrence of financial risk (Drollette, 2009).

Research carried out by Ifft et al. (2013) shows that there is a strong relationship between the possession of crop insurance and debt. This relationship may result from the reduction of financial risk or its increase in response to the lower business risk provided by crop insurance. This coincides with the concept of risk balancing developed by Gabriel and Baker (1980) and current trends in the agricultural sector. The risk-balancing concept assumes that exogenous reduction of business risk on the farm would cause the farm to take more financial risks. At the same time, as shown by the results of the research carried out by de Mey et al. (2014) in EU countries, whether this assumption will be rejected or not depends on the agricultural production sector and the country in which agricultural activity is conducted.

The possibility to limit the effects of the business risk occurring in the agricultural business activity may positively affect not only the demand but also the supply of credits /loans. However, the increase in demand for and supply on loans may be accompanied by an increase in financial risk. According to Woodar and Marlow (2017), the demand for a loan among farmers is determined by a number of factors, including the possession of crop insurance. Hazell (1992) represents the view that if farmers are sure that in case of a much lower income, for reasons beyond their control, they receive compensation, they can make the maximum allocation of resources, including financial resources. Purchase of agricultural insurance can also be important from the point of view of the loan grantor, because it guarantees income, which affects the farmer's ability to pay its debts. Insurance results in a lower likelihood of a farmer's insolvency (Woodard and Marlow, 2017). The creditworthiness of farmers is increasing and the bank is more willing to lend. This is evidenced by the research carried out by Mishra (1994), who indicates that the introduction of a comprehensive crop insurance system in India resulted in an increase in loan flows for insured farmers. The scope of extended loans increased, the number of borrowers rose and the amount of loans granted enhanced. There was also a significant increase in loan repayments.

## 3 Methodology and Data

The study used farm data that was available in the Polish Farm Accountancy Data Network (FADN). The subject of the research consists of individual farms conducting continuous agricultural accounting under the Polish FADN (Legal basis: Act of 29 November 2000 on collection and use of accounting data of agricultural holdings…,) in the years 2009-2015, which having crop insurance and at the same time are indebtedness.

Farm-level data collected in the database of the Polish FADN is varied, among others, in terms of production, area, as well as economic size. Each farm surveyed by FADN is assigned to a certain type of farming and economic size class. In order to determine the economic situation of the examined farms, as well as the impact of subsidies on their financial effectiveness, the analysed group was divided according to types of farming (classification according to TF8 typology) and according to the economic size classes (ES6 classification).

We presented basic descriptive statistics for our research sample (for two subsamples: *NonIns* – without crop/livestock insurance premium; Ins – using insurance protection). We used the non-parametric Mann-Whitney *U* test in order to assess a statistical significance of difference between indebtedness situation between two subsamples: . The aforesaid statistical test verifies the hypothesis of significant differences between distributions of traits in two independent populations (Moczko, 2014; Mann and Whitney, 1947). We also used Chi-Square test (additionally, Fisher's exact value) for analysis two-way tables (crop/livestock insurance premium; credit/ long-term credit/short-term credit as dummy variables). We used following set of financial indicator that relate to indebtedness: (1) debt-to-assets (DtA) – total debt/total assets [%];(2) debt-to-equity (DtE) – total debt/total assets [%]; (3) the share of long-term credit and loans in total liabilities (LongCred/TotCred).

## 4 Results and Discussion

As presented in table 1, the number of agricultural crop insurance contracts was stable in the period 2009-2018 and decreased by only 3%. However, the insured sum insurance sum doubled in 2009-2015 and amounted to about 13 billion PLN. Logically, an increase of the amount of premiums and subsidies to premium indicated that a very expansive policy of intervention in the field of subsidizing insurance premiums was maintained in the analyzed period. When we compare the change in the number of insurance contracts and the amount of insurance sum, it can be concluded that the demand side of the insurance market was characterized by a significant degree of concentration. Farms that bought crop/livestock insurance policies were characterized by a better production, economic and financial situation.

**Table 1** Subsidied crop insurance – the situation of Polish agriculture

| Specification | 2009 | 2012 | 2015 | 2015/2009 |
|---|---|---|---|---|
| **Number of agricultural crop insurance contracts** | 144 080 | 135 707 | 139 108 | 0,97 |
| **Sum insured in thous. PLN** | 6 493 338 | 12 087 100 | 13 695 068 | 2,11 |
| **The amount of premiums due to insurance companies in thous. PLN** | 175 517 | 354 932 | 374 597 | 2,13 |
| **Incl. amount of subsidies for premiums in thous. PLN** | 79 620 | 158 831 | 173 033 | 2,17 |
| **Area of insured crops in hectares** | 2 808 104 | 2 751 439 | 2 823 606 | 1,01 |
| **including:** | | | | |
| **cereals** | 1 676 589 | 1 595 930 | 1 568 261 | 0,94 |
| **rape** | 885 854 | 754 876 | 787 808 | 0,89 |
| **corn** | 110 342 | 249 563 | 299 853 | 2,72 |
| **fruit trees and shrubs** | 8 968 | 4 029 | 13 040 | 1,45 |

Source: based on data of Polish Ministry of Agriculture and Rural Development.

Table 2 presents a short description of the research sample of farms (operated byfarm operators as natural persons) that participate the FADN system. It should be noted that FADN database includes entities oriented to commodity production, whose size exceeds economic strength (Economic Size, ES) of the equivalent of EUR 2 000. It should be noted that the number of farms was not constant, which resulted from the resignation of

some entities from participation in the FADN system. The share of farms with crop/livestock policies in the sample did not exceed 22% during the period. In 2015, only 19.5% of farmers purchased the insurance policy. The highest (i.e. PLN 99.9 thousand) average income from a family farm was generated in 2012, while the lowest (PLN 61.7 thousand). in the analyzed period. High volatility of agricultural incomes results from significant fluctuations in prices (including: price changes of the purchase basket of agricultural products and the cumulative index of price scissors) and yields in Poland.

**Table 2** Description of economic situation of the sample (according to purchase of crop/livestock insurance)

| Year | The number of sample | NonIns | Ins | Share of farms with premiums for crop /livestock insurance [%] | Average net family farm income [PLN] |
|---|---|---|---|---|---|
| 2009 | 12 258 | 9782 | 2476 | 20,20% | 61 709,37 |
| 2010 | 11 004 | 8619 | 2385 | 21,70% | 84 284,26 |
| 2011 | 10 890 | 8514 | 2376 | 21,80% | 93 183,23 |
| 2012 | 10 909 | 8522 | 2387 | 21,90% | 99 936,02 |
| 2013 | 12 117 | 9479 | 2638 | 21,80% | 89 809,81 |
| 2014 | 12 123 | 9489 | 2634 | 21,70% | 80 285,14 |
| 2015 | 12 105 | 9749 | 2356 | 19,50% | 72 522,50 |

Note: Ins – farms with crop/livestock insurance, NonIns – entities without insurance protection;
Source: own computation based on FADN data.

Tables 3 and 4 present key descriptive statistics for two subsamples (*NonIns* and *Ins*) for the period 2009-2015. The large difference between maximum and minimum indicated a significant large empirical distribution of the sample. Both higher values of means and median of debt-to-assets and debt-to equity ratio for farms with insurance protection indicate that farm households that used crop/livestock insurance (bought insurance policies) were described by higher indebtedness. Furthermore, the share of long-term credits and loans for the group of farms *Ins* in total liabilities was slightly higher: means and median were about 63% and 75%. Table 4 describes a detailed situation in selected years of the research period.

**Table 3** Indebtedness of farms – a general description for the period 2009-2015

| | DtA | DtE | LongCred/TotCred |
|---|---|---|---|
| | | **NonIns** | |
| **Mean** | 4,8% | 8,7% | 60,2% |
| **Median** | 0,0% | 0,0% | 73,3% |
| **Min** | 0,0% | -15649,8% | 0,0% |
| **Max** | 151,0% | 60947,0% | 100,0% |
| **SD** | 8,7% | 356,5% | 31,9% |
| | | **Ins** | |
| **Mean** | 7,3% | 9,6% | 62,9% |
| **Median** | 3,6% | 3,7% | 75,0% |
| **Min** | 0,0% | -1973,0% | 0,0% |
| **Max** | 105,3% | 1456,1% | 100,0% |
| **SD** | 9,9% | 26,5% | 30,3% |
| | | **Total** | |
| **Mean** | 5,4% | 8,9% | 61,0% |
| **Median** | 0,9% | 0,9% | 73,8% |
| **Min** | 0,0% | -15649,8% | 0,0% |
| **Max** | 151,0% | 60947,0% | 100,0% |
| **SD** | 9,0% | 316,7% | 31,5% |

Source: own computation based on FADN data.

**Table 4** Indebtedness situation of farms – a detailed description

| | N | Mean | SD | Min | Max |
|---|---|---|---|---|---|
| **2009** | | | | | |
| **NonIns** | | | | | |
| **DtA** | 9 782 | 5,3% | 9,0% | 0,0% | 99,8% |
| **DtE** | 9 782 | 12,2% | 497,3% | 0,0% | 49160,1% |
| **LongCred/ TotCred** | 5 599 | 57,6% | 33,1% | 0,0% | 100,0% |
| **Ins** | | | | | |
| **DtA** | 2 476 | 6,9% | 9,1% | 0,0% | 85,5% |
| **DtE** | 2 476 | 9,0% | 18,7% | 0,0% | 587,7% |
| **LongCred/ TotCred** | 1 775 | 60,5% | 30,7% | 0,0% | 100,0% |
| **2013** | | | | | |
| **NonIns** | | | | | |
| **DtA** | 9 479 | 4,8% | 8,9% | 0,0% | 100,6% |
| **DtE** | 9 479 | 5,1% | 163,3% | -15649,8% | 1837,4% |
| **LongCred/ TotCred** | 4 477 | 61,9% | 31,3% | 0,0% | 100,0% |
| **Ins** | | | | | |
| **DtA** | 2 638 | 7,5% | 10,2% | 0,0% | 70,2% |
| **DtE** | 2 638 | 10,1% | 18,4% | 0,0% | 235,1% |
| **LongCred/ TotCred** | 1 794 | 65,0% | 30,1% | 0,0% | 100,0% |
| **2015** | | | | | |
| **NonIns** | | | | | |
| **DtA** | 9 749 | 4,6% | 8,9% | 0,0% | 151,0% |
| **DtE** | 9 749 | 6,2% | 18,2% | -296,0% | 570,5% |
| **LongCred/ TotCred** | 4 308 | 61,7% | 31,0% | 0,0% | 100,0% |
| **Ins** | | | | | |
| **DtA** | 2 356 | 7,9% | 11,0% | 0,0% | 105,3% |
| **DtE** | 2 356 | 9,9% | 45,6% | -1973,0% | 340,8% |
| **LongCred/ TotCred** | 1 579 | 64,3% | 29,5% | 0,0% | 100,0% |

Source: own computation based on FADN data.

Table 5 presents results of Mann-Whitney U test (i.e. computed p-value) for the selected financial variables. As the computed p-value was lower than the significance level, one should reject the null hypothesis that the difference of financial indicators related to debt between farms with agricultural insurance policies and without them is equal to 0. Bold values denote statistical significance at the $p < 0.05$ level. Only difference between the share of long-term credit in total liabilities was statistically insignificant. This may explained by the fact that the share of long-term credit is correlated with investment activity of farm household. The rest of empirical results confirm the stated hypothesis. Our results are consistent with empirical findings from the U.S. and Western Countries. Access to risk reduction programs, such as crop/livestock insurance or income insurance can encourage farmers to use leverage and prudently use their debts. Thus, participation in crop (to a lesser extent, livestock) insurance can play a key role in overcoming financial constraints in the agricultural sector. According to a survey conducted by Cai (2013), insured farmers have an average of 25% more debt than farmers who do not participate in the crop insurance program. A similar view is presented by Du (2017). The author argues that farmers who have been selected for a compulsory insurance program are 20% more likely to be indebted than those who are not insured.Furthermore, insured farmers are more likely to become more indebted. However, as noted by Ifft et al.

(2015) the participation of farmers in the crop insurance program (in the USA) leads to an increase in the use of short-term debt rather than long-term debt.

**Table 5** Differences between debt ratios of insured and noninsured farms - results of Mann-Whitney U test

| Year | DtA | DtE | LongCred/TotCred |
|---|---|---|---|
| **2009** | **0,0000** | **0,0000** | 0,0236 |
| **2010** | **0,0000** | **0,0000** | 0,4434 |
| **2011** | **0,0000** | **0,0000** | 0,1643 |
| **2012** | **0,0000** | **0,0000** | **0,0001** |
| **2013** | **0,0000** | **0,0000** | **0,0000** |
| **2014** | **0,0000** | **0,0000** | **0,0011** |
| **2015** | **0,0000** | **0,0000** | **0,0039** |
| **2009-2015** | **0,0000** | **0,0000** | **0,0000** |

Note: Bold values denote statistical significance at the $p < 0.05$ level.
Source: own computation based on FADN data.

A detailed empirical analysis contingency (two-way) tables with Chi-Square test (for dummy variables: purchase of crop/livestock insurance; credit/long-term credit/short-term credit as dummy variables) indicated a statistically significant associations between the aforesaid variables (p-value < 0.0001).

## 5 Conclusions

Purchase of crop/livestock insurance may be regarded a factor that determine determining farmers' financial decisions, at the same time increasing the financial risk of agricultural holdings. A vast number of studies indicate that there is a relationship between agricultural insurance and the level of indebtedness of the farm. Farmers may rely on compensation for losses, make more risky decisions related to the use of foreign capital in financing business activities. From the perspective of the bank,– having crop insurance increases the creditworthiness of farmers. Thus, access to credit for farmers with crop insurance can be significantly higher than in the case of uninsured farms. In addition, not only the supply, but also the size of extended loans may increase. It should therefore be noted that crop insurance can be an important factor in overcoming limitations of farmers in accessing bank credits.

Our empirical results indicated that insured farms were more indebted than entities without insurance protection. Only difference between the share of long-term credit in total liabilities was statistically insignificant. Our previous findings related to comparative analysis of insured and non-insured farms indicated that Insured farms were usually described by larger utilized arable areas (UAAs), additionally, the total value of their total assets is higher. Their financial situation is much better compared to households without insurance (see: Soliwoda, 2017, pp. 70-74). Therefore, crop/livestock insurance should not be regarded as only a risk management tool. This can also contribute to reducing the equity gap in agriculture.

Our findings may be useful insurers and financial institution that offer various credits for rural inhabitants. The use of crop/livestock insurance is important variable from the perspective of credit scoring. Our future research will be oriented to the supply side of agricultural credit: crop/livestock insurance policy may be treated as one of factors that can improve the creditworthiness of farm households. Further research will refer to dynamic processes, including credit risk migration of farmers and credit signaling in agriculture. Particular attention should be paid to two types of farms: "field crops" and "mixed" that are sensitive to risk related to crop production. Variables that refer to farm size (area, total assets, turnover), income and its variability should be included in addition to the typical debt ratios in our more in-depth studies.

## Acknowledgments

Our research was financed under the project "Business insurance in holistic risk management in agriculture oriented towards sustainability, implementation of innovations and technologies and climate change mitigation" (acronyme: UBROL) of the National Center for Research and Development (NCBR) – Strategic Programme GOSPOSTRATEG (Agreement No. Gospostrateg1/390422/25/NCBR/2019 of 13/03/2019).

## References

Atwood, J. A., Watts, M. J., Baquet, A. E. (1996). An Examination of the Effects of Price Supports and Federal Crop Insurance Upon the Economic Growth, Capital Structure, and Financial Survival of Wheat Growers in the Northern High Plains. *American Journal of Agricultural Economics*, vol. 78(1), pp. 212–224.

Cai, J. (2013). The impact of insurance provision on households' production and financial decisions. *Technical report*, University Library of Munich, Germany.

Carriker, G. L., Williams, J. R., Barnaby, G. A., Black, J. R. (1991). Yield and Income Risk Reduction Under Alternative Crop Insurance and Disaster Designs. *Western Journal of Agricultural Economics*, vol. 16, pp. 238-250.

de Mey, Y., Van Winsen, F., Wauters, E., Vancauteren, M., Lauwers, L., Van Passel, S. (2014). Farm-level evidence on risk balancing behavior in the eu-15. *Agricultural Finance Review*, vol. 74 (1), pp. 17-37.

Drollette, S. A. (2009). *Managing Financial Risk in Agriculture*. Utah State University, Deprtment of Applied Economics.

Du, X. (2017). *Essays on the Economics of Crop and Livestock Insurance.* UC Berkeley.

Enjolras, G., Sentis, P. (2011), Crop insurance policies and purchases in France. *Agricultural Economics*, vol. 42, pp. 475–486.

Gabriel, S. C., Baker, C. B. (1980). Concepts of business and financial risk. *American Journal of Agricultural Economics*, vol. 62 (3), pp. 560-564.

Hazell, P. B. R. (1992). The appropriate role of agricultural insurance in developing countries. *Journal of International Development*, vol. 4(6), pp. 567-581.

Ifft J. E., Kuethe T., Morehart M., (2015), Does federal crop insurance lead to higher farm debt use? Evidence from the Agricultural Resource Management Survey (ARMS). *Agricultural Finance Review,* vol. 75(3), pp. 349-367.

Ifft, J., Jodlowski M. (2017). Federal crop insurance and agricultural credit use. In: *Agricultural & Applied Economics Association Annual Meeting 2017*, Chicago, Illinois, July 30-August 1.

Ifft, J., Kuethe, T., Morehart, M. (2013). Farm debt use by farms with crop insurance. *Choices*, vol. 28(3).

Ifft, J., Kuethe, T., Morehart, M. (2015). Does federal crop insurance lead to higher farm debt use? Evidence from the agricultural resource management survey. *Agricultural Finance Review*, vol. 75(3), pp. 349-367.

Liang, L. (2014). Federal crop insurance and credit constraints: Theory and evidence. *Technical report, No 169825, 2014 Annual Meeting*. Minneapolis, Minnesota from Agricultural and Applied Economics Association.

Mann, H., Whitney, D. (1947). On a test of whether one of two random variables is stochastically larger than the other. *Annals of Mathematical Statistics*, vol. 18.

Mishra, P. K. (1994). Crop insurance and crop credit: Impact of the comprehensive crop insurance scheme on cooperative credit in Gujarat. *Journal of International Development*, vol. 6(5), pp. 529-567.

Moczko, J. A. (2014). Czy zawsze prawidłowo interpretujemy wyniki statystycznych testów nieparametrycznych? *Przegląd Lekarski*, vol. 71(11), pp. 654–658.

Sherrick, B. J., Barry, P. J., Ellinger, P. N., Schnitkey, G. D. (2004), Factors Influencing Farmers' Crop Insurance Decisions. *American Journal of Agricultural Economics*, vol. 86 (1), pp. 103-114.

Soliwoda, M. (2017). Income and financial situation of farms using crop and livestock insurance. In: Pawłowska-Tyszko, J. ed., *Assessment of the functioning of crop and livestock insurance in Polish agriculture*. Monographs of Multiannual Programme, No. 60.1. Warsaw: IAFR-NRI, pp. 70-74.

Sulewski, P., Kłoczko-Gajewska, A. (2014). Farmers' risk perception, risk aversion and strategies to cope with production risk: an empirical study from Poland. *Studies in Agricultural Economics,* vol. 116, pp. 140-147.

Turvey, C. G., Kong, R. (2009). Business and financial risks of small farm households in China. *China Agricultural Economic Review*, vol. 1(2), pp.155-172.

van Asseldonk, M. A. P. M., Burger, C. P. J., d'Hotel, E. M., Muller, B., Le Cotty, T., Meijerink, G. W. (2013). Linking Crop Insurance and Rural Credit. *LEI WUR/FaRMAf' Project Report Farm Risk Management for Africa Research Report.* Wageningen, Netherlands: Wageningen University.

Williams, J. R., Carriker, G. L., Barnaby, A., Harper, J. (1993). Crop Insurance and Disaster Assistance Designs for Wheat and Grain Sorghum. *American Journal of Agricultural Economics,* vol.75, pp. 435-47.

Woodard J. D., Marlow, S. (2017). *Crop Insurance, Credit, and Conservation*. AGree Transforming Food & Ag Policy.

# Factors of Professional Qualification Test Results of Selected Non-Bank Consumer Credit Providers Employees

**[1]Ivan Soukal, [2]Eva Hamplová**

[1]University of Hradec Králové
Faculty of Informatics and Management, Department of Economics
Rokitanského 62, 500 03, Hradec Králové, Czech Republic
E-mail: ivan.soukal@uhk.cz

[2]University of Hradec Králové
Faculty of Informatics and Management, Department of Economics
Rokitanského 62, 500 03, Hradec Králové, Czech Republic
E-mail: eva.hamplova@uhk.cz

***Abstract:*** *Non-bank financial institutions providing or intermediating consumer credit were throughout a year of 2018 ensuring the qualification of their employee to meet requirements of a recent regulation. Czech National Bank stipulated decree no. 381/2016 and decree no. 384/2016 to implement legal act no. 257/2016 Coll., on consumer credit. This regulation came into force recently and therefore, a professional qualification level of all employees involved in the provision and intermediation of a consumer credit now has to be proven. Qualification could be proven at accredited institutions only by passing an exam test. We analyzed the test results of 1.916 employees of two medium sized non-bank financial institutions who took the final qualification test at an accredited institution. We set main and auxiliary hypotheses regarding an effect of gender, age, and time. Gender was not found as a factor of performance in the qualification testing. Age was found as a factor of the test score. The youngest and the oldest employees performed statistically worse than employees between age of 30–59. The last tested variable of time was found as a factor. Performance of employees who took the test in the first quartile was both statistically as well as from practitioner's point of view significantly better.*

*Keywords: consumer credit, qualification test, non-bank financial institution, gender, age, time*

*JEL codes: G23, G28*

## 1 Introduction

Act No. 257/2016 Coll., on Consumer Credit introduced a new regulation focused on strengthening the position of the consumers and protection of their rights, as well as unifying regulatory framework in the EU. The part related to tied consumer credit, consumer credit for purposes other than housing stated an obligatory duty to disclaim qualification of all persons participating in the process of the provision and intermediation of a consumer credit. Otherwise, provider won't obtain the authorization to pursue the business of a non-bank consumer credit provider or the authorization to pursue the business of an independent intermediary from the Czech National Bank (thereinafter as CNB). CNB is the only granting authority regarding an authorization for such business. The license of the non-banking consumer loans provider is granted for five years period (until the end of the year which follows five years period) and can be repeatedly extended for another 60 months. Qualification can be proved only by passing a qualification test organized by an accredited examiner (Decree No. 381/2016 Coll.). The Act No. 257/2016 Coll. has been in effect since 1 December 2016. Since then there was twenty-four months period during which the qualification had to be proven, i.e. by 1 December 2018. This regulation was a part of the greater picture. CNB was unifying the regulation framework and so on consumer credit for non-housing purposes market was adopted the same scheme as for housing loans. The latter market regulation was due to an EU directive transposition reflecting low interest rates, which occurred on the mortgage Czech market as well (Hedvicakova and Svobodova, 2016) and the market bubble.

The study's aim is to analyze the results of such testing by accredited professional examiner in order to assess whether gender and age are factors of employees' performance. Accredited professional examiner wished to remain anonymous and we are as well bound to respect an anonymity of providers that used his services. The accredited professional examiner provided qualification testing to non-bank financial institutions during the whole year of 2018.

## 2 Sample and Methodology

The test sample was consisted of 1.916 records of individual test performance records. All exam takers were employees of non-bank financial institutions. We analyzed the final test only; study or training test results were beyond the scope of the study. Analyzed results were gathered from the qualification test for provision and intermediation of a consumer credit for other purpose than housing, see (Article 3(1)(i) of Act No. 257/2016 Coll., on Consumer Credit). The qualification tests were taken from January till December 2018. Every test:

- contained sixty test questions and two case studies,
- multiple question types:
  - 75 % one correct answer,
  - 25% multiple correct answers,
- had to be finished in 120 minutes or sooner,
- was successful if the test score was 72 points of max. 95 points at least and at the same time the criteria of point score in particular parts were applied as well, see (Article 12 of Decree No. 384/2016 Coll.)

All statistics were performed in IBM SPSS 25, charts were constructed in IBM SPSS 25 and MS Excel 365.

T-test for independent samples is a suitable tool for means comparison of a dependent variable between two samples or to be more specific to discover whether there are statistically significant differences between the means of two samples, using parametric data drawn from random samples with a normal distribution (Best and Kahn, 2006; Cohen et al., 2007; Hair, 2014; Ho, 2014; Meloun and Militký, 2012). The t-test variant which was employed assumed that the two samples are unrelated to each other. T-test are commonly employed in education and test focused studies e.g. (Ballantine et al., 2008; Fogarty and Black, 2014; Huang and Liu, 2009) and others. The hypothesis states that there is no statistically significant difference between the means of two samples. We tested one hypothesis:

- H1: There is no difference in the test score of male and female employees.

This widely used test is suitable for gender and age effect on other variables. It was employed e.g. by (Sulaiman, 2012) who tested the relationship between financial risk tolerance and each of the demographic features including gender and age. (Pahl, 2008) tested an independence of gender and credit usage and also employment categories. (Aesaert and van Braak, 2015) used chi-square test of independence to identify gender as a factor of measured competence.

ANOVA or One-way analysis of variance is an effective way to determine whether the means of more than two samples are too different to attribute to sampling error. In other words, if there is no statistically significant difference between samples' means. The ANOVA consists of these phases: within-groups variance calculation, between-groups variance calculation, F-ratio calculation by between-groups and within-groups variance fraction and F-ratio assessment (Cohen et al., 2007; Hair, 2014; Meloun and Militký, 2012). (Aesaert and van Braak, 2015) investigated gender influence on the total test scores using a t-test and a one-way between-groups ANOVA. We tested a hypothesis:

- H2: The test score means in age groups are the same.

Bonferroni all-pair-wise multiple comparison test is a part of a post-hoc analysis in ANOVA or MANOVA. Its purpose is to isolate where the differences among samples are. It replaces a series of t-tests which might be eventually misleading due to an inability to

reflect a total number of samples. Therefore, e.g. (Smalheiser, 2017) or (Cohen et al., 2007) recommends employing Bonferroni all-pair-wise multiple comparison test or other similar tool such as Turkey HSD test. Bonferroni test calculation multiplies each of the significance levels from the least square difference t-test (in SPSS as LSD) by the number of tests performed. The post-hoc analysis presents results of hypotheses for each sample stating that the means in two samples are the same.

- H2Bon: The test score means in each pair of age groups are the same.

Due to an assumption that the sets of scores have approximately equal variances, we performed a Levene's test for equality of variances, see e.g. (Cohen et al., 2007; Hair, 2014). Although we possessed not just means, but the whole samples where variance can be calculated on, SPSS does this test automatically and a researcher then chooses a correct type of the t-test result. Also, Levene's test for equality of variances was employed before ANOVA. Homogeneity of variance is tested in a hypothesis that variance is equal in both samples. Our auxiliary hypotheses were then:

- H1aux: The test scores variance is the same for both male and female employees.
- H2aux: The test scores variance is the same in all age groups.

Chi-Square test of independence measures the difference between a statistically generated expected result and an actual result to see if there is a statistically significant difference between them, i.e. to see if the frequencies observed are significant. This test is used to in contingency table to investigate an independence between categorical variables, see e.g. (Cohen et al., 2007; Hair, 2014; Meloun and Militký, 2012; Wellington, 2004). The hypothesis states that there is no statistically significant difference between observed samples or specifically in in case of a contingency table that tested variables are independent. We tested two hypotheses in contingency table independence test:

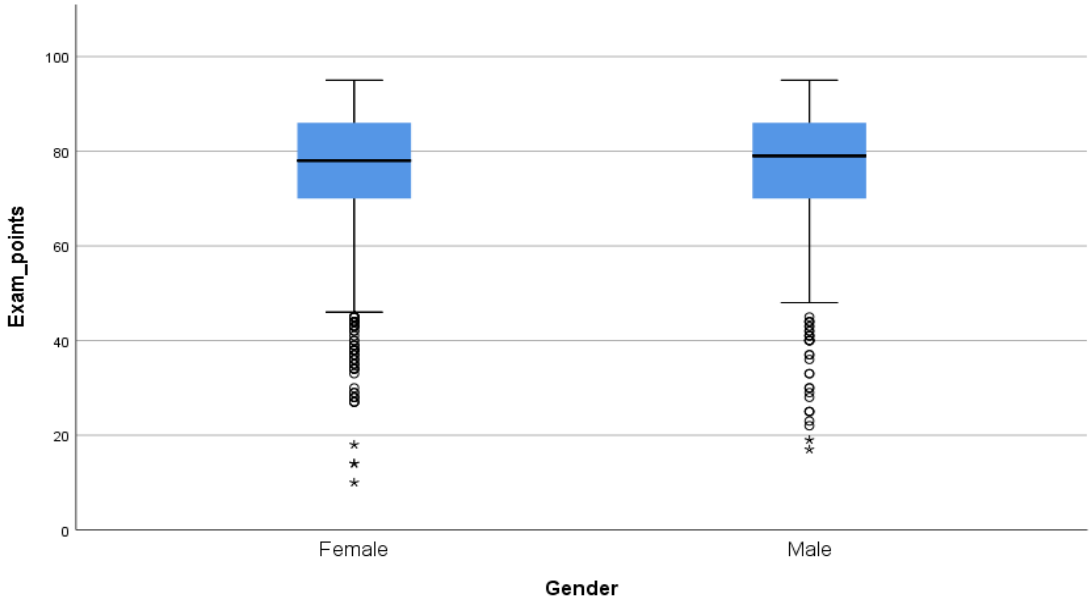
- H3: The test result is independent on time (quartile) of taking the exam.

All tests were performed at a significance level of 5%.

## 3 Results

At first the factor of gender was tested. In order to perform the t-test the Levene's test for equality of variances tested auxiliary hypothesis. H1aux stated that the test scores variance is the same in both male and female employees. We failed to reject a hypothesis with p-value 0,385 and therefore we accepted the results as suitable for the t-test with the same sample variance. H1 that there is no difference in the test score of male and female employees was tested. We failed to reject the hypothesis a p-value 0,977. We claim that there is no statistical evidence that test score depends on gender. The confidence interval was <75;76> points for female employees and <75;77> for male ones. Figure below presents the test results.

**Figure 1** Box-plot of exam points by gender



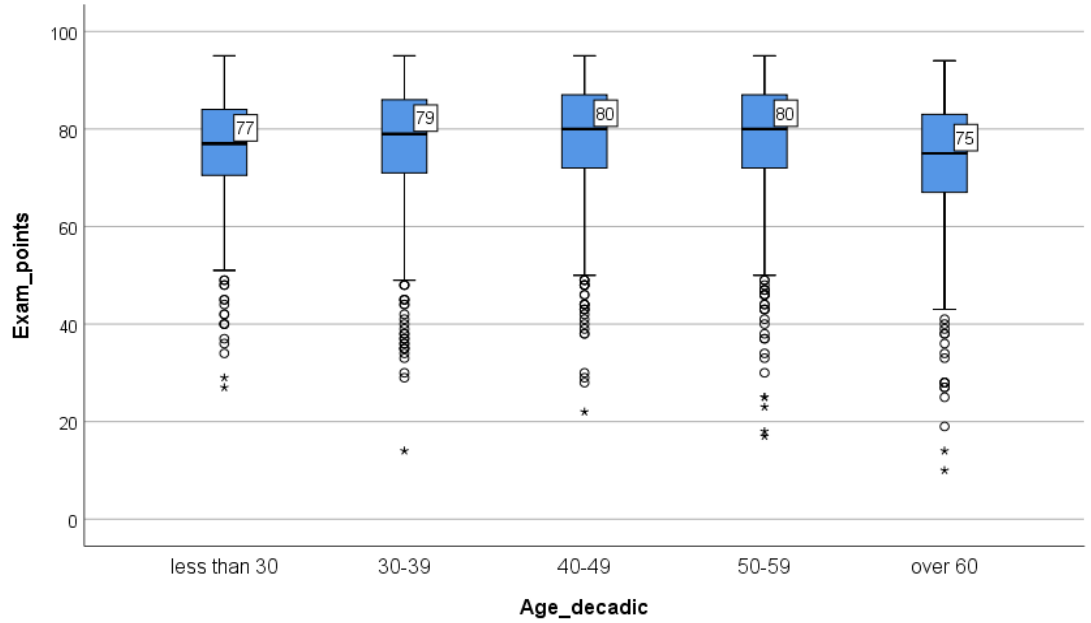

Source: own research.

Figure shows that male sample had slightly wider interquartile range, but female sample contained more outliers. This influenced a standard deviation which is higher in the female sample compared to the male one.

The sample was divided into groups by age, to be more specific we decimalized the age and then there were created groups of young employees below the age of thirty, then employees in their thirties, forties, etc. The second hypothesis H2 stated that the test result is independent on age of a participant. There was performed a chi-square contingency table test for which we failed to reject the hypothesis with a p-value 0,669. We claim that the test result (passed/failed) is independent of the age of an employee.

The test results were analyzed in greater detail by the test score. The figure below shows means for each group. There can be seen some difference in both mean scores as well as in variances.

**Figure 2** Box-plot of exam points and means by age decimals




Source: own research.

There was performed the ANOVA on the test scores as the next step. However, the Levene's test for equality of variances had to be performed before the ANOVA. We failed to reject the hypothesis H2aux with p-value 0,256. Therefore, we can assume that variance was the same in all age groups and so the ANOVA could be employed. The tested hypothesis was H2 which stated that the test score means in age groups are the same. We were able to reject the hypothesis with p-value 0,000. We claim that there was a statistically significant between-group difference and therefore, the test scores differ in the age groups.

There was performed a post-hoc analysis by Bonferroni all-pair-wise multiple comparison test to assess the between-group difference in greater detail. Tested hypothesis H2Bon stated that the test score means in each pair of age groups are the same. See results in table below.

**Table 1** The test score post-hoc analysis

| Age_decadic | Age_decadic | Mean Difference | Std. Error |
|---|---|---|---|
| over 60 | less than 30 | -2.711 | 1.268 |
| | 30-39 | -4.135* | 1.103 |
| | 40-49 | -5.294* | 1.030 |
| | 50-59 | -4.430* | 1.101 |

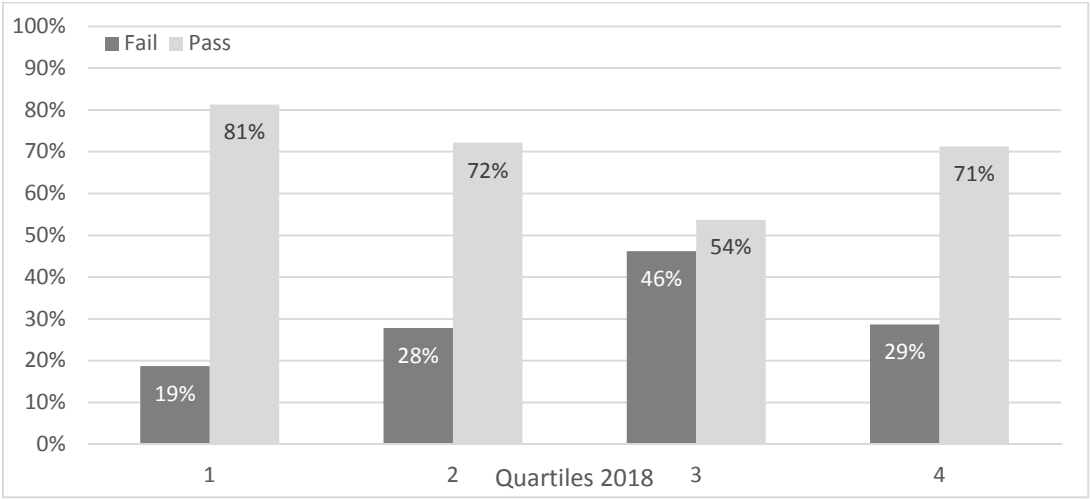
**The mean difference is significant at the 0.05 level.*

Source: own research.

The post-hoc analysis found a statistically significant difference of the oldest group to the rest with an exception of the youngest group. There was no statistically significant difference among the age groups 30-39, 40-49, and 50-59. Generally, we can sum the results up by a claim that the youngest and the oldest workers showed statistically significant difference to the rest of the sample, i.e. they achieved statistically significant lower test scores than the rest of the sample.

The last hypothesis was related to the test result over time. H3 stated that the test result is independent on time (quartile) of taking the exam. We were able to reject H3 hypothesis with a p-value 0.000.

**Figure 3** share of failed and passed result over time




Source: own research.

Figure 3 shows that the best results were achieved at the beginning of testing and the worst in the quartile from seventh to ninth month. The second and the fourth quartile showed almost the same level of success.

## 4 Discussion

The result of H1 testing as well as 95% confidence intervals for means of test scores showed no statistically significant difference. It has to be reminded that as the sample increases, the sensitivity of statistical testing increases as well. Hence, the results showed that in our sample the gender is not a factor of success in the professional qualification testing accordingly the Act No. 257/2016 Coll., on consumer credit. There can be found only negligible difference between male and female samples and so the managerial implication is to give no regards on gender in terms of qualification testing outcome.

Results of H2 and H2bon hypotheses confirmed that the youngest employees (below 30 years) and the oldest (over 60 years) ones perform statistically worse in a qualification testing. On the other hand, there is a question of effect. The same issue of sample size has to be considered as it was commented in a previous paragraph. Large sample size caused that even 4 points means difference is statistically significant. However, means difference was around four or five points only and all group means were above a 72-point threshold at the same time. Therefore, the real-world effect is questionable. The result can be explained by experience for the youngest employees and cognitive abilities for the oldest group. The youngest group cannot benefit from that much work experience which could help them achieving a better score mainly in the case studies exam part. Concerning the oldest group, study (Salthouse, 2012) concludes that there are important age-related changes in cognitive functioning over the workers lifespan. Nevertheless, our results do not support an implication that employees over 60 do not perform adequately in the qualification testing. Hence, there was found only very limited evidence for possible human resources decision. We suggest that taking age as a factor of choosing for whom the exam should be paid or not might be closer to the problem the age discrimination than evidence supported decision. This approach could even bring an adverse impact as suggested by (Fisher et al., 2017). Although preliminary testing on the data (Soukal and Hamplová, 2018) showed no statistically significant difference, a previous results assessment remains.

The only results that we find both statistically and real-world significant are related to the last hypothesis of time. We claim that employees that decided to take an exam at the beginning of the testing were "early-takers". Therefore, they were more motivated, more skilled and overall more prepared for the test. Otherwise, they would take later exam term to gain more time for studying. Study (Albert et al., 2010) describe the problem also as a general problem of survey design. Quota or time-limited surveys can be biased by such participants increasing overall score. Our findings are in accord to this claim. We did not find the evidence explaining the rest of the results, especially the worst results in the summer. Qualitative study would have to be conducted to explain such a dramatic performance decrease because the exam conditions were stable over the whole period. Yet, we suggest an implication that employees willing to take the such testing among the first are above average performing due to previous experience, learning abilities, being incentive driven etc.

## 5 Conclusions

The new Act No. 257/2016 Coll., on consumer credit states obligatory duty for consumer credit providers and intermediaries to ensure and prove the professional qualification level of all employees involved in the provision and intermediation of a consumer credit. There performed the analysis of 1.916 individual records of professional qualification tests each unique but consisted of sixty test questions and two case studies. The testing was organized by an accredited professional examiner over the year 2018.

Firstly, gender was not found as factor of the test score by the t-test. There was only a marginal difference between genders regarding variance. Interquartile range was wider for male sample. Female sample showed greater std. deviation suggesting slightly higher share of outliers than male sample. Secondly, age was found as factor of the test score

by the ANOVA and a post-hoc analysis. There was found statistically significant difference in mean scores of the youngest (age below 30) and the oldest employees (age over 60) to employees in age from 30 to 59. We explain lower scores in the youngest and the oldest groups by less amount of experience for the youngest one and by age-related changes in cognitive functioning for the oldest one. Although, there is the statistically significant result, we do not find a real-world effect strong enough to derive age-related managerial implication. Thirdly, time (quartile) was found as a factor of the test performance by the chi-test. There was found statistically significant difference among quartiles of 2018. The results in the first quartile, i.e. at the beginning of testing, were both statistically as well as from practitioner's point of view, found significantly better compared to others. We interpret such result as an outcome of "early-takers" participation. Such employees are considered more motivated, more skilled and overall more prepared for the test. This finding is in accord to survey methodology issue studied by (Albert et al., 2010).

## Acknowledgments

This study is supported by internal research project "Investment evaluation within concept Industry 4.0", and by project IGA 2019 "Support of pedagogical work, technical equipment, and communication with experts", both at Faculty of Informatics and Management, University of Hradec Kralove, Czech Republic.

## References

Act No. 257/2016 Coll. of 14 July 2016, on Consumer Credit as amended.

Act No. 258/2016 Coll. of 14 July 2016, on amending some laws in connection with the adoption of the Consumer Credit Act as amended.

Aesaert, K., van Braak, J. (2015). Gender and socioeconomic related differences in performance based ICT competences. *Computers & Education*, vol. 84, pp. 8–25. DOI: https://doi.org/10.1016/j.compedu.2014.12.017.

Albert, B., Tullis, T., Tedesco, D. (2010). *Beyond the usability lab: conducting large-scale online user experience studies*. Amsterdam, Burlington, MA: Morgan Kaufmann.

Ballantine, J. A., Duff, A., McCourt Larres, P. (2008). Accounting and business students' approaches to learning: A longitudinal study. *Journal of Accounting Education*, vol. 26(4), pp. 188–201. DOI: https://doi.org/10.1016/j.jaccedu.2009.03.001.

Best, J. W., Kahn, J. V. (2006). *Research in education*, 10th ed. Boston: Pearson/Allyn and Bacon.

Cohen, L., Manion, L., Morrison, K. (2007). *Research methods in education*, 6th ed. London and New York: Routledge.

Decree No. 381/2016 Coll. of 16 November 2016, on applications, notifications and the submitting of statements pursuant to the Consumer Credit Act.

Decree No. 384/2016 Coll. of 23 November 2016, on professional qualifications for the distribution of consumer credit.

Fisher, G. G., Truxillo, D. M., Finkelstein, L. M., Wallace, L. E. (2017). Age discrimination: Potential for adverse impact and differential prediction related to age. *Human Resource Management Review*, vol. 27(2), pp. 316–327. DOI: https://doi.org/10.1016/j.hrmr.2016.06.001.

Fogarty, T. J., Black, W. H. (2014). Further tales of the schism: US accounting faculty and practice credentials. *Journal of Accounting Education*, vol. 32(3), pp. 223–237. DOI: https://doi.org/10.1016/j.jaccedu.2014.07.001.

Hair, J. F., Black, W. C., Babin, B. J., Anderson, E. A. (Ed.). (2014). *Multivariate data analysis*, 7th ed., Pearson New International Edition. Harlow: Pearson.

Hedvicakova, M., Svobodova, L. (2016). Development and the Current Situation of the Mortgages for the Czech Households. In Krajicek, J., Nesleha, J. and Urbanovsky, K., eds., *European Financial Systems 2016: Proceedings of the 13th International Scientific Conference*. Brno: Masaryk university, pp. 234-241.

Ho, R. (2014). *Handbook of univariate and multivariate data analysis with IBM SPSS*, 2nd ed. Boca Raton: CRC Press, Taylor & Francis Group.

Huang, Y.-M., Liu, C.-H. (2009). Applying adaptive swarm intelligence technology with structuration in web-based collaborative learning. *Computers & Education*, vol. 52(4), pp. 789–799. DOI: https://doi.org/10.1016/j.compedu.2008.12.002.

Meloun, M., Militký, J. (Ed.). (2012). *Statistical data analysis: a practical guide* (Reprinted). New Delhi: WPI, Woodhead Publ. India Pvt. Ltd.

Pahl, J. (2008). Family finances, individualisation, spending patterns and access to credit. *The Journal of Socio - Economics*, vol. 37(2), pp. 577–591. DOI: https://doi.org/10.1016/j.socec.2006.12.041.

Salthouse, T. (2012). Consequences of Age-Related Cognitive Declines. *Annual Review of Psychology*, vol. 63(1), pp. 201–226. DOI: https://doi.org/10.1146/annurev-psych-120710-100328.

Soukal, I., Hamplova, E. (2018). Preliminary Results of Non-bank Consumer Credit Providers in the Professional Qualifications Test by the Act No. 257/2016 Coll., on Consumer Credit. In Nesleha, J., Hampl, F. and Svoboda, M., eds., *European Financial Systems 2018: Proceedings of the 15th International Scientific Conference*. Brno: Masaryk university, pp. 662-669.

Smalheiser, N. R. (2017). *Data literacy: how to make your experiments robust and reproducible*. Amsterdam: Academic Press, an imprint of Elsevier.

Sulaiman, E. K. (2012). An Empirical Analysis of Financial Risk Tolerance and Demographic Features of Individual Investors. *Procedia Economics and Finance*, vol. 2, pp. 109–115. DOI: https://doi.org/10.1016/S2212-5671(12)00070-6.

Wellington, J. (2004). *Educational research: contemporary issues and practical approaches* (reprinted). London: Continuum.

# Prediction of Bankruptcy in a Different Period of Economic Development

**Martina Sponerová[1], Miroslav Svoboda[2], Miroslav Sponer[3]**

[1,2] Masaryk University
Faculty of Economics and Administration, Department of Finance
Lipová 41a, 603 00 Brno, Czech Republic
E-mail: martina.sponerova@econ.muni.cz
254801@mail.muni.cz

[3] E-mail: miroslav.sponer@centrum.cz

***Abstract**: The ability to predict bankruptcy is the factor, which eliminates the credit risk of a bank, so the prediction of bankruptcy and credit risk of a bank is a permanent subject matter of many scientific types of research. This paper focuses on the Czech economy, specifically at small and medium-sized enterprises (SMEs). We have chosen the SMEs sector because it plays a significant role in this economy. The aim of this article is finding if there exist different factors that could predict bankruptcy in the time at the end of the financial crisis and at the time of upturn. Our motivation is to show the most important factors which have to be taken into attention in different stages of economic development. We have investigated around 2 800 companies from the segment small and medium-sized enterprises (SMEs), of which 642 failed during the period 2010 – 2017. We have investigated financial data for the years from 2010 to 2017. The whole dataset was divided into two parts, to the period of the financial crisis and to the period of the upturn. The analyses were done separately for each period and for the whole period to capture different characteristics of companies in a different time. Our suggestion is that it is necessary to evaluate the financial information of the company according to the period of economic development.*

*Keywords: credit risk, bankruptcy prediction, SME, financial indicator*

*JEL codes: G32, G33, C53*

## 1 Introduction

The prediction of bankruptcy and the quantification of credit risk is the subject of interest of many studies, scientific articles and publications. The ability to predict the bankruptcy is the factor, which eliminates credit risk of a bank. Academics and practitioners have focused their research to improve the performance of existing bankruptcy models and they are still developing new models and methods to precisely predict business failure.

Business failure is closely connected with credit risk, which is one of the biggest risks of financial institutions. Hence, there is a pressure on financial institutions to still improve their credit risk management systems to predict bankruptcy as accurately as possible.

The aim of this article is finding if there exist different factors that could predict bankruptcy in the time at the end of the financial crisis and at the time of upturn. Our motivation is to show the most important factors which have to be taken into attention in different stages of economic development.

This paper focuses on SMEs because they are reasonably considered as the most important segment of the economy in many countries. For OECD members, the percentage of SMEs out of the total number of firms is higher than 97%. SMEs employ approximately two-third of employees and create more than half of the added value in EU-28 (Eurostat, 2019). Thanks to their simple structure, they can respond quickly to changing economic conditions and meet local customers´ needs, growing sometimes into large and powerful corporations or failing within a short time of the firm´s inception.

There is extensive empirical literature on default prediction methodologies. Many authors during the last fifty years have examined several possibilities to predict default or

business failure. The seminal works in this field were Beaver (1967) and Altman (1968). The researcher William Beaver was the first to apply a number of ratios, which could discriminate between failed and non-failed companies up to five years prior to bankruptcy. Altman improved Beaver´s method and assessed a more complete financial profile of firms. Altman examines 22 potentially helpful financial ratios and selects five that provide, when combined, the best overall prediction of corporate bankruptcy. The variables are classified into five standard ratio categories - liquidity, profitability, financial leverage, activity, and solvency. Being the first person to successfully develop multiple discriminate analysis (MDA) prediction model with a degree of 95.0% rate of accuracy, he is considered the pioneer of insolvency predictors. Altman´s model has been applied successfully in many studies worldwide concerning the subjects of capital structure and strategic management, investment decisions, asset, and credit risk estimation and financial failure of publicly traded companies (Lifschutz and Jacobi, 2010).

For many years thereafter, MDA was the prevalent method applied to the default prediction models. It was used by many authors for example very often cited in the research literature is Taffler model developed in Great Britain in 1977 (Taffler and Tishaw, 1977). However, in most of these studies, authors pointed out, that two basic assumptions of MDA are often violated – the independent variables included in the model are multivariate normally distributed; the group of variance-covariance matrices is equal across the failing and non-failing group (Barnes, 1982, Karels and Prakash, 1987).

Another MDA model has been developed by Inka and Ivan Neumaier in 1995 known as IN95. This model was constructed especially for the Czech market and was updated in the next years. We use the last version - IN05 model which was developed in 2005 (Inka and Ivan Neumaier, 2005).

Considering these MDAs´ problems, Ohlson (1980), for the first time, applied the conditional logit model to the default prediction´s study. The practical benefits of logit methodology are that they do not require the restrictive assumptions of MDA and allow working with disproportional samples. After Ohlson, most of the academic literature used logit models to predict default. Next, very often cited model, which uses conditional probability, is the model by Zmijewski (1984). He was the pioneer in applying probit analysis to predict default but, until now, logit analysis has given better results in this field. A probit approach is the same as in the logit approach, different is the only distribution of random variables.

We witness a substantial increase in the number and complexity of default prediction studies due to the rapid advancement in technology and methodology. Above all, we can mention artificial neuron networks used by Angelini et al. (2007), decision trees method used by Gulnur and Fikret (2011) and hazard models used by Shumway (2001).

Recent empirical literature also gains momentum in understanding the credit risk behavior of small firms. Altman and Sabato (2007) studied a panel of 2010 U.S. SMEs including 120 defaults in the period 1994 to 2002. They chose five accounting ratio categories describing the main aspects of a company´s financial profile: liquidity, profitability, leverage, coverage, and activity. For each of these categories, they created a number of financial ratios identified in the literature as being most successful in predicting firms´ bankruptcy. Finally, five variables (one from each category) were selected with the best prediction power of SME default and a distress prediction model for SMEs was developed using logistic regression technique. However, they acknowledge the need to employ qualitative information to improve the predictive performance of their model.

Empirical literature also highlights the significance of qualitative information such as business type, industrial sector, location, age, etc. in the understanding of firms´ credit risk behavior (Grunert et al., 2005). Altman et al. (2010) took account this issue and studied about 5.8 million SMEs, of which 66 000 failed during the observed period 2000 – 2007. They reported that the prediction performance of Altman and Sabato (2007) model improved by about 13% when qualitative information is added. They found that data

relating to legal action by creditors to recover unpaid debts, company filing histories, comprehensive audit report/opinion data, and firm-specific characteristics make a significant contribution to increasing the default prediction power of risk models built specifically for SMEs (Altman et al., 2010).

## 2 Methodology and Data

Our dataset consist of a sample of 2 790 SMEs that survived in the period 2010 – 2017 out of which 642 companies failed in this time period. This data was exclusively gained from a bank database by the random selection of SMEs that survived and all of SMEs that failed during the above mentioned period.

In our previous research, we have compared the prediction power of the bankruptcy models, which are used very often in many scientific papers - the Altman´s Z-score, the Ohlson´s O-score, the Zmijewski's model, the Taffler's model, and the IN05 model. We found that the performance of these models reached from 69% to 55%. Next step in our research was determined to re-estimate coefficients for analyzed companies and develop a new model, which should provide the best possible results. (Plíhal et al., 2017)

We used sixteen financial indicators see Table 1. Most of them are included in models, which we have compared in our previous research. They measure most of all earning, liabilities and assets in various concepts with different indicators.

**Table 1** List of financial indicators

| Coding | Formula |
|---|---|
| **X001** | working capital/total assets |
| **X002** | retained earnings/total assets |
| **X003** | equity/liabilities |
| **X004** | sales/total assets |
| **X005** | EBT/short-term liabilities |
| **X006** | current assets/liabilities |
| **X007** | short-term payables/total assets |
| **X008** | total assets/liabilities |
| **X009** | EBIT/interest cost |
| **X010** | short-term liabilities/current assets |
| **X011** | EAT/total assets |
| **X012** | liabilities/equity |
| **X013** | liabilities/total assets |
| **X014** | current assets/short-term liabilities |
| **X015** | equity/long-term assets |
| **X016** | Equity + reserves + long-term liabilities/long-term assets |

Source: own processing

We have split our database to period from 2010 to 2014, which represents the period of the end of the financial crisis and to period from 2015 to 2017, which represents the period of the upturn. We have tested each group separately and all the dataset by the logistic regression through IBM SPSS software.

The group representing the period of financial crisis consists of 1 686 companies out of which 511 failed during this time. The group representing the upturn consists of 458 companies out of which 21 failed.

### Model Specification

Logistic regression is the appropriate regression analysis to conduct when the dependent variable is dichotomous (binary). Like all regression analyses, the logistic regression is a predictive analysis. Logistic regression is used to describe data and to explain the relationship between one dependent binary variable and one or more nominal, ordinal, interval or ratio-level independent variables. The dependent variable should be

dichotomous in nature (e.g. in our case bankrupt or non-bankrupt companies). There should be no outliers in the data, no high correlations (multicollinearity) among the predictors. Tabachnick and Fidell (2013) suggest that as long correlation coefficients among independent variables are less than 0.90 the assumption is met. Mathematically, logistic regression estimates a multiple linear regression function defined as:

$$\pi(x) = \frac{exp^{(\alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \cdots \beta_n X_n)}}{1 + exp^{(\alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \cdots \beta_n X_n)}} \quad (1)$$

## 3 Results and Discussion

We have tested both groups separately and all the dataset. The results are mentioned in Tables 2 – 4.

Variables mentioned in Table 1 entered into logistic regression with below-mentioned result.

**Table 2** Final list of variables for the period of the financial crisis

| Coding | Coefficient B | p-value |
|---|---|---|
| **X002** | -1.799 | 0.000 |
| **X006** | 0.659 | 0.000 |
| **X011** | -1.268 | 0.090 |
| **X013** | 0.034 | 0.000 |
| **X014** | -0.419 | 0.000 |
| **X015** | 0.016 | 0.006 |
| **Constant** | -2,794 | 0.000 |

Source: own processing

The model developed for the period of the financial crisis shows that it is necessary to pay attention to many factors of a company´s financial situation. Most used indicators are indicators of liabilities and assets, earning is measured only in 2 cases of 6 and equity in 1 case of 6.

**Table 3** Final list of variables for the period of upturn

| Coding | Coefficient B | p-value |
|---|---|---|
| **X001** | 9.693 | 0.001 |
| **X005** | 1.462 | 0.007 |
| **X011** | -12.484 | 0.000 |
| **X014** | -3.410 | 0.004 |
| **Constant** | 0.592 | 0.000 |

Source: own processing

The model developed for the period of upturn has fewer indicators and measures most of all assets and earning, liabilities are measured in 2 cases of 4 and equity is not measured at all.

**Table 4** Final list of variables for all the dataset

| Coding | Coefficient B | p-value |
|---|---|---|
| **X002** | -1.860 | 0.000 |
| **X003** | -0.218 | 0.091 |
| **X005** | 0.316 | 0.059 |
| **X006** | 0.826 | 0.000 |
| **X011** | -3.439 | 0.001 |
| **X013** | 0.027 | 0.000 |
| **X014** | -0.440 | 0.000 |
| **X015** | 0.012 | 0.004 |
| **Constant** | -2,612 | 0.000 |

Source: own processing

The result if we do not distinguish economic development is a mixture of both previous models. It measures most of all indicators related to assets and liabilities, earning is measured in 3 cases of 8 and equity is measured in 2 cases of 8.

## 4 Conclusions

This study analyzed if there are various factors to predict bankruptcy during the different period of economic development for Czech SME´s. We have investigated financial data for the years from 2010 to 2017. The whole dataset was divided into two parts, to the period of the financial crisis and to the period of the upturn. The analyses were done separately for each period and for the whole period to capture different characteristics of companies in a different time.

Our findings confirm our hypothesis and several suggestions arise from them. Our results show that during the financial crisis there are many factors influencing bankruptcy most of all liabilities and assets. On the other side during the period of upturn, it is important to focus on earnings and assets, the importance of liabilities is not so high. The model developed for all the dataset is a mixture of both models. Our suggestion is that it is necessary to evaluate the financial information of the company according to the period of economic development to assess the probability of bankruptcy precisely.

## Acknowledgments

The support of the Masaryk University internal grant MUNI/A/1120/2018 – Vybrané aspekty rizik na finančních trzích is gratefully acknowledged.

## References

Altman, E. I., Sabato, G. (2007). Modeling Credit Risk for SMEs: Evidence from the U.S. Market. *ABACUS*, Vol. 43(3), pp. 332 – 357.

Altman, E. I., Sabato, G., Wilson, N. (2010). The value of non-financial information in small and medium-sized enterprise risk management. *The Journal of Credit Risk*, Vol. 6(2), pp. 1-33.

Angelini, E., di Tollo, G., Roli, A. (2007). A neural network approach for credit risk evaluation. *The Quarterly Review of Economics and Finance*, vol. 48(4), pp. 733-755.

Barnes, P. (1982). Methodological implications of non-normality distributed financial ratios. *Journal of Business Finance and Accounting*, vol. 9(1), pp. 51-62.

Eurostat (2019). Retrieved from: *http://ec.europa.eu/eurostat/*.

Grunert, J., Norden, L., Weber, M. (2005). The role of non-financial factors in internal credit ratings. *Journal of Banking & Finance*, vol. 29(2), pp. 509-531.

Gulnur, D., Fikret, G. (2011). Knowledge discovery using neural approach for SME´s credit risk analysis problem in Turkey. *Expert Systems with Applications*, vol. 38, pp. 9313-9318.

Lifschutz, S., Jacobi, A. (2010). Predicting Bankruptcy: Evidence from Israel. *International Journal of Business and Management*, vol. 5 (4), pp. 133–141.

Neumaierová, I., Neumaier, I. (2005). Index IN05. IN: *Proceedings of the European Financial Systems 2005*. Brno, Masarykova University in Brno, pp. 143-146. ISBN 80-210-3753-9.

Ohlson, J. A. (1980). Financial ratios and the probabilistic prediction of bankruptcy. *Journal of Accounting Research*, vol. 18, pp. 109-131.

Plíhal, T., Sponerová, M., Sponer, M. (2018). Comparative Analysis of Credit Risk Models in Relation to SME Segment. *Financial Assets and Investing*, vol. 9(1), pp. 35–50. ISSN 1804-5081.

Shumway, T. (2001). Forecasting bankruptcy more accurately: A simple hazard model. *Journal of Business*, vol. 74(1), pp. 101-124.

Taffler, R., Tishaw, H. (1977). Going, going, gone – four factors which predict. *Accountancy*, vol. 3, pp. 50 – 54.

Zmijewski, M. (1984). Methodological issues related to the estimation of financial distress prediction models. *Journal of Accounting Research*, vol. 22, pp. 59-82. ISSN 0021-8456.

# Prediction of Economic Growth to Determine the Growth Rate of Business Value

**Pavla Srbová, Mária Režňáková**

Brno University of Technology
Faculty of Business and Management, Department of Finance
Kolejní 2906/4, 612 00 Brno, Czech Republic
E-mail: xpsrbov00@vutbr.cz, reznakova@fbm.vutbr.cz

***Abstract:*** *The aim of this paper is to describe approaches to determining the growth rate of two-stage discounted cash flow valuation method and to propose possibilities to refine its prediction. Business value is given by a set of business-economic variables, so-called value drivers; one of which is the growth rate. The determination of the growth rate is based on an analysis and prediction of macroeconomic factors and on the company's internal factors. According to our research the value of an enterprise is very sensitive to changes in the growth rate. Therefore, we believe the issue requires closer attention. The growth rate as a value driver is commonly derived from the GDP growth rate, which characterizes economic cycles. In literature this is often identified with business cycles. Authors of this paper deal with GDP prediction and possibilities of using composite indicators to determine the growth rate of cash flow, specifically to refine the first phase prediction. Composite indicators are used to predict the development of economic cycles and their use is therefore particularly suitable for pro-cyclical sectors. Another possibility of using composite indicators is to incorporate partial factors directly into business valuation models. In particular, we see the benefit of using composite indicators in their better accessibility. For the purpose of our analysis we use the Pearson correlation coefficient to determine the correlation between the GDP and the selected industry from 2007 to 2017 or the composite indicator, the logarithmic difference to analyse economic cycles and the mean deviation value to compare the GDP prediction with the real GDP.*

*Keywords: business value, discounted cash flow, growth rate, business cycle, composite indicator*

*JEL codes: G32, E17, E32*

## 1 Introduction

The value of a company is an aggregate measure of its performance. As stated by Keuleneer and Verhoog (2005, p. 93) "Value is said to be one of the best performance measures because it is the only measure that requires complete information. To understand value creation, one must use a long-term strategic point of view, manage all cash flows on the income statement and movements on the balance sheet, and must know how to compare cash flows from different time periods on a risk adjusted basis."

Decisive for defining the value of a company are the future revenues, i. e. the value is understood as the current value of future revenues. In order to be able to estimate them it is necessary to recognize factors that can influence the future revenues. They are chiefly macroeconomic factors, competition position of the company and its management standard which are reflected in the so-called value drivers. Value drivers are any business quantities that together determine the value of the company (Mařík, 2011). The key value drivers are sales and their growth, profit margin, investment in the net working capital and fixed assets, and cost of capital (see Copeland et al., 1994; Koller et al., 2010; Mařík at al., 2011; Damodaran, 2006).

Our previous research shows that the value of a company is highly sensitive to the growth rate and the cost of capital (see Režňáková et al., 2013). This is why in this article we offer an analysis of factors influencing the growth rate and possibilities of predicting the future income growth rate. The determination of the growth rate is based on the analysis and prediction of macroeconomic factors and on the company's internal

factors. According to some authors, GDP is the decisive factor influencing the future development of a company and thus its future revenues (Mařík, 2011).

**Business valuation by free cash-flow method**

For the purposes of applied research we used the discounted free cash-flow method. In practice, this is a frequently used two-stage model where the value of a business is determined as the aggregate value of discounted cash flow in the first and the second stage (Mařík, 2011):

$$BV = \sum_{t=1}^{T} \frac{FCF_t}{(1+i_k)^t} + \frac{TV}{(1+i_k)^T} \quad (1)$$

Where: BV is a business value; $FCF_t$ is free cash flow forecast for each year; $i_k$ is discounted rate; T is number of years during the first stage and TV is terminal value (continuing value).

This model is the fundamental method of income capitalization approach to business valuation (e.g. Keuleneer and Verhoog, 2005; Mařík, 2011). The precondition for determining the business value through the income capitalization method is its unlimited continuation (the going concern principle – see e. g. Mařík, 2011).

The first stage (also referred to as the projection period) covers the period from the present to the business stabilization. The length of this period is generally between 5 and 10 years to make well-founded projection (Keuleneer and Verhoog, 2005).

During the second stage, the company generates the FCF with a constant growth rate maintained until infinity and this terminal value (TV) must also be discounted (Keuleneer and Verhoog, 2005). Jennergen (2008) in the article suggests that a substantial part of the terminal value is formed by cash flow associated with the already acquired assets.

For the calculation of the terminal value mostly two methods are applied, they are the Gordon model and the parametric model (e.g. Mařík and Maříková, 2006; Copeland et al., 1994; Blasco and Ribal, 2013). The terminal value according to Gorden growth model can be calculated as follows (Dvořák, 2007; Mařík, 2011):

$$TV = \frac{FCFF_T * (1+g)}{i_k - g} \quad (2)$$

Where g is the predicted growth rate FCF to infinity.

Mařík and Maříková (e.g. 2011; 2011b) recommend the use of the TV parametric model according to Copeland et al. (1994) which is an expansion of the Gordon model. This model provides a more structured view on the creation of continuous value:

$$TV = \frac{NOPAT_{(t+1)} * \left(1 - \frac{g}{r_1}\right)}{i_k - g} \quad (3)$$

Where NOPAT is operating profits after tax in the first year following the end of the predicted period; g is the growth rate; $g/r_1$ is the investment rate, i. e. net investment /NOPAT; $r_1$ is the return on of net investments, i. e. year-on-year change in NOPAT/increase in invested capital in the previous year.

According to Mařík and Maříková (2006), while reviewing the continuous value it is necessary to consider the fact that it has a crucial importance for the calculated resulting value of the company. The attention paid to its determination, however, does not correspond with its importance. An insufficient explanation of parameters that have a key impact on the resulting value can give rise to doubts. Determination of the terminal value is based on the assumption that the *going concern principle* is satisfied. This is why the growth rate must be at least equal to inflation and, at the same time, such a company cannot achieve a growth higher than the GDP growth in the long term. The growth rate for the terminal value is usually placed somewhere between the inflation rate and the

nominal GDP growth rate. Within this margin the valuer choses the growth rate at their own discretion which is inadequate (Mařík and Maříková, 2006; Dvořák, 2007).

The importance and techniques of determining terminal value are addressed by Dvořák (2007). He argues that various procedures for calculating the terminal value yield the same results under consistent assumptions. He recommends extending the first stage so that the return on the invested capital be calculated only on the basis of the cost of capital. He also recommends to verify the resulting value by an alternative procedure.

Our research is based on the assumption that the growth rate prediction relating to the company's sales can be particularized by using the indicators used to predict the business cycles. Bonenkamp et al. (2001) define economic cycles as regular fluctuations in macroeconomic variables such as output, unemployment, consumption, price or interest rate. Economic cycles can therefore be described on the basis of GDP developments. According to Burns and Mitchell (1946), in Bonenkamp et al. (2001), economic cycles are a kind of fluctuation in the overall economic activity of nations which will be reflected mainly in trading companies. According to Czesaný (2007), given the length of available time series, GDP can be considered a suitable indicator of economic activity even in our conditions. If the company's revenues are in line with the GDP development, then this macroeconomic indicator can help to refine the company's sales prediction. At the same time, there are indicators that are capable of foreseeing the GDP development and their value is available before the actual GDP figure (Czesaný, 2007). The predictive ability of these indicators can thus lead to a more accurate growth rate of sales in the first stage of valuation as a key value generator for the company. These are so-called composite leading indicators (CLIs). Their importance lies in the fact that they minimize false signals in economic fluctuations that could be displayed by individual (isolated) indicators (Czesaný, 2006). CLIs include both qualitative and quantitative data and their reliability depends on the individual indicators with which they are composed. GDP and its expenditure components, unemployment, inflation, interest rates, as well as corporate profits, industrial production or housing construction indicator are most commonly used as periodically developing indicators (Czesaný, 2006). At the same time, it is important to realize that factors that are difficult to predict, such as financial crises, wars or strikes, also influence predictions (Czesaný, 2006). In this paper we will concentrate on the suitability of using GDP and OECD composite indicator in the prediction of sales

## 2 Methodology and Data

To analyze the economic cycle, we used the first order logarithmic difference method to eliminate the trend in GDP and to convert the original values into a linear series:

$$\Delta y(1) = y(t) - y(t-1) \tag{4}$$

Where y is a sign for the logarithm of a given value. The goal is to find extreme values in a given time series. According to A. Okun, recession begins if in the period at least in two quarters there are negative growth rates followed by a positive growth rate (Bonenkamp et al., 2001).

The mean deviation value is used to analyze the prediction deviations from actual GDP:

$$AFE = \sum_{t=1}^{T} \frac{\big(F(t) - A(t)\big)}{T} \tag{5}$$

Where A(t) is the actual value in time t and F(t) is predicted value for period t, T is the number of observations. (MF CR, 2013)

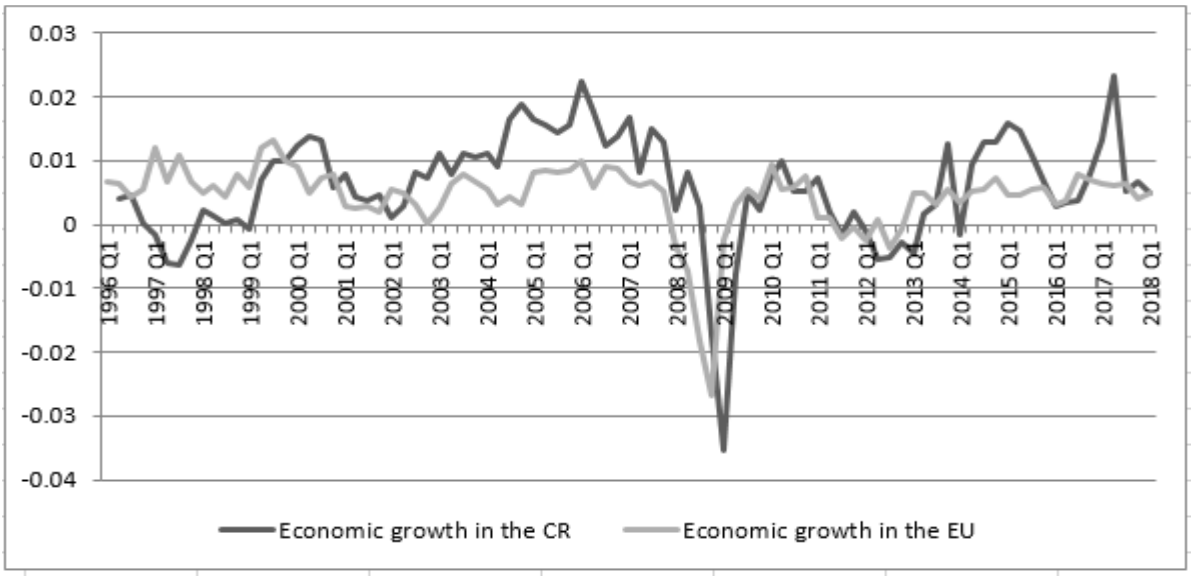
Using the Pearson correlation coefficient (PCC), the correlation between industry and GDP is determined. Authors use the cross correlation to determine the CLI predictive power when GDP is the reference series.

The data used in this paper are drawn from Eurostat, OECD, the Czech Statistical Office (CSO) and the Ministry of Industry and Trade (MIT).

## 3 Results and Discussion

First, we analyzed the GDP development in the Czech Republic and EU countries - see Figure 1.

**Figure 1** GDP Development (Economic cycles) in the CR and the EU from 1996 to 2017 Using the Logarithmic Difference Method




Source: authors' calculations based on data of Eurostat

The Czech Republic is heavily export-oriented and thus the global trade has a significant impact on its economy (global economic growth/decline). Already in 2006, Czesaný dealt with the synchronization of economic cycles in of EU countries. He found out that their synchronization was the result of the single market creation and the emergence of the economic and monetary union.

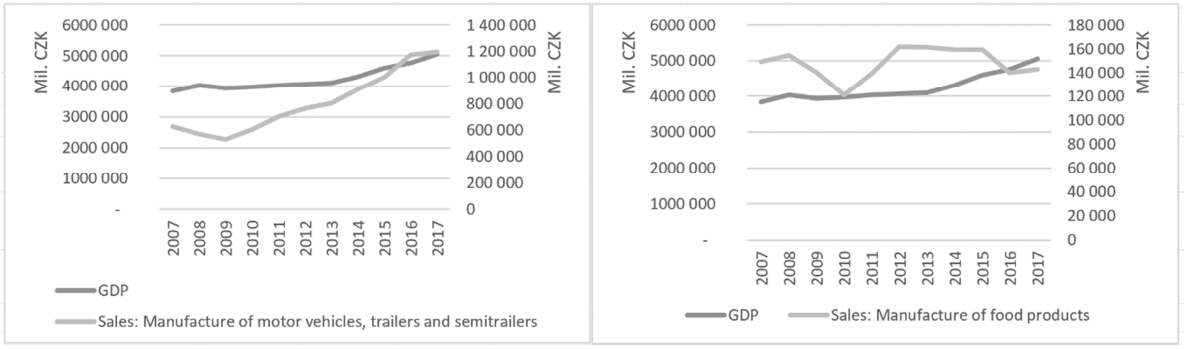
In the next step, industries with cyclical developments were identified, i.e. the correlation between the development of sales in the industry and GDP was demonstrated.

**Table 1** Correlation analysis of sales and GDP in current prices

| | **PCC** | **Number of Enterprises** [ths. pcs.] |
|---|---|---|
| Agriculture, forestry and fishing | 0.70 | 30 |
| Mining and quarrying | -0.18 | 20 |
| **Manufacturing** | **0.92** | **830** |
| Electricity, gas, steam and air conditioning supply | 0.52 | 116 |
| **Water supply; sewerage, waste management and remediation activities** | **0.84** | **62** |
| Construction | -0.69 | 85 |
| **Wholesale and retail trade; repair of motor vehicles and motorcycles** | **0.81** | **277** |
| Transportation and storage | 0.52 | 67 |
| **Accommodation and food service activities** | **0.94** | **29** |
| Information and communication | 0.00 | 56 |
| Financial and insurance activities | n.a. | n.a. |
| Real estate activities | 0.66 | 346 |
| Professional, scientific and technical activities | -0.15 | 67 |
| **Administrative and support service activities** | **0.81** | **41** |
| **Other service activities** | **0.97** | **86** |

Source: Authors' calculations based on data of CSO and MIT

**Figure 2** Correlation of GDP and Sales in Selected Sectors from 2007 to 2017



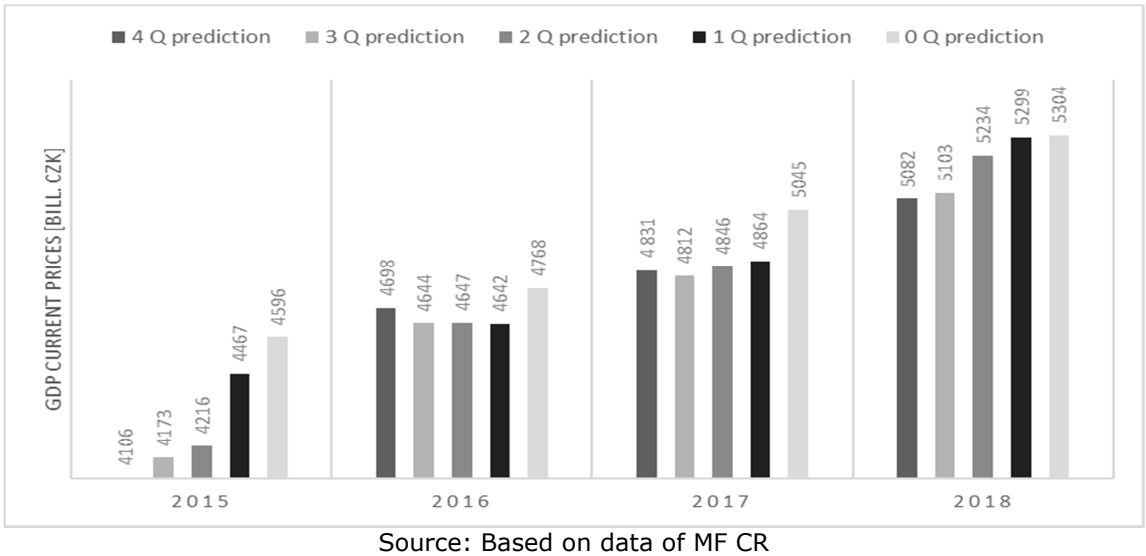

Source: based on data of CSO and MIT

If we compare the development of the economic cycle (GDP development in this case) with developments in individual sectors (Table 1, Figure 2), we find that not all sectors evolve in line with the economic cycle. The highest correlation between GDP development and industry sales is in manufacturing (0.92), accommodation and catering services (0.94) and other services (0.97) which include education; human health and social work activities; arts and other service activities. The high degree of correlation between the manufacturing industry and GDP results from the high share of this sector in GDP (the average share of revenues for 2007 - 2017 in GDP is 60%). However, in a more detailed analysis, we found that only some industries' sales evolve in line with the economic cycle. Such an industry is the automotive industry (0.95), while the food industry appears to be unaffected by GDP (0.04). It follows that GDP and its forecast can only be used to predict the sales only in some industries.

**Prediction of the Czech economic development**

In the following part we looked into the GDP prediction accuracy. Figure 3 shows GDP predictions in various periods, in particular: one year before (4 Q prediction), nine months before (3 Q prediction), six months before (2 Q prediction) and three months before (1 Q prediction) and the actual values (0 Q prediction).

**Figure 3** The Prediction of GDP in the CR from 2015 to 2018 with Different Time Intervals



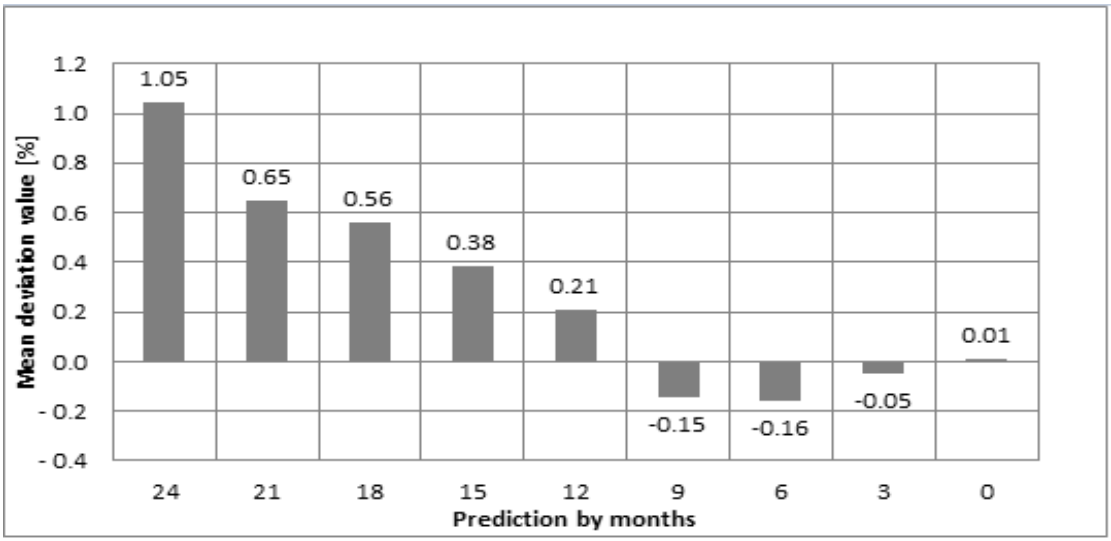

Source: Based on data of MF CR

The analysis suggests that:

- Prediction in all periods in question is more pessimistic than reality;

- Our assumption that the prediction will be refined with the shortening of the predicted period was not fulfilled. Therefore, we analyzed the variations between actual GDP development and its prediction. The mean AFE deflection value (see (5) was used for this purpose. The results are shown in Figure 4

**Figure 4** Variation between Predicted and Actual GDP Depending on the Number of Predicted Months




Source: Adapted from MF CR calculations

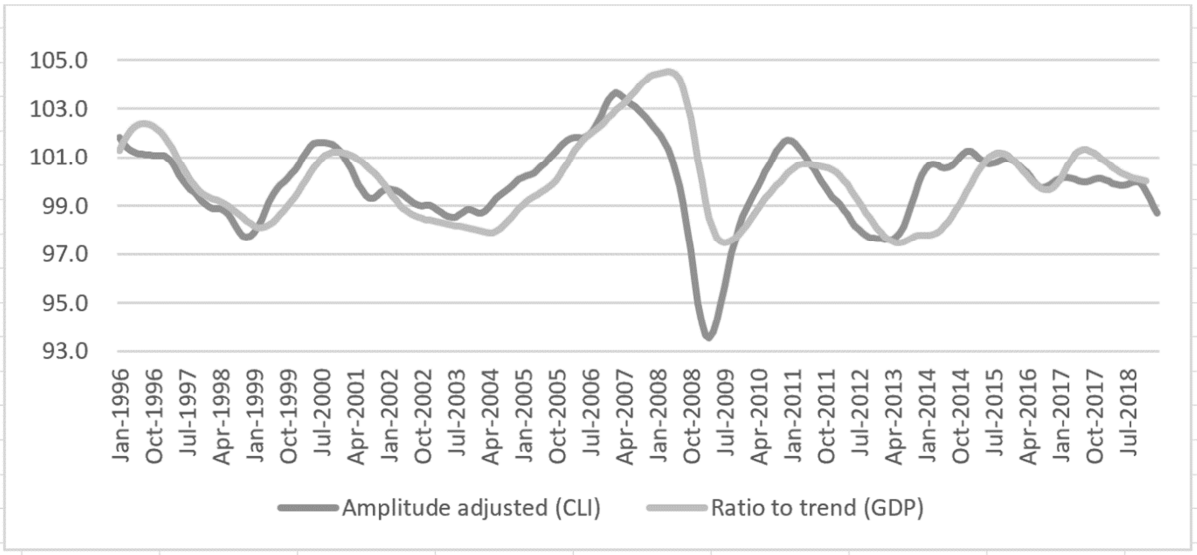
The GDP prediction data from April 2005 to January 2018 were used for the analysis. The results show that the prediction is more accurate with the shortening of the predicted period. The prognosis for 12-24 months reaches a positive deviation (one year in advance the mean deviation value is 0.21% from reality). In case of a forecast shorter than a year, the deviation is negative. These results could have been influenced by the economic cycle because according to findings of the Ministry of Finance (MF CR, 2013) the actual GDP predictions are overrated for the period of recession and underrated for the period of economic growth.

Based on the assessment of macroeconomic predictions of the Ministry of Finance (MF CR, 2013), it was found that they are comparable with those of international institutions. It follows that predictions by international institutions can be used to predict the Czech GDP. In the next part of the text we will focus on CLI OEDC because similarly to the MF CR prediction this indicator achieves good predictive results. The performed predictions have an informative value for up to 18 months. A prediction for a longer period of time is rather an estimate of an economic development trend with an increasing confidence interval.

**CLI OECD and its prediction capability**

The advantage of OECD CLI is that it outperforms GDP and, at the same time, actual values are available before the exact GDP value is known (due to the complexity of the calculation). The appropriateness of using the OECD CLI to predict GDP was verified on the basis of the Person's correlation coefficient - see Figure 5.

**Figure 5** Comparison CLI OECD and GDP




Source: based on data of OECD

It follows from the analysis that CLI OECD precedes the GDP development by six months (correlation 0.85). For this reason the indicator can be used for the prediction of sales and thus for determining the sales growth rate in the projection period.

## 4 Conclusions

The existing approaches to determining growth rates are inadequate in view of the fact that even a small change in the "g" (grow rate) parameter causes a big change in the company value. For this reason it is necessary to address the refinement of procedures for its determination.

In this paper we focused on evaluating the possibility of using GDP prediction to predict the growth rate of a company According to the Ministry of Finance findings, the actual GDP predictions are overrated for the period of recession and underrated for the period of economic growth and their informative value is comparable with the predictions by international institutions. It follows from the findings mentioned above that if we use only GDP prediction to predict the company sales, there will be inaccuracies in the predicted sales resulting in an incorrectly determined business value.

We also analyzed the possibility of using composite indicators to predict sales. In this paper, we examined the possibility of using the OECD CLI. We found that this indicator is ahead of the development in GDP by six months.

Composite indicators are used to predict economic development and the use of existing ones is thus appropriate for pro-cyclical industries. Not all sectors behave like this so it might be appropriate to formulate a composite indicator individually for each sector or to analyze the industry's behavior in relation to the composite indicator. Another possibility is to use individual early indicators, which include these indicators and, based on their analysis in relation to the behavior of individual sectors, to include them directly in the models of determining the growth rate.

## Acknowledgments

The authors are grateful to the Internal Grant Agency of University No. FP-S-18-5234 "*Prediction models in finance: analysis of factors and predictions of bankruptcy, company performance and value*" for the financial support while carrying out this research.

## References


Blasco, A., Ribal, J. (2013). Application of the continuing value model to small and medium-sized Spanish enterprises. *Mathematical and Computer Modelling*, vol. 57 (7–8), pp. 1788-1794.

Bonenkamp, J., Jacobs, J. P. A. M., Kuper, G. H. (2001). *Measuring business cycles in The Netherlands, 1815-1913: a comparison of business cycle dating methods*. University of Groningen. Research Institute SOM.

Copeland, T., Koller, T., Murrin, J. (1994). *Stanovení hodnoty firem.* Praha: Victoria Publishing.

Czesaný, S. (2006). *Hospodářský cyklus: teorie, monitorování, analýza, prognóza*. Praha: Linde.

Czesaný, S. (2007). *Monitorování a analýza hospodářského cyklu.* Praha: CSO. Retrieved from: https://www.czso.cz/csu/czso/monitorovani-a-analyza-hospodarskeho-cyklu-n-iay2xddmch.

Damodaran, A. (2006). *Damodaran on valuation: security analysis for investment and corporate finance*, 2nd ed. Hoboken: John Wiley.

Dvořák, A. (2007). Odhad parametrů pokračující hodnoty v modelu DCF. *Ekonomika a Management*, vol. 2007(1), pp. 1-13.

Jennergen, L. P. (2008). Continuing value in firm valuation by the discounted cash flow model. *European Journal of Operational Research*, vol. 185(3), pp. 1548-1563.

Keulneer, L., Verhoog, W. (2003). *Recent trends in valuation: from strategy to value*. Chichester: John Wiley & Sons Ltd.

Koller, T., Goedhart, M., Wessels, D. (2010). *Valuation: measuring and managing the value of companies*, 5th ed. Hoboken: John Wiley & Sons.

Mařík, M. (2011). *Metody oceňování podniku: proces ocenění – základní metody a postupy.* Praha: Ekopress.

Mařík, M., Maříková, P. (2011a). Slabší místa v ocenění českých podniků – 1. Část. *Odhadce a oceňování podniku.* No. 2, Year XVII, pp. 21-31.

Mařík, M., Maříková, P. (2011b). Slabší místa v ocenění českých podniků – 2. Část. *Odhadce a oceňování podniku*. No. 3-4, Year XVII, pp. 26-35.

Mařík, M., Maříková, P. (2007). *Diskontní míra pro výnosové oceňování podniku*. Praha: Oeconomica.

Mařík, M., Maříková, P. (2006). Rentabilita investic a pokračující hodnota při oceňování podniku*. Soudní inženýrství*. No 4, Year 17, pp. 189-198.

MF CR (2013). *Příprava Makroekonomické predikce – pohled do zpětného zrcátka.* Retrieved from: https://www.mfcr.cz/cs/verejny-sektor/makroekonomika/makroekonomicka-predikce/2018/makroekonomicka-predikce-cervenec-2018-32565.

Režňáková, M., Putnová, A., Videcká, Z. (2013). Sensitivity of business valuation to changes in valuation parameters. In: *Proceedings of the 8th International Conference on New Horizons in Industry, Business and Education*. Crete, pp. 309-314.

# Importance of VAT in Government Budgets

**Zdeněk Strmiska[1], Jana Vodáková[2]**

Masaryk University
Faculty of Economics and Administration
Department of Finance
Lipová 41a, 602 00 Brno, Czech Republic
[1]E-mail: strm@mail.muni.cz
[2]E-mail: Jana.Vodakova@econ.muni.cz

***Abstract:*** *Value added tax (VAT) is one of the most important government revenue sources globally. It is especially significant for the European Union countries known for above average public expenditure. This article aims to analyze importance of VAT in government budgets of the European Union countries and investigate various factors that can influence VAT revenue. VAT significance can depend on various circumstances, for instance on the level of economic development, fiscal policy, tax policy etc. One of the important aspects related to VAT revenue is VAT Gap. It measures revenue loss due to tax avoidance, fraud, evasion and due to bankruptcies, financial insolvencies or miscalculations. We compare European Union countries according to selected criteria and aim to analyze reasons behind VAT importance among government revenue sources. Data about taxation are mainly provided by Eurostat. VAT Gap report published by European Commission is used for data about VAT Gap and certain other VAT information. We use regression analysis to assess impact of VAT Gap, VAT rates, GDP per capita and geographical location on VAT revenues.*

*Keywords: value added tax, government revenues, VAT to GDP ratio, tax rate, effective tax rate, VAT Gap*

*JEL codes: H20, H71*

## 1 Introduction

There are many definitions of VAT. One of the more general is by Ebrill (2001): *"A broad-based tax levied on commodity sales up to and including, at least, the manufacturing stage, with systematic offsetting of tax charged on commodities purchased as inputs-except perhaps on capital goods-against that due on outputs."*

Such a broad definition indicates substantial differences between individual countries. The concept of "ideal VAT" is generally followed but many modifications are made in practice (James, 2015). VAT is not the same tax everywhere and is considerably modified in implementation processes to serve specific policy needs.

Although these policy needs differ, the ultimate reason for the VAT implementation is to increase government revenue. And VAT appears to be quite an efficient tool or at least more efficient than other available options (Keen and Lockwood, 2006).

VAT was harmonized across the European Union in order to remove barriers in the single market. The European Union issued several directives which form the basis of the VAT system in every member state (for details see e.g. Andrejovská and Mihóková, 2015). But a concept of VAT is not identical in all member states. Although the structure is basically the same, there are many important differences, ranging from different rates on various products to specific anti-avoidance measures.

These differences are reflected in the importance (or share) of VAT in government budgets of respective countries. Share of VAT on the total taxation stretches from 14 % in Italy to 34 % in Croatia. Comparison of VAT to GDP is no less divergent: from 4.7 % in Ireland to 12.9 % in Croatia (Eurostat, 2018).

This paper aims to analyze factors behind so major divergence. It can be because of the wide range of standard VAT rates which are capped by European Union only on the downside (rates must be no less than 15 % as stated in Article 97 of Council Directive

2006/112/EC). Or it can reflect success of respective countries in their struggle against tax evasion. It may also depend on the tax culture. For example, northern European countries could aim to maximize VAT revenue to finance their vast welfare states. Or southern countries, under pressure from international creditors, could focus on VAT to balance their budgets and limit the level of public debt.

## 2 Methodology and Data

We use primarily data on taxation available from European Commission regarding Taxation and Customs Union. European Commission provides detailed data about the tax revenues and various relevant indicators, for example ratios of individual taxes to GDP and their share in the tax revenue of a specific country. Data relevant for our research cover year 2016, the last year for which the complete data are currently available.

### Regression analysis

We decided to use an ordinary least squares (OLS) model to identify influence of various factors on the government VAT revenue. We use two models in our research with VAT to GDP and VAT to the total tax revenue as dependent variables. Potential heteroscedasticity of the data was tested by Breusch-Pagan and White's tests. No heteroscedasticity was indicated with p-values of both tests comfortably higher than 0.10. Residuals appear to be normally distributed.

### Model Specification

The connections and relationships between variables are studied by regression analysis. Regressors in both models are equivalent, the dependent variables are ratios of VAT to GDP and VAT to the total tax revenue.

$$VAT\ to\ GDP = constant + \beta_1(VAT\ Gap) + \beta_2(VAT\ standard\ rate) + \beta_3(VAT\ effective\ rate) + \beta_4(GDP\ per\ capita\ in\ PPP) + \beta_5(Eastern\ EU) + \beta_6(Southern\ EU) + \beta_7(Northern\ EU) \quad (1)$$

$$VAT\ to\ taxation = constant + \beta_1(VAT\ Gap) + \beta_2(VAT\ standard\ rate) + \beta_3(VAT\ effective\ rate) + \beta_4(GDP\ per\ capita\ in\ PPP) + \beta_5(Eastern\ EU) + \beta_6(Southern\ EU) + \beta_7(Northern\ EU) \quad (2)$$

The VAT Gap represents the degree of tax evasion and standard VAT rate and effective rate are applied to reflect different rate structure across the European Union. GDP was added to measure economic development. Eastern EU, Southern EU and Northern EU are groups of countries with certain common characteristics. Applied regressors are discussed in a more detail below.

### VAT Gap

A comprehensive review of general tax gap and the VAT gap principles is provided by Nerudova and Dobranschi (2019). It is an important measure of tax compliance. Although there is some diversity in calculation techniques among institutions dealing with the tax gap, it generally represents the difference between the taxes collected and taxes owed to the public budget. Some authors compare tax that is reported and paid voluntarily to the tax owed (Andreoni et al., 1998). The tax evasion may be estimated by two basic methods: micro or bottom up and macro or top down. Bottom up methods are better suited for studying direct taxes while top down estimates are generally preferred for indirect taxes (Stavjaňová, 2014).

We will use definition adopted by Institute for Advanced Studies and European Commission in the VAT Gap Report (2018): The VAT Gap is defined as the difference between the VAT total tax liability, sometimes also known as VAT total theoretical liability, and the amount of VAT collected. VAT Gap report authors selected top-down approach and the VAT liability is computed from national accounts data, e.g. supply and use tables, household, government, and non-profit institutions expenditures. Non-

deductible VAT from intermediate consumption and gross fixed capital formation of exempt industries is taken into consideration. Other country-specific tax regulations are considered such as VAT thresholds, non-deductible business expenditures on food, drinks and accommodation etc.

**VAT rates**

*VAT standard rate* is simply the basic rate applied in the country. Although a significant number of countries have one or two reduced rates, these can be applied only on selected goods and services and their scope is limited.

*VAT effective rate* contains effects of distinct VAT rates on products and services and exemption of certain items in line with respective legislation. The output of a given sector that is exempt from VAT is estimated for each type of consumption. For instance, some education services are exempt from VAT in the European Union countries. Therefore, the rates in household, government, and non-profit organizations final consumption of educational services must be estimated and taken into account. The figures used in this paper are obtained from VAT Gap Report (2018) which uses national accounts data and VAT statements provided by member states to the European Commission and in several specific cases, where this information was insufficient, additional data provided by member states.

**GDP per capita**

We use data by IMF (2018). The GDP in our research is used as a regressor to asses economic development of the respective countries. Therefore, the data are in purchasing power parity (PPP) to better compare relative level of development in the countries with diverse currency exchange rates.

**Geographical location**

Countries vary in the way the state is economically organized, what type of taxation they choose to rely upon and the extension of a welfare state. The differences are based on history, culture, people's desires and other factors. For example, the northern European states are known for more generous welfare states and higher reliance on regressive taxation including consumption taxes and VAT (Kato, 2003). Similar conclusions may be reached when investigating taxation in eastern Europe (lower reliance on income tax, higher on taxation of consumption) or southern Europe. We want to cover a wide economical difference between countries and, with some degree of necessary simplification, to assess whether the importance of VAT may depend on preferences in the selected countries.

Eastern EU consists mainly of countries that were part of the former Eastern Bloc: Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, Slovenia.

Southern EU countries in our research are Croatia, Cyprus, Greece, Italy, Malta, Portugal and Spain.

Northern EU countries are Denmark, Finland and Sweden.

The table below summarizes the relevant data:

**Table 1** Selected data

| | VAT to GDP | VAT to Taxation | VAT Gap | VAT standard rate | VAT effective rate | GDP / capita (PPP) |
|---|---|---|---|---|---|---|
| **Austria** | 7.7 | 18.26 | 7.30 | 20.0 | 11.1 | 48 013 |
| **Belgium** | 6.8 | 15.27 | 9.68 | 21.0 | 10.1 | 45 124 |
| **Bulgaria** | 9.2 | 31.68 | 13.56 | 20.0 | 14.2 | 20 453 |
| **Croatia** | 12.9 | 34.09 | 1.15 | 25.0 | 15.9 | 23 362 |
| **Cyprus** | 9.0 | 27.31 | 10.28 | 19.0 | 10.7 | 35 220 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Czech Rep.** | 7.4 | 21.33 | 14.19 | 21.0 | 12.7 | 33 529 |
| **Denmark** | 9.5 | 20.63 | 8.51 | 25.0 | 14.4 | 48 338 |
| **Estonia** | 9.1 | 27.15 | 6.78 | 20.0 | 13.0 | 29 684 |
| **Finland** | 9.1 | 20.70 | 7.98 | 24.0 | 12.4 | 42 408 |
| **France** | 6.9 | 15.14 | 11.92 | 19.6 | 9.7 | 42 366 |
| **Germany** | 6.9 | 17.86 | 9.39 | 19.0 | 10.6 | 48 532 |
| **Greece** | 8.1 | 20.98 | 29.22 | 24.0 | 12.4 | 26 844 |
| **Hungary** | 9.3 | 23.65 | 13.33 | 27.0 | 14.9 | 27 770 |
| **Ireland** | 4.7 | 19.95 | 11.15 | 23.0 | 11.7 | 69 248 |
| **Italy** | 6.1 | 14.38 | 25.90 | 22.0 | 10.2 | 36 877 |
| **Latvia** | 8.1 | 26.10 | 11.27 | 21.0 | 11.5 | 25 725 |
| **Lithuania** | 7.8 | 26.24 | 24.52 | 21.0 | 17.1 | 30 097 |
| **Luxembourg** | 6.5 | 17.00 | 0.85 | 17.0 | 12.2 | 103 286 |
| **Malta** | 7.0 | 22.05 | 2.71 | 18.0 | 10.3 | 39 510 |
| **Netherlands** | 6.8 | 17.58 | 4.00 | 21.0 | 10.2 | 51 248 |
| **Poland** | 7.2 | 21.55 | 20.80 | 23.0 | 11.9 | 27 741 |
| **Portugal** | 8.5 | 24.78 | 10.16 | 23.0 | 11.3 | 29 042 |
| **Romania** | 6.4 | 24.96 | 35.88 | 20.0 | 13.5 | 22 369 |
| **Slovakia** | 6.7 | 20.73 | 25.68 | 20.0 | 16.1 | 31 403 |
| **Slovenia** | 8.2 | 22.36 | 8.04 | 22.0 | 12.0 | 32 215 |
| **Spain** | 6.5 | 19.35 | 2.71 | 21.0 | 8.5 | 36 443 |
| **Sweden** | 9.2 | 20.88 | 1.08 | 25.0 | 13.4 | 49 995 |
| **United Kingdom** | 6.8 | 20.26 | 11.67 | 20.0 | 9.3 | 42 838 |

Source: Authors' construction based on Eurostat (2018), VAT Gap Report (2018), IMF (2018)

## 3 Results and Discussion

The VAT importance in government budgets depends on several criteria. Above we discussed possible causes that determine the importance of VAT revenues in the economy and the public budgets. To measure the relative importance of VAT we opted for available data about rate of VAT to GDP and rate of VAT to total tax revenue.

The impact of selected regressors is summarized in tables below.

**Table 2** Ordinary least squares model 1 (VAT to GDP)

| | **Coefficient** | **Std. Error** | **t-ratio** | **p-value** | |
|---|---|---|---|---|---|
| constant | 4.65898 | 2.09866 | 2.220 | 0.0381 | ** |
| VAT Gap | −0.102194 | 0.0216195 | −4.727 | 0.0001 | *** |
| VAT standard rate | −0.0049153 | 0.0871108 | −0.05643 | 0.9556 | |
| VAT effective rate | 0.550559 | 0.130294 | 4.226 | 0.0004 | *** |
| GDP per capita (PPP) | −5.4431e-05 | 1.66938e-05 | −3.261 | 0.0039 | *** |
| Eastern EU | −0.727738 | 0.755901 | −0.9627 | 0.3472 | |
| Southern EU | 0.581155 | 0.509303 | 1.141 | 0.2673 | |
| Northern EU | 0.503548 | 0.795084 | 0.6333 | 0.5337 | |

| | | | |
|---|---|---|---|
| R-squared | 0.797281 | Adjusted R-squared | 0.726329 |
| F(7, 20) | 11.23695 | P-value(F) | 1.00e-05 |

Source: Authors' calculation of the model based on Eurostat (2018), VAT Gap Report (2018), IMF (2018)

**Table 3** Ordinary least squares model 2 (VAT to total tax revenue)

| | Coefficient | Std. Error | t-ratio | p-value | |
|---|---|---|---|---|---|
| constant | 21.1527 | 7.22698 | 2.927 | 0.0083 | *** |
| VAT Gap | −0.220508 | 0.0744496 | −2.962 | 0.0077 | *** |
| VAT standard rate | −0.359326 | 0.299977 | −1.198 | 0.2450 | |
| VAT effective rate | 1.15265 | 0.448685 | 2.569 | 0.0183 | ** |
| GDP per capita (PPP) | −0.0001208 | 5.74872e-05 | −2.102 | 0.0485 | ** |
| Eastern EU | 2.70398 | 2.60304 | 1.039 | 0.3113 | |
| Southern EU | 2.99677 | 1.75385 | 1.709 | 0.1030 | |
| Northern EU | −0.0316772 | 2.73797 | −0.01157 | 0.9909 | |

| | | | |
|---|---|---|---|
| R-squared | 0.735838 | Adjusted R-squared | 0.643381 |
| F(7, 20) | 7.958732 | P-value(F) | 0.000118 |

Source: Authors' calculation of the model based on Eurostat (2018), VAT Gap Report (2018), IMF (2018)

First of all, both models have a rather high R-squared and adjusted R-squared. This means that the models interpret a substantial part of VAT to GDP and VAT to total taxation variance.

The impact of the regressors is as follows:

The VAT Gap affects the VAT revenue as expected. The higher the VAT Gap, the lower the VAT significance among other tax sources and the lower the ratio of VAT to GDP. While this relationship is hardly surprising, it has profound implications. Lower VAT importance in government budget may not be the result only of a taxation preference (i.e. that state prefers direct taxes or selective consumption taxes to the general taxation of consumption) but also of inability to tackle VAT evasion. Because VAT tends to be reliable source of government income, countries would be well advised to focus on tax evasion prevention.

The standard VAT rate appears not to have a statistically significant impact. Attempts to strengthen government revenues solely by raising the VAT standard rate may be misguided. As mentioned above, efforts to tackle the VAT evasion could be more productive.

The effective VAT rate is considerably more sophisticated measure of a VAT rate level (see above) and does have a statistically significant effect on VAT revenues. Higher rates translate to the higher VAT collection.

Perhaps the most unexpected result is a statistically significant impact of GDP per capita. More developed countries (measured by a higher GDP) tend to have relatively lower VAT revenues and not only as a share of total taxation, but also compared to GDP. We would like to further investigate this relationship in the future to asses whether this has any deeper implications.

Geographical location did not show a statistically significant impact.

Although the models perform better than initially expected and appear to explain the VAT importance quite reliably, their power should not be overestimated. Firstly, we use data only for the most recent year available (2016). This substantially limits the robustness of the models and we would like to expand the data range significantly in the prospective research. Secondly, only European Union countries are considered, although VAT is applied around the globe. And finally, the taxation is a very complex area, and this is only a limited way to analyze VAT systems, their benefits and challenges.

## 4 Conclusions

We analyzed the importance of VAT in government budgets based on selected criteria. The results appear to be promising with both models achieving R-squared well above 0.7 as well as high adjusted R-squared (0.73 and 0.64). The analysis identified that the VAT importance among other government revenue sources depends on the VAT effective rate, the VAT Gap and economic development of the country (measured by GDP per capita). Whereas the VAT standard rate and the geographical location did not show a statistically significant impact.

The results confirm that the VAT standard rate alone is not sufficient to measure the VAT importance, the impact on government revenue and the burden on taxpayers. There are other important characteristics of a VAT system, notably the structure and application of reduced rates, VAT thresholds, exemptions and last but not least the VAT evasion.

The states trying to improve their VAT revenue would probably earn more by focusing on the VAT evasion and closely looking at the structure of their VAT systems than by simply raising the standard VAT rate.

We aim to expand our research in the future to contain more years and possibly, if reliable data are available, more countries.

## Acknowledgments

Support of Masaryk University within the project MUNI/A/1102/2018 is gratefully acknowledged.

## References

Andrejovská A., Mihóková L. (2015). Developments of VAT Rates in EU Countries in the Context of Harmonization and Fiscal Consolidation. *Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis*, vol. 63(2), pp. 487–498.

Andreoni, J., Feinstein, J., Erard, B. (1998). Tax Compliance*. Journal of Economic Literature*. vol. 36, pp. 818-860.

Council Directive 2006/112/EC of 28 November 2006 on the common system of value added tax.

Ebrill, L. P. (2001). *The Modern VAT*. Washington, D.C.: International Monetary Fund.

Eurostat (2018). *Data on taxation. Indirect taxes.* Retrieved from: https://ec.europa.eu/taxation_customs/sites/taxation/files/indirect-taxes.xlsx.

IMF (2018). *World Economic and Financial Surveys. World Economic Outlook Database.* Retrieved from: https://www.imf.org/external/pubs/ft/weo/2018/01/weodata/index.aspx

James, K. (2015). *The Rise of the Value-Added Tax*. New York: Cambridge University Press.

Kato, J. (2003). *Regressive Taxation and the Welfare State: Path Dependence and Policy Diffusion*. Cambridge: Cambridge University Press.

Keen, M., Lockwood, B. (2006). Is the VAT a Money Machine? *National Tax Journal*, vol. 59(4), pp. 905-928.

Nerudova D., Dobranschi M. (2019). Alternative method to measure the VAT gap in the EU: Stochastic tax frontier model approach. *PLoS ONE*, vol. 14(1).

Stavjaňová, J. (2014). Value Added Tax Gap in the Czech Republic. *Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis*, vol. 62(6), pp. 1427–1436.

VAT Gap Report (2018). *Study and Reports on the VAT Gap in the EU-28 Member States: 2018 Final Report.* Retrieved from: https://ec.europa.eu/taxation_customs/sites/taxation/files/2018_vat_gap_report_en.pdf.

# Strategic Approaches of SMEs in Economic Performance of E-commerce

**Veronika Svatošová**

Mendel University in Brno
Faculty of Regional Development and International Studies,
Department of Regional and Business Economics
Zemědělská 1665/1, 613 00 Brno, Czech Republic
E-mail: veronika.svatosova@mendelu.cz

***Abstract:*** *The researches and practice declare the strategic key factor of long-term business success is considered to be strategic approach to economic performance along with proposing and implementing financial strategy. The paper deals with the issue of economic performance of SMEs in e-commerce along with their financial strategy. The aim of the research is to evaluate the economic performance of enterprises primarily focused on e-commerce, which affects the financial strategy in e-commerce. The research sample of enterprises involved to the survey is selected based on the following restrictive criteria: headquarter of enterprise in the Czech Republic, legal form of business joint stock company and limited liability company, existence of enterprise in e-commerce minimum 5 years, main business area B2C market. The main research methods are following: methods of personal interviewing among selected enterprises, selected methods of financial analysis and selected methods of statistical induction for verifying stated hypotheses. The main results of paper revealed the level of long-term coverage is the biggest problematic area in the creation and implementation of a financial strategy that reduces the economic performance of e-commerce and type of financial strategy does not correspond to the type of corporate strategy in e-commerce.*

*Keywords: e-commerce, SMEs in e-commerce, financial analysis, methods of statistical inductions, financial strategy in e-commerce, economic performance in e-commerce*

*JEL codes: M20, M21, M29, G30, G39*

## 1 Introduction

In business processes, finance has traditionally been placed at the margin of strategic planning and innovative processes. The changes in finance and accounting change this categorization. The more complex view of financial performance gives rise to a trend towards integration of finance management into strategic management and formulation and implementation of the principal corporate strategy (Smith, 2014, p. 20; Stříteská and Svoboda, 2012; Chmelíková, 2014). Finance and financial policies help managers assess the available alternatives and monitor decisions to be implemented in the corporate practice (Narayanan and Nanda, 2004, p. 6). Financial strategy must hence be seen as a key element of long-term success of business strategy. Corporate practice lacks a complex view of formulation and implementation of financial policies, finance management and financial strategy (Jindřichovská et al., 2013; Karadag, 2015; Mallete, 2006; Nadeem et al., 2018). The paper deals with the issue of economic performance of SMEs in e-commerce along with their financial strategy. Surprisingly enough, a couple of relevant sources deal with financial strategy and economic performance as a whole as well as with financial aspects and financial strategy oriented towards e-commerce. The paper defines general information for definition and aspects of finance management and strategy, further specifying the same for the purpose of application to e-commerce.

## 2 Theoretical Framework

There is the reason for the difference between finance management in traditional and e-commerce enterprises. A study on finance management is very important, especially for sustainable development of e-commerce enterprises. E-commerce is often based on a new business model existing in browser and server applications and offering trading

activities for people all over the world (Li, 2017). Finance management in e-commerce is centralised. A network financial system is the optimum method of centralised finance management as it helps collectively distribute funds across all branches of a large company. Another important level of finance management in e-commerce is coordination of finance and enterprising, significantly facilitated by the current Internet speed (Tu, 2016). Deepening and broadening of research on e-commerce requires updating the traditional theories of corporate finance management. The traditional finance management model was difficult to adapt to the needs of e-commerce, and so it is necessary to investigate finance management options in the e-commerce context, and not only on the theoretical level but also, and mainly, on the level of practical implementation (Lili, 2016). The concept of network financing and implementation of an appropriate strategy is a significant innovation in the theory of corporate finance management. Capital management effectiveness directly determines whether finance management of e-commerce businesses is effective or not, to a large extent influencing success and failure of e-commerce enterprising. Decentralisation of finance management is the main feature of e-businesses prevailingly trading electronically. A shared finance service centre is an important assumption for building e-commence corporate finance (Jia, 2016). In the era of information technologies finance management is influential and should be seen as the basis of corporate governance helping capitalise options of business development. Traditional models of finance management are known: ***centralised type***, ***decentralised type*** and ***type fusion of centralisation and decentralisation***. E-commerce cannot accept these traditional models anymore. The new financial processes have given rise to a new finance management model with significant theoretical background and accounting procedures: a network of financial services creates an environment for financial and governance processes and corporate integration on all levels (Cui, 2016). E-commerce determines two types of financial strategies and objectives of e-shops. The first is the aim to achieve **maximum profit**. Enterprises should reduce their costs and improve their income with the aim to increase profit to be invested on their further development (Tu, 2016). Global companies possess significant advantage in affecting Internet prices of consumer goods thanks to quantity-based cost-saving. Global companies in developed countries, such as Amazon, can use their resources and network scale to easily weaken local markets in developing countries (Broome, 2016). The other financial strategy aims at **maximum corporate value**, including long-term stability of market price maximisation (Tu, 2016). Critical factors of financial success in e-commerce include: *added value, regional focus, expansion, maintenance of geographic flexibility and segmentation, implementation of appropriate technology for critical perception management, provision of exceptional services, creation of an effective lint to and understanding the culture of the local market* (Villa et al., 2018). Depending on the company skills these changes may create new opportunities and offer new challenges such as a shift from manufacturer depending on wholesale companies providing market access to direct dealing with end customers (Broome, 2016).

## 3 Methodology and Data

The aim of the research is to evaluate the current economic performance of enterprises primarily focused on e-commerce, which affects the financial strategy in e-commerce. The paper also deals with the term economic performance, which is defined by the following indicators for the purposes of the research: return on equity (ROE), return on assets (ROA), current (total) liquidity, long-term coverage indicator and total Weighted Average Capital of Cost (WACC), which also serve as input indicators for identifying the current financial strategy in the e-commerce. Economic performance is assessed by other methods of financial analysis, i.e. indicators of profitability, liquidity, debt and activity. To meet the main and partial objectives of the survey, data from the 2011 financial statements are used in comparison with the 2016 financial statements, i.e. the most recent data published by the companies participating in the research (n = 209). The aim of the comparison of selected data is to trace the economic development of selected enterprises over the past five years. To analyze the economic situation of enterprises are

used methods of financial analysis, namely selected methods of profitability, liquidity, activity and debt using ratio and absolute indicators. The results of the financial analysis are also used to identify the financial strategy of enterprises primarily focused on e-commerce. The other data was obtained from questionnaire survey evaluating the strategy in e-commerce (details see Svatošová, 2018).

**Research Sample**

The research sample of enterprises was identified according to the following criteria: Enterprises belonging to the category: **SMEs primarily focused on e-commerce** (affiliated stone shops) - defined as e-shops or e-malls. Small and medium-sized enterprises are then compared to large enterprises. Enterprises that **trade mainly through websites**. Enterprises selling predominantly on the **B2C market**. Enterprises **offering physical products** (the most visible segment in the online market, online services not included, difficult to identify and measurable for the research file). Registered main seat **in the Czech Republic** (enterprises that are only domestic or with a minimum share of foreign capital). Legal form of business**: Joint Stock Company, Limited Liability Company**. Existence of enterprise on the market - at least 7 years (i.e. established in 2011 and earlier). Prerequisite is the **trustworthiness and reliability** of the enterprise (membership in Association for Electronic or certification of customer-verified award by Heuréka.cz). Enterprises that have at least **one or more full-featured e-shop**. Based on the above-mentioned restrictive criteria, the research sample of enterprises consists of 367 enterprises. All enterprises were found in the Commercial Register. All enterprises in the population were addressed by the first phase by telephone (with owners, managers or other responsible persons). Finally, the research sample consists of **209 enterprises** that responded to all inquiries in the questionnaire survey. The return of questionnaires was therefore 56.9% (details see Svatošová, 2018).

## 4 Results and Discussion

The data for the financial analysis were used from the 2011 financial statements in comparison with 2016 published in the Commercial Register. The missing data necessary for the implementation of the research was obtained directly from the enterprises that participated in the questionnaire. The following Table 1 presents summary descriptive statistics (arithmetic mean, median, mode, standard deviation) of selected methods of financial analysis (selected indicators of profitability, liquidity, indebtedness, activity) in 2016 compared to 2011 divided by size of enterprise, see Table 2. For aggregate calculations, the balance sheet and profit and loss statement of primarily e-commerce businesses were used primarily (n = 209). The results of the financial analysis were used as a basis for the identification of the financial strategy of enterprises primarily focused on e-commerce in 2016 compared to 2011. Among the enterprises primarily focused on e-commerce, the significant differences are identified, especially in the size of assets, the equity and debt ratio, as well as profit or loss. In general, smaller enterprises have lower profit rates and lower sales. In both years, current assets in the form of short-term receivables, regardless of their size of enterprises, dominate the total assets of selected enterprises. Liabilities are dominated by short-term liabilities (irrespective of the size of the enterprise in both years under review). In both years, it was shown that the most problematic area is the indicator of long-term coverage irrespective of the size of enterprises, which means that enterprises in e-commerce are undercapitalized in the long term, i.e. the portion of fixed assets is covered by short-term liabilities. This situation in the long term can cause liquidity and liquidity problems that can negatively affect the overall financial condition of enterprises in e-commerce. There is also an unbalanced capital structure, in which short-term liabilities dominate (regardless of the size of enterprises). Enterprises primarily focused on e-commerce are mainly focused on short-term financing, which is closely related to the higher liquidity rate in both years under review (again regardless of the size of enterprises). It was also found that there was a mismatch between the receivables turnover, which is significantly lower than liabilities turnover. This situation can cause cash flow problems and stable short-term financing in e-commerce in the long term. Regardless of their size, enterprises primarily focused on

e-commerce significantly underestimate the long-term financing, which is also evidenced by the long-term debt ratio, which is very low for all enterprises in both years. Enterprises primarily focused on e-commerce focus primarily on ensuring short-term financial stability, but a comprehensive approach to long-term financing and overall financial policy in e-commerce is missing. It is therefore recommended to concentrate in the long term on the increase in the value of long-term liabilities and loans, which should lead to higher value of total assets and profitability, which can be used to investments of enterprises into further development and expansion into other markets, which is the current trend of e-commerce. The overall stable position of enterprises on the market and their stable economic situation makes it possible to increase the value of long-term liabilities in order to fulfill the strategy focused on development. It was also found that there was no significant difference between the general economic results achieved in 2016 compared to 2011. Enterprises primarily focused on e-commerce did not change their approach to finance and financial policy; i.e. higher level of liquidity and lower profitability. This means that based on the findings of the financial analysis, businesses primarily focused on e-commerce should focus on market stabilization. However, this approach does not correspond to the most commonly applied e-commerce strategy focused on development.

**Hypotheses verification**

Hypotheses H1, H2, H3 a H4 are served for complementing the final results of survey. Research hypotheses relate to the type of financial strategy in e-commerce and the type of strategy in e-commerce in relation to their economic performance (for more details see Svatošová, 2018). Hypothesis verification is performed at the significance level $\alpha = 0.05$. The rejection or non-rejection of the verified hypothesis is decided on the basis of p-value comparison, which is the minimum level of significance, for which the null hypothesis can be rejected, and the significance levels α. The Shapiro-Wilk test confirmed that the selection does not come from the normal probability distribution at the significance level $\alpha = 0.05$, since $p \leq \alpha$. Since the normality condition is not met, parametric tests cannot be used. Hypothesis verification is performed by using Statistica program (Kubanová, 2004). ***H1: There is no relationship between the type of financial strategy and the size of enterprises in e-commerce.*** This hypothesis is verified by Kruskal-Wallis test. Since $p>\alpha$, i.e. $p=0.4782$, we do not reject the hypothesis. Therefore, there is no correlation between the type of financial strategy in e-commerce and the size of selected enterprises. ***H2: There is no relationship between the type of financial strategy and the size of the assets of enterprises in e-commerce.*** This hypothesis is verified by Kruskal-Wallis test. Since $p>\alpha$, i.e. $p=0.6864$, we do not reject the hypothesis. Therefore, there is no relationship between the type of financial strategy in e-commerce and the size of the assets of selected enterprises. ***H3: The level of long-term coverage is the biggest problematic area in the creation and implementation of a financial strategy that reduces the economic performance of e-commerce***. This hypothesis is verified by financial analysis and by the financial strategy model in the Vensim program (for more details see Svatošová, 2018). When evaluating the economic performance indicators, the lowest rate is achieved in long-term coverage in all surveyed enterprises. This indicator is almost in all cases lower than 0.95, especially in comparison with other financial performance indicators, which are characterized by higher evaluation variability. Therefore, we do not reject this hypothesis and it can be stated that the indicator of long-term coverage is the biggest problematic area of enterprises in e-commerce. ***H4: The type of financial strategy in e-commerce, i.e. rescue, conservative, balanced, aggressive financial strategies, does not correspond to the type of e-commerce strategy, focusing on quality, stabilization, development, profit maximization or strategy not specified***. This hypothesis is verified by Kruskal-Wallis test. Since $p> \alpha$, i.e. $p = 0.7797$, we do not reject the hypothesis. Therefore, it can be stated that the type of financial strategy does not correspond to the type of strategy in e-commerce. Details about this hypothesis verification see (Svatošová, 2018).

**Table 1** Results of Selected Methods of Financial Analysis for 2016 by Size of Enterprises

| 2016 | ROA | ROE | Current liquidity | Quick liquidity | Cash liquidity | Interest coverage | Long-term coverage | Working capital | Equity ratio | Debt ratio | Short-term indebtedness | Long-term indebtedness | Current Assets ratio | Fixed Assets ratio |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Enterprises total - 209 enterprises** | | | | | | | | | | | | | | |
| **Total mean** | 0,06 | 0,17 | 1,40 | 0,72 | 0,25 | 6,52 | 0,52 | 57761,42 | 0,33 | 0,66 | 0,47 | 0,17 | 0,66 | 0,33 |
| **Total median** | 0,04 | 0,13 | 2,46 | 1,52 | 0,41 | 275,06 | 0,31 | 19695,00 | 0,30 | 0,52 | 0,33 | 0,01 | 0,81 | 0,14 |
| **Total mode** | 0,03 | 0,12 | 0,00 | 0,00 | 0,00 | 0,00 | 0,26 | 31837,00 | 0,26 | 0,74 | 0,00 | 0,00 | 0,92 | 0,00 |
| **Total minimum** | -337,18 | 0,84 | 0,00 | 0,00 | 0,00 | 0,00 | -403,57 | 377,00 | -403,6 | 0,01 | 0,00 | 0,00 | 0,97 | 0,00 |
| **Total maximum** | 0,05 | 0,35 | 0,97 | 0,36 | 0,24 | 2,36 | 0,78 | -135639,0 | 0,14 | 0,86 | 0,32 | 0,61 | 0,31 | 0,78 |
| **Standard deviation** | 0,90 | 1,57 | 0,54 | 0,11 | 0,53 | 1,99 | 2,81 | -498988,4 | 0,57 | 0,90 | 1,45 | 1,48 | 0,79 | 0,83 |
| **Micro enterprises (up to 10 employees) –51 enterprises** | | | | | | | | | | | | | | |
| **Total mean** | 0,08 | 0,10 | 3,18 | 2,00 | 1,16 | 379,69 | 0,83 | 9984,90 | 0,78 | 0,20 | 0,15 | 0,05 | 0,49 | 0,49 |
| **Total median** | 0,09 | 0,31 | 2,40 | 1,57 | 0,78 | 0,00 | 0,28 | 3173,00 | 0,27 | 0,57 | 0,41 | 0,04 | 0,77 | 0,07 |
| **Total mode** | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| **Total minimum** | -0,86 | 0,11 | 0,00 | 0,00 | 0,00 | 0,00 | -8,10 | 595,00 | -8,10 | 0,48 | 0,00 | 0,00 | 0,57 | 0,00 |
| **Total maximum** | 0,03 | 0,03 | 5,62 | 2,74 | 2,42 | 1603,10 | 0,99 | 167509 | 0,97 | 0,04 | 0,04 | 0,01 | 0,24 | 0,76 |
| **Standard deviation** | 0,04 | 0,04 | 4,76 | 2,50 | 2,04 | 1217,42 | 1,00 | 24899,46 | 0,97 | 0,05 | 0,05 | 0,02 | 0,27 | 0,76 |
| **Small enterprises (up to 50 employees) –85 enterprises** | | | | | | | | | | | | | | |
| **Total mean** | 0,09 | 0,27 | 1,52 | 0,88 | 0,40 | 24,72 | 0,43 | 14679,61 | 0,33 | 0,64 | 0,54 | 0,09 | 0,82 | 0,16 |
| **Total median** | 0,04 | 0,12 | 1,84 | 0,98 | 0,42 | 0,00 | 0,00 | 8347,00 | 0,33 | 0,51 | 0,34 | 0,03 | 0,57 | 0,10 |
| **Total mode** | 0,01 | 0,02 | 0,00 | 0,00 | 0,00 | 0,00 | 0,26 | 31837,00 | 0,26 | 0,74 | 0,68 | 0,00 | 0,92 | 0,00 |
| **Total minimum** | -19,07 | 0,18 | 0,00 | 0,00 | 0,00 | 0,00 | -104,37 | 377,00 | -104,3 | 0,13 | 0,00 | 0,00 | 0,97 | 0,00 |
| **Total maximum** | 0,10 | 0,40 | 0,95 | 0,76 | 0,38 | 13,08 | 0,38 | -30096,00 | 0,24 | 0,97 | 0,90 | 0,07 | 0,93 | 0,11 |
| **Standard deviation** | 0,12 | 0,39 | 0,99 | 0,67 | 0,39 | 35,26 | 0,48 | -782,87 | 0,32 | 0,91 | 0,84 | 0,11 | 0,91 | 0,18 |

| 2016 | ROA | ROE | Current liquidity | Quick liquidity | Cash liquidity | Interest coverage | Long-term coverage | Working capital | Equity ratio | Debt ratio | Short-term indebtedness | Long-term indebtedness | Current Assets ratio | Fixed Assets ratio |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Medium-sized enterprises (up to 250 employees) – 41 enterprises** | | | | | | | | | | | | | | |
| **Total mean** | 0,08 | 0,25 | 1,55 | 0,79 | 0,42 | 9,01 | 0,45 | 52562,80 | 0,32 | 0,66 | 0,53 | 0,11 | 0,83 | 0,15 |
| **Total median** | 0,05 | 0,15 | 1,85 | 0,74 | 0,16 | 19,24 | 0,36 | 50236,00 | 0,34 | 0,62 | 0,49 | 0,02 | 0,78 | 0,10 |
| **Total mode** | -0,02 | 0,00 | 0,00 | 0,19 | 0,05 | 0,00 | 0,00 | 6515,00 | 0,00 | 0,00 | 0,81 | 0,00 | 0,87 | 0,08 |
| **Total minimum** | -2,89 | 0,78 | 0,00 | 0,00 | 0,00 | 0,00 | -3,68 | 20112,00 | -3,68 | 0,50 | 0,36 | 0,00 | 0,71 | 0,05 |
| **Total maximum** | 0,42 | 0,91 | 0,90 | 0,58 | 1,43 | 13,01 | 0,87 | -65170,00 | 0,47 | 0,86 | 0,85 | 0,27 | 0,97 | 0,36 |
| **Standard deviation** | 0,33 | 0,64 | 1,02 | 0,73 | 1,12 | 29,16 | 0,88 | 2418,73 | 0,52 | 0,80 | 0,72 | 0,26 | 0,92 | 0,28 |
| **Large enterprises (up to 500 employees) – 12 enterprises** | | | | | | | | | | | | | | |
| **Total mean** | 0,11 | 0,18 | 2,28 | 1,35 | 0,71 | 79,23 | 0,68 | 346239,0 | 0,58 | 0,41 | 0,31 | 0,05 | 0,71 | 0,27 |
| **Total median** | 0,14 | 0,20 | 3,47 | 2,37 | 0,57 | 0,00 | 0,72 | 333213,5 | 0,70 | 0,45 | 0,30 | 0,01 | 0,89 | 0,18 |
| **Total mode** | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| **Total minimum** | 0,01 | 0,01 | 697,33 | 697,33 | 54,00 | 0,00 | 1,00 | 2089,00 | 1,00 | 0,00 | 0,00 | 0,00 | 1,00 | 0,00 |
| **Total maximum** | 0,18 | 0,22 | 1,38 | 0,74 | 0,74 | 18,82 | 1,18 | 498511,0 | 0,84 | 0,74 | 0,65 | 0,09 | 0,90 | 0,39 |
| **Standard deviation** | 0,18 | 0,22 | 1,38 | 0,74 | 0,74 | 18,82 | 1,18 | 248211,0 | 0,84 | 0,74 | 0,65 | 0,09 | 0,90 | 0,40 |
| **Large enterprises (500 + employees) – 20 enterprises** | | | | | | | | | | | | | | |
| **Total mean** | 0,03 | 0,14 | 1,20 | 0,57 | 0,12 | 3,82 | 0,48 | 200259,8 | 0,24 | 0,74 | 0,50 | 0,23 | 0,60 | 0,38 |
| **Total median** | 0,02 | 0,07 | 1,49 | 0,89 | 0,07 | 7,45 | 0,24 | 343108,0 | 0,23 | 0,53 | 0,51 | 0,01 | 0,77 | 0,10 |
| **Total mode** | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| **Total minimum** | -4,69 | 0,84 | 0,52 | 0,30 | 0,16 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| **Total maximum** | 0,05 | 0,35 | 0,97 | 0,36 | 0,16 | 2,36 | 0,76 | -135639,0 | 0,14 | 0,86 | 0,26 | 0,60 | 0,31 | 0,78 |
| **Standard deviation** | 0,06 | 0,32 | 0,85 | 0,29 | 0,15 | 2,75 | 0,84 | -171497,6 | 0,19 | 0,88 | 0,35 | 0,62 | 0,35 | 0,80 |

Source: own processing based on financial statements of selected enterprises

**Table 2** Results of Selected Methods of Financial Analysis for 2011 by Size of Enterprises

| 2011 | ROA | ROE | Current liquidity | Quick liquidity | Cash liquidity | Interest coverage | Long-term coverage | Working capital | Equity ratio | Debt ratio | Short-term indebtedness | Long-term indebtedness | Current Assets ratio | Fixed Assets ratio |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Enterprises total - 209 enterprises** | | | | | | | | | | | | | | |
| **Total mean** | 0,05 | 0,10 | 1,32 | 0,92 | 0,72 | 2,48 | 0,56 | 27184,09 | 0,50 | 0,50 | 0,44 | 0,05 | 0,58 | 0,42 |
| **Total median** | 0,05 | 0,19 | 2,02 | 1,19 | 0,64 | 0,00 | 0,00 | 6276,50 | 0,25 | 0,57 | 4,37 | 0,53 | 0,64 | 0,13 |
| **Total mode** | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,07 | 100,00 | 0,07 | 0,00 | 0,00 | 0,00 | 0,02 | 0,00 |
| **Total minimum** | -1512,7 | 4,18 | 0,00 | 0,00 | 1,22 | 442,60 | -375,70 | 48,00 | -362,01 | 0,00 | 0,00 | -13,04 | 0,57 | 0,00 |
| **Total maximum** | 0,06 | 0,13 | 0,39 | 0,30 | 0,34 | 1,35 | 0,53 | -2900196 | 0,43 | 0,77 | 0,72 | 0,06 | 0,32 | 1,00 |
| **Standard deviation** | 0,73 | 1,31 | 0,66 | 0,10 | 0,63 | 1,97 | 2,43 | -171313,87 | 0,55 | 0,73 | 0,35 | 0,25 | 0,82 | 0,85 |
| **Micro enterprises (up to 10 employees) –51 enterprises** | | | | | | | | | | | | | | |
| **Total mean** | 0,07 | 0,25 | 1,57 | 2,09 | 2,03 | 1345,19 | 0,45 | 5316,16 | 0,29 | 0,70 | 0,55 | 0,12 | 0,85 | 0,14 |
| **Total median** | 0,05 | 0,18 | 3,34 | 2,37 | 1,32 | 0,00 | 0,27 | 2289,00 | 0,27 | 0,56 | 0,56 | 0,00 | 0,84 | 0,09 |
| **Total mode** | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| **Total minimum** | -14,02 | 0,56 | 0,00 | 0,00 | 0,00 | 0,00 | -25,89 | 84,00 | -25,24 | 0,00 | 0,00 | 0,00 | 1,00 | 0,00 |
| **Total maximum** | 0,05 | 0,19 | 1,69 | 1,76 | 2,11 | 532,58 | 0,64 | 130883,00 | 0,28 | 0,72 | 0,58 | 0,24 | 0,98 | 0,16 |
| **Standard deviation** | 0,06 | 0,24 | 1,56 | 1,97 | 2,21 | 646,27 | 0,55 | 17955,79 | 0,25 | 0,77 | 0,56 | 0,20 | 0,91 | 0,15 |
| **Small enterprises (up to 50 employees) –85 enterprises** | | | | | | | | | | | | | | |
| **Total mean** | 0,06 | 0,17 | 1,37 | 0,98 | 0,81 | 65,06 | 0,45 | 6918,64 | 0,35 | 0,64 | 0,55 | 0,09 | 0,75 | 0,24 |
| **Total median** | 0,03 | 0,13 | 1,80 | 0,97 | 0,60 | 0,00 | 0,24 | 4194,00 | 0,24 | 0,66 | 0,54 | 0,01 | 0,71 | 0,12 |
| **Total mode** | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 21746,00 | 0,00 | 1,00 | 1,00 | 0,00 | 0,99 | 0,00 |
| **Total minimum** | -223,52 | 1,47 | 0,00 | 0,00 | 0,00 | 0,00 | -157,52 | 100,00 | -152,05 | 0,08 | 0,08 | -5,48 | 0,50 | 0,00 |
| **Total maximum** | 0,25 | 0,48 | 1,16 | 1,07 | 1,26 | 19,54 | 0,81 | 31983,00 | 0,53 | 0,77 | 0,67 | 0,18 | 0,92 | 0,50 |
| **Standard deviation** | 0,18 | 0,39 | 1,10 | 0,88 | 0,95 | 39,22 | 0,67 | 3853,91 | 0,46 | 0,70 | 0,61 | 0,13 | 0,79 | 0,34 |

| 2011 | ROA | ROE | Current liquidity | Quick liquidity | Cash liquidity | Interest coverage | Long-term coverage | Working capital | Equity ratio | Debt ratio | Short-term indebtedness | Long-term indebtedness | Current Assets ratio | Fixed Assets ratio |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Medium-sized enterprises (up to 250 employees) – 41 enterprises** | | | | | | | | | | | | | | |
| **Total mean** | 0,08 | 0,20 | 1,60 | 0,90 | 0,80 | 1,27 | 0,50 | 38295,90 | 0,39 | 0,60 | 0,49 | 0,09 | 0,80 | 0,19 |
| **Total median** | 0,05 | 0,13 | 3,03 | 1,47 | 0,81 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,01 | 0,78 | 0,09 |
| **Total mode** | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,85 | 0,12 |
| **Total minimum** | -2,37 | -10,50 | 0,00 | 0,00 | 0,00 | 12,02 | 0,23 | 49,00 | 0,23 | 0,00 | 0,00 | 0,00 | 0,03 | 0,00 |
| **Total maximum** | 0,05 | 0,23 | 1,38 | 1,14 | 1,13 | 1,04 | 0,48 | 309004,00 | 0,21 | 0,78 | 0,72 | 0,15 | 0,99 | 0,28 |
| **Standard deviation** | 0,08 | 0,26 | 1,30 | 0,96 | 1,08 | 1,06 | 0,56 | 40657,00 | 0,29 | 0,79 | 0,69 | 0,18 | 0,94 | 0,28 |
| **Large enterprises (up to 500 employees) – 12 enterprises** | | | | | | | | | | | | | | |
| **Total mean** | 0,08 | 0,13 | 1,80 | 2,56 | 2,00 | 6,50 | 0,65 | 175086,17 | 0,61 | 0,39 | 0,35 | 0,03 | 0,62 | 0,38 |
| **Total median** | 0,09 | 0,12 | 4,31 | 3,66 | 2,19 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,01 | 0,66 | 0,36 |
| **Total mode** | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| **Total minimum** | -21,13 | -21,30 | 0,00 | 0,00 | 0,00 | 0,00 | 0,99 | 1931,00 | 0,99 | 0,01 | 0,00 | 0,00 | 1,00 | 0,00 |
| **Total maximum** | 0,09 | 0,11 | 0,73 | 1,24 | 1,91 | 2,95 | 1,01 | -350461,00 | 0,88 | 0,53 | 0,52 | 0,10 | 0,52 | 0,58 |
| **Standard deviation** | 0,08 | 0,13 | 1,80 | 2,56 | 2,00 | 6,50 | 0,65 | 175086,17 | 0,61 | 0,39 | 0,35 | 0,03 | 0,62 | 0,38 |
| **Large enterprises (500 + employees) – 20 enterprises** | | | | | | | | | | | | | | |
| **Total mean** | 0,03 | 0,06 | 1,11 | 0,66 | 0,47 | 42,37 | 0,56 | 58202,55 | 0,51 | 0,49 | 0,44 | 0,05 | 0,48 | 0,51 |
| **Total median** | 0,01 | 0,03 | 2,24 | 1,24 | 0,30 | 0,00 | 0,45 | 262570,00 | 0,44 | 0,28 | 0,22 | 0,00 | 0,53 | 0,22 |
| **Total mode** | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| **Total minimum** | -14,79 | 5,71 | 0,04 | 0,04 | 0,04 | 0,00 | -2,59 | -1239,00 | -2,59 | 3,40 | 0,15 | 0,00 | 0,01 | 0,46 |
| **Total maximum** | 0,06 | 0,13 | 0,42 | 0,30 | 0,34 | 34,88 | 0,53 | -2570475,0 | 0,43 | 0,77 | 0,72 | 0,06 | 0,32 | 1,00 |
| **Standard deviation** | 0,08 | 0,15 | 0,50 | 0,33 | 0,40 | 41,31 | 0,64 | -487924,62 | 0,53 | 0,74 | 0,69 | 0,08 | 0,36 | 0,99 |

Source: own processing based on financial statements of selected enterprises

## 4 Conclusions

Based on the results of the financial analysis, it can be stated that the most problematic area in the two observed years is the indicator of long-term coverage, which means that most of the enterprises primarily focused on e-commerce are undercapitalized in the long term. Furthermore, it was found that no significant differences were observed between the reference years (irrespective of the size of enterprises), meaning that the surveyed enterprises focus on a higher liquidity rate, which is achieved by a higher rate of short-term receivables. There was also a discrepancy between receivables turnover and liabilities receivables, which may cause cash flow problems. To sum up, enterprises primarily focused on e-commerce, regardless of their size, focus on short-term financing; long-term financing focused on development is not taken into account in most cases. This approach affects the overall lower economic performance achieved, which does not correspond to e-commerce strategy focused on development. The analysis and evaluation of economic performance, which was monitored by means of indicators of profitability, liquidity, indebtedness and total capital costs, following the identification of the financial strategy in e-commerce, was carried out with the aim to evaluate the impact of the selected financial strategy in e-commerce on the type of strategy in e-commerce. At the same time, the results of the financial analysis in e-commerce evaluated the overall financial condition of enterprises in e-commerce. It was also found that the size of enterprises does not affect the selection of financial strategy in e-commerce. Thus, the most common type of financial strategy in e-commerce is a conservative financial strategy, i.e. strategy focused on high liquidity and low profitability, which affects economic performance and e-commerce strategy. The conservative financial strategy limits the further strategic development of enterprises primarily focused on e-commerce. It can be stated that the type of financial strategy does not correspond to the type of strategy in e-commerce. In summary, **it is recommended** to change the conservative financial strategy into aggressive financial strategy in e-commerce that is focused on higher level of profitability and lower liquidity that should reflect the corporate e-commerce strategy focused on progression and long-term development. This strategy could be achieved by increasing the volume of long-term liabilities that could be used for obtaining of a needed volume of fixed and current assets usable for fulfilling the purpose of corporate e-commerce strategy. This aggressive financial strategy could also improve the level of long-term coverage, the most problematic issue revealed in financial analysis, the level of financial leverage that could lead to the higher level of profitability and also the overall financial position of enterprises primarily focused on e-commerce.

## Acknowledgments

This paper has been prepared in terms of the project IGA of the Mendel University in Brno titled as "Evaluating the performance of SMEs in the context of regional development" with registration number FRRMS - IGA - 2019/004.

## References

Broome, P. A. (2016). Conceptualizing the foundations of a regional e-commerce strategy: Open networks or closed regimes? The case of CARICOM. *Cogent Business & Management*, vol. 3(1), 1139441. Retrieved from: https://www.cogentoa.com/article/10.1080/23311975.2016.1139441.

Cui, J. (2016). Study on the Dynamic Financial Management Mode under E-commerce Era. *3rd International Conference on Education, Management and Computing Technology*, pp. 264-268, DOI: 10.2991/icemct-16.2016.54. Retrieved from: http://www.atlantis-press.com/php/paper-details.php?id=25853592.

Chmelíková, G. (2014). Capital Structure in Start-up Firms in the Conditions of the Economy. *Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis*. vol. 62(2), pp. 363-372.

Jia, L. (2016). Intelligent Data Mining Algorithm Application in Enterprise Financial Management Strategy Optimization: A E-commerce Perspective. *International Journal of Security and Its Applications*, vol. 10(7), pp. 157-167. Retrieved from: https://apps.webofknowledge.com.

Jindřichovská, I., Ugurlu, E., Kubíčková, D. (2013). Changes in Capital Structure of Czech SMEs: A DynamicPanel Data Approach. *E+M Ekonomika a Management*, vol. 2(3), pp. 36-49.

Karadag, H. (2015). Financial Management Challenges In Small and Medium-Sized Enterprises: A Strategic Management Approach. *Emerging Market Journal*, vol. 5(1), pp. 26-40.

Kubanová, J. (2003). *Statistické metody pro ekonomickou a technickou praxi.* 1. vyd. Pardubice: Univerzita Pardubice.

Li, Y. (2017) Analysis on Financial Management of E-commerce Enterprise. *Advances in Social Science, Education and Humanities Research* Atlantis Press, vol. 123, pp. 1180-1183. Retrieved from: https://apps.webofknowledge.com/full_record.do?product=WOS&search_mode=GeneralSearch&qid=1&SID=E2bg4e6l6YUyjcZDdvx&page=1&doc=2.

Lili, J. (2016). Intelligent Data Mining Algorithm Application in Enterprise Financial Management Strategy Optimization: A E-commerce Perspective. *International Journal of Security and Its Applications*, vol. 10(7), pp.157-168. DOI: http://dx.doi.org/10.14257/ijsia.2016.10.7.14.

Mallete, F. (2006). A Framework for Developing Your Financial Strategy. *Corporate Finance Review*, vol. 10(5), pp. 11-20.

Nadeem, A., Abedin, B., Cerpa, N., Chew, E. (2018). Editorial: Digital Transformation & Digital Business Strategy in Electronic Commerce - The Role of Organizational Capabilities. *Journal of Theoretical and Applied Electronic Commerce Research*, vol. 13 (2), pp. 1-8, Retrieved from: http://www.jtaer.com/.

Narayanan, M. P., Nanda, V. K. (2004). *Finance for Strategic Decision-Making*. 1st ed. West Sussex: John Wiley & Sons.

Smith, S. S. (2014). Strategy, Sustainability, and Innovative Financial Reporting. *Journal of Strategic Innovation and Sustainability*, vol. 10(1), pp. 19-23.

Střítestká, M., Svoboda, O. (2012). Survey of Performance Measurement Systems in Czech Companies. *E+M Ekonomie a Management: Economics and Management*, vol. 1, pp. 68-84.

Svatošová, V. (2018). *Význam strategického řízení malých a středních podniků primárně orientovaných na elektronické obchodování*. Habilitation thesis, 2018. Brno: Mendelova univerzita v Brně.

Tu, Y. (2016). Study on the Strategies of Financial Management in E-Commerce Enterprises. *Proceedings of the 2016 International Conference on Education, Management, Computer and Society*, vol. 37, pp. 1350-1352. Retrieved from: https://www.atlantis-press.com/.

Villa, E., Ruiz, L., Valencia, A., Picón, E. (2018). Electronic Commerce: Factors Involved in its Adoption from a Bibliometric Analysis. *Journal of Theoretical and Applied Electronic Commerce Research*, vol. 13(1), pp. 39-70. Retrieved from: https://www.researchgate.net/publication/322190489_Electronic_Commerce_Factors_Involved_in_its_Adoption_from_a_Bibliometric_Analysis/overview.

# Leasing Companies in the Czech Republic from the Perspective of Basel III Regulation

**Martin Svítil**

Soukromá vysoká škola ekonomická Znojmo
Loucká 656/21, 66902 Znojmo
E-mail: svitil.martin@svse.cz

***Abstract:*** *The aim of the paper is to evaluate the situation of leasing financing providers (leasing companies) against the rules of capital adequacy, especially the newly prepared rules of 2017 Basel III regulatory framework (sometimes called Basel IV), that should enter into force between 2022 and 2027. In the first part, the article summarizes the opinion of leasing companies associated in the European Federation of Leasing Company Associations Leaseurope on the new capital adequacy rules of Basel III. This opinion is based on the theoretical basis of risk management (especially credit risk) in leasing, as well as on several empirical studies conducted with real data sets. These studies and their results are discussed in more detail in the article. The results clearly show that the risk associated with the provision of foreign capital through leasing is significantly lower than the risk calculated by the capital adequacy calculation for Basel III rules. This is confirmed by several other sources mentioned in the text. The second part of the article focuses on the situation in the Czech Republic. It is based on publicly available data on the largest leasing companies operating on the Czech market and shows the state of their capital adequacy on simplified indicators of the ratio of Equity / Balance sheet total and Equity / Receivables. As a complementary indicator, the ratio of Share capital / Balance sheet total is also used. Furthermore, a simplified stress test based on 5% resp. 10% decline in net receivables and coverage of this decline from equity was performed. The results show that although Leaseurope's objections to Basel III rules applicable to leasing companies are justified, leasing companies operating in the Czech Republic would - with some minor exceptions - probably have no serious problems with their fulfillment.*

*Keywords: Leasing, Basel III, capital, regulatory capital*

*JEL codes: G23, G32, G38*

## 1 Introduction

The aim of the paper is to evaluate the status of leasing financing providers (leasing companies) against the rules of capital adequacy, especially the newly prepared rules of 2017 Basel III regulatory framework (sometimes called Basel IV), that should enter into force between 2022 and 2027. The paper aims to summarize, on the one hand, the opinion of the European Federation of Leasing Company Associations Leaseurope. On the other hand, it aims to focus on assessing the situation of the largest leasing companies on the Czech market by using methods of financial analysis.

Leasing financing has long been a common and popular way of acquiring foreign capital for businesses throughout Europe, including the Czech Republic.

According to the European Federation of Leasing Company Associations **Leaseurope** (Leaseurope, 2019), its members provided funding of EUR 384,1 billion (of which EUR 14,7 billion in real estate financing) in 2017 for all products provided. Of this, net leasing financing without related products for 2017 accounted for EUR 291,6 billion (+ 9,93% compared to 2016), realized through 7,6 million contracts (+ 6,8% versus 2016). Thus, the average contracted amount was about € 38 400. The net leasing portfolio reached EUR 649,2 billion (+ 2,5%).

As Table 1 shows, most of Europe's largest leasing companies are owned by either large banks (the fourth company in the list, a Dutch DLL belonging to the not very well-known Rabobank Group), or by a large automobile manufacturer, such as the German Alphabet, which is part of the BMW Group. Exceptions are, for example, Siemens Financial

Services, (Germany), or LeasePlan, owned by a pension funds and investment funds group.

**Table 1** 2017 Leaseurope Ranking of European Leasing Companies

| Rank | Company | Country | Total new business within Europe in 2017 (thousands €) | Number of new contracts within Europe in 2017 |
|---|---|---|---|---|
| 1. | Société Générale Equipment Finance (incl. ALD Automotive) | France | 19 143 335 | 578 771 |
| 2. | BNP Paribas Leasing Solutions (incl. Arval) | France | 18 256 472 | 620 784 |
| 3. | VW Leasing GmbH | Germany | 15 278 733 | 609 941 |
| 4. | DLL International BV | Netherlands | 10 400 581 | 168 606 |
| 5. | Deutsche Leasing | Germany | 8 437 000 | 76 140 |
| 6. | UniCredit Leasing | Italy | 6 732 861 | 122 234 |
| 7. | Alphabet | Germany | 5 973 771 | 226 708 |
| 8. | Nordea Finance | Sweden | 5 515 485 | 221 006 |
| 9. | Crédit Agricole Leasing & Factoring | France | 5 173 665 | 114 216 |
| 10. | DNB Finans | Norway | 4 358 419 | 172 069 |
| 11. | CM CIC BAIL | France | 4 160 679 | 112 949 |
| 12. | ING Lease | Netherlands | 3 212 475 | 37 880 |
| 13. | LeasePlan Corporation | Netherlands | 3 156 998 | 295 153 |
| 14. | Siemens Financial Services GmbH (SFS) | Germany | 2 555 382 | n.a. |
| 15. | LBBW Leasing | Germany | 2 472 584 | 42 101 |

Source: Leaseurope (2019)

In the Czech Republic, according to information provided by the Česká leasingová a finanční asociace **ČLFA** (Czech Leasing and Finance Association) (ČLFA, 2019a), its members provided financing totaling almost CZK 164 billion for 2018, of which leasing of movable investments (machinery, equipment and vehicles) for businesses was CZK 51,1 billion (down by CZK 4,47 billion year on year).

Even within the Czech Republic, the aforementioned trend showing the affiliation of leasing companies to either large financial groups or to suppliers of funded subjects applies, as shown in Table 2:

**Table 2** Ranking of ČLFA member companies according to the amount of input debt for financing of all commodities and for all financial products in 2018

| Rank | Company | New business in 2018 (in M CZK) |
|---|---|---|
| 1. | UniCredit Leasing CZ, a.s. | 16 847,63 |
| 2. | ČSOB Leasing, a.s. | 15 860,66 |
| 3. | ŠkoFIN s.r.o. | 15 404,26 |
| 4. | Home Credit, a.s. | 10 651,32 |
| 5. | Raiffeisen-Leasing, s.r.o. | 9 978,44 |

| | | |
|---|---|---|
| 6. | SG Equipment Finance Czech Republic s.r.o. | 9 862,22 |
| 7. | Mercedes Benz Financial Services Česká republika s.r.o. | 8 300,61 |
| 8. | ESSOX, s.r.o. | 8 166,10 |
| 9. | s Autoleasing, a.s. | 5 785,37 |
| 10. | MONETA Auto, s.r.o. | 4 356,66 |
| 11. | LeasePlan Česká republika, s.r.o. | 4 126,39 |
| 12. | ALD Automotive s.r.o. | 4 109,19 |
| 13. | MONETA Leasing, s.r.o. | 3 355,46 |
| 14. | Erste Leasing, a.s. | 3 260,85 |
| 15. | ARVAL CZ s.r.o. | 2 522,71 |

Source: ČLFA (2019a)

Due to the fact that most leasing companies belong to large financial groups and their financial statements are consolidated, these companies are also required to comply with regulatory requirements, currently including Basel III capital adequacy requirements. To some extent, leasing providers are in a similar position to their parent banks, although the risk status and the ways of how risk - in particular credit risk - is managed, is fundamentally different for leasing companies.

## 2 Methodology and Data

Information on the position of the leasing companies in relation to Basel III rules was largely drawn from the European Federation of Leasing Company Associations **Leaseurope**, which publishes this data on its official website (Leaseurope, 2019). Its members are 45 member associations from 32 countries, representing over 1 400 leasing companies and thus about 93% of the leasing market in Europe. The Czech Republic is represented by the Czech Leasing and Finance Association (ČLFA).

Leaseurope represents its members and promotes their interests in dealing with European and international institutions, informs and provides expertise, and, last but not least, maintains pan-European statistics on leasing and related financing. Leaseurope also works on some topics with the European federation of consumer credit providers Eurofinas - some associations (and thus some financial companies) are indeed a member of both federations.

Nine of the largest leasing companies in the Czech Republic were selected for the actual comparison within the leasing market in the Czech Republic, based on the indicator "Ranking of CLFA member companies according to the amount of input debt in financing all commodities and all financial products in 2018", published regularly in ČLFA statistics.

The Czech leasing market mainly consists of members of the above-mentioned Česká leasingová a finanční asociace **ČLFA** (Czech Leasing and Finance Association). This organization was founded in 1991 as the Association of Leasing Companies of the CSFR in the former Czechoslovakia. "Currently, 42 companies are members of the Czech Leasing and Finance Association, which account for about 97% of all domestic leasing transactions, most of the non-bank loans for consumers and most of the factoring deals." (ČLFA, 2019b)

Furthermore, data from publicly available sources, especially annual reports of selected leasing companies and banks, as available on the on-line version of the Czech Commercial Register, was used.

These datasets make it possible to achieve the objectives of this paper using methods of financial analysis, especially balance sheet ratios (assets and liabilities).

## 3 Results and Discussion

As stated by ČNB (2018, p. 112-114): "at the end of 2017, the Basel Committee on Banking Supervision (BCBS) introduced a package of proposals aimed at strengthening the risk capital framework Basel III. (...) All changes should be implemented by 1 January 2022 with the exception of the binding minimum level of risk weights from internal models, which is subject to a transition period ending on 1 January 2027." (translation by author)

The leasing companies are protected by Leaseurope as they have to comply with the same stringent capital adequacy requirements as banks under the new Basel III rules. Therefore, in April 2018, an extensive document **Leaseurope response to the European Commission consultation on the finalisation of Basel III** (Leaseurope, 2018a), was prepared. In the first part Leaseurope emphasize that the demonstrated low risk of leasing, which is documented by the results of the Cologne University research (see below), is not recognised by the calculations for the current Capital Requirements Regulation framework. For all three regulatory credit risk approaches, capital requirements are much higher than the unexpected losses projected in downturn simulations.

Separate chapters deal with the Standardised approach, Internal Rating Based approaches, and the proposed output floors based on the SA calculations. At the end of the document, Leaseurope states: "If Leaseurope's proposals in this response, both for standard and internal approaches, are not taken into account by the European Commission, leasing will be significantly hit by the new framework as the current LGD levels are very low compared to traditional unsecured lending products." (Leaseurope, 2018a, p. 13).

The next document **Capital Requirements for Leasing: A Proposal Adjusting for Low Risk** (Leaseurope, 2018a) and following **Prudential Treament of Leasing** (Leaseurope, 2018b) deal with the Real unexpected loss for leasing. According to research, based on more than 2,4 million leasing contracts across 25 European countries, the **unexpected loss for leasing is 1,1%**, while the regulatory **capital requirements** based on individual approaches (utilized models) require **8,3%** for Standardized Approach, **5,8%** for IRB-Foundation Approach and finally **5,3%** equity for the most complex (and the most expensive to create and operate) IRB-Advanced Approach.

Besides leasing companies themselves, the issue of capital adequacy in leasing companies was mentioned, for example, by Schmit et al. (2003) in preparing the first Basel Capital Adequacy Accord and the EU New Capital Adequacy Framework, as he stated: "Our results confirm that leasing is a low-risk activity and point to the need to review the Basel proposal in order to provide for better recognition of physical collaterals other than real estate." (Schmit et al., 2003, p. 34).

Hartmann-Wendels and Honal (2010) point out that in the case of leasing contracts, the actual LGD is in some cases negative, i.e. that the leasing company receives more than the amount of its contract receivable for the forfeited and sold object (e.g. car, truck etc.). The coverage of credit risk using the subject of financing is also dealt with in more detail by Svítil (2011).

Salonen (2011) expects bank owned leasing companies to be required according to Basel III to hold equity of ca. 10 - 12% of total capital. This is the sum of all capital items, where the uncertainty is determined, among other things, by a countercyclical buffer setting in the expected range of 0 to 2%.

According to Phaure (2013), capital requirements should be 10,5% from 2020 onwards, again in the form of a summary of all items. Phaure expects, in connection with this, the need for capital increases for leasing companies.

For evaluation of the situation of leasing companies operating in the Czech Republic in terms of capital adequacy (represented by the requirements for the volume of equity) based on publicly available sources (i.e. mandatory financial statements and annual

reports), some simplification has to be made. As basic indicators, (i) the **Equity / Balance sheet ratio** and (ii) the **Equity / Receivables ratio** from the provided financing or from the business relations (depending on how the leasing company keeps them in accounting) can be used. As a supplementary indicator, (iii) the ratio of **Basic Capital to Balance Sheet Total** can be mentioned. Selected indicators for the largest leasing companies are shown in Table 3 and Charts 1 and 2:

**Table 3** Basic indicators of capital adequacy of leasing companies in the Czech Republic

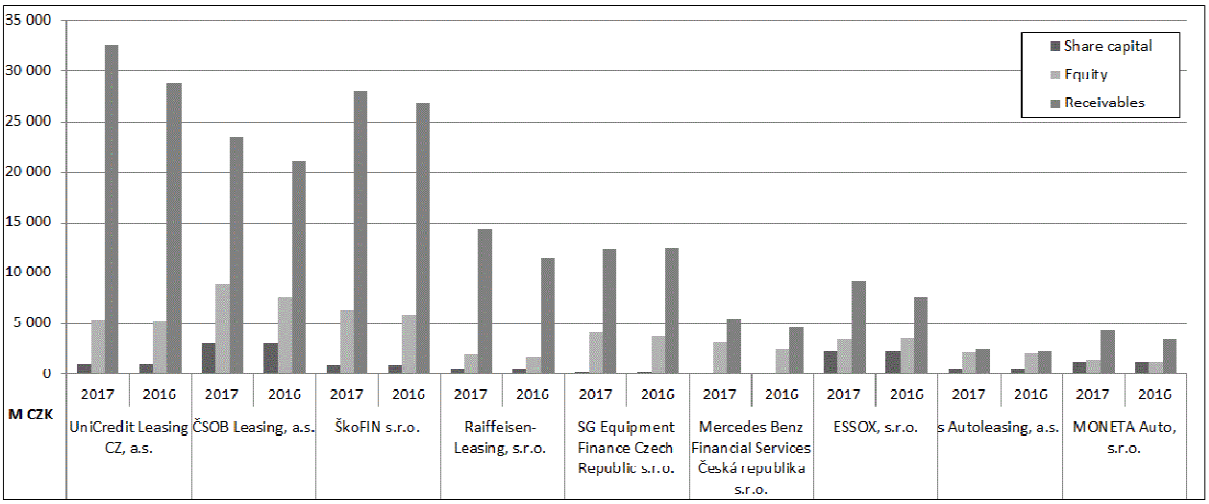
| **Leasing company** | **UniCredit Leasing CZ, a.s.** | | **ČSOB Leasing, a.s.** | | **ŠkoFIN s.r.o.** | | **Raiffeisen-Leasing, s.r.o.** | | **SG Equipment Finance Czech Republic s.r.o.** | |
|---|---|---|---|---|---|---|---|---|---|---|
| **in CZK millions** | **2017** | **2016** | **2017** | **2016** | **2017** | **2016** | **2017** | **2016** | **2017** | **2016** |
| Share capital | 981 | 981 | 3 050 | 3 050 | 865 | 865 | 450 | 450 | 146 | 146 |
| Equity | 5 337 | 5 257 | 8 882 | 7 623 | 6 316 | 5 900 | 1 932 | 1 695 | 4 097 | 3 779 |
| Receivables | 32 552 | 28 703 | 23 445 | 21 007 | 28 059 | 26 770 | 14 250 | 11 503 | 12 294 | 12 412 |
| Balance sheet total | 35 140 | 31 022 | 46 151 | 41 066 | 42 037 | 39 383 | 16 367 | 13 235 | 30 120 | 29 642 |
| Equity / Balance sheet | 15,2 % | 16,9 % | 19,2 % | 18,6 % | 15,0 % | 15,0 % | 11,8 % | 12,8 % | 13,6 % | 12,7 % |
| Equity / Receivables | 16,4 % | 18,3 % | 37,9 % | 36,3 % | 22,5 % | 22,0 % | 13,6 % | 14,7 % | 33,3 % | 30,4 % |
| Share capital / Balance sheet | 2,8% | 3,2% | 6,6% | 7,4% | 2,1% | 2,2% | 2,7% | 3,4% | 0,5% | 0,5% |

| **Leasing company** | **Mercedes Benz Financial Services s.r.o.** | | **ESSOX, s.r.o.** | | **s Autoleasing, a.s.** | | **MONETA Auto, s.r.o.** | |
|---|---|---|---|---|---|---|---|---|
| **in CZK millions** | **2017** | **2016** | **2017** | **2016** | **2017** | **2016** | **2017** | **2016** |
| Share capital | 115 | 115 | 2 288 | 2 288 | 500 | 500 | 1 200 | 1 200 |
| Equity | 3 146 | 2 491 | 3 509 | 3 596 | 2 122 | 2 020 | 1 449 | 1 242 |
| Receivables | 5 517 | 4 677 | 9 235 | 7 602 | 2 485 | 2 245 | 4 337 | 3 503 |
| Balance sheet total | 21 482 | 19 964 | 13 111 | 11 661 | 11 273 | 10 035 | 7 434 | 6 216 |
| Equity / Balance sheet | 14,6% | 12,5% | 26,8% | 30,8% | 18,8% | 20,1% | 19,5% | 20,0% |
| Equity / Receivables | 57,0% | 53,3% | 38,0% | 47,3% | 85,4% | 90,0% | 33,4% | 35,5% |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Share capital / Balance sheet | 0,5% | 0,6% | 17,5% | 19,6% | 4,4% | 5,0% | 16,1% | 19,3% |

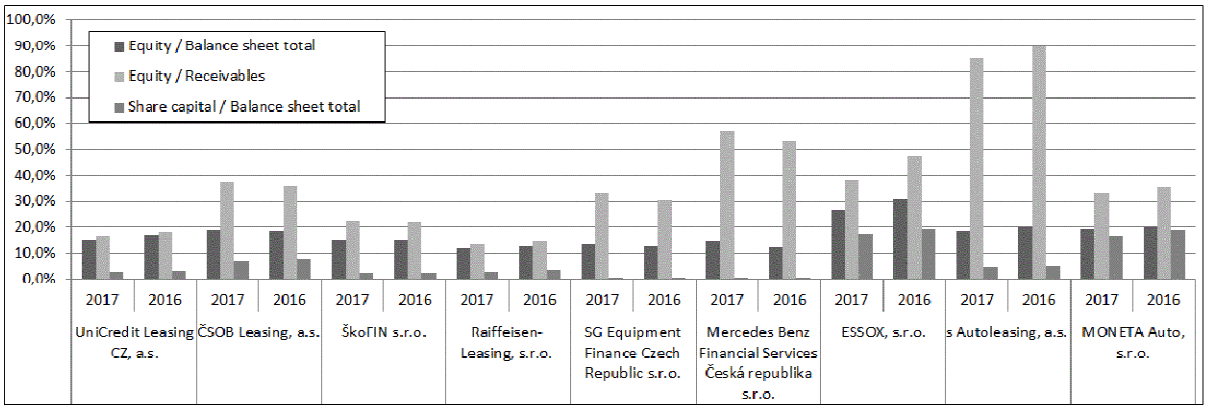
Source: author by using Annual Reports of the mentioned leasing companies

**Figure 1** Capital Volumes of Leasing Companies in the Czech Republic




Source: author by using Annual Reports of the mentioned leasing companies

**Figure 2** Capital Adequacy Ratios of Leasing Companies in the Czech Republic




Source: author by using Annual Reports of the mentioned leasing companies

As shown in the table and graphs, most of the major leasing companies operating on the Czech market have no problem not only in meeting the current capital adequacy requirements, but also in meeting any increased Basel III rules. Even if the most pessimistic estimates of capital requirements of up to 12% (Salonen, 2011), or 10.5% respectively (Phaure, 2013) are used, only one leasing company (Raiffeisen-Leasing) would touch the highest limit for the most conservative Equity / Balance sheet total indicator (11,8% in 2017) and two others would approach it (SG Equipment Finance and Mercedes Benz Financial Services). For the less conservative Equity / Receivables indicator, even Raiffeisen Leasing would meet the requirements with 13,6%.

In case of comparison with the more recent assumptions of Leaseurope, where the range is between 5,3% and 8,3%, depending on the model used, none of the leasing companies under review would need to increase equity.

On the other hand, the extremely favorable economic situation of the Czech Republic in recent years has to be taken into account. This is, of course, reflected in the leasing

companies' financial performance, both by increasing their new business volumes and by decreasing the number of default contracts / clients.

However, this current favorable situation may change and leasing companies can get into a much more difficult position within a few years (or even months), as was the case, for example, during the last financial crisis of 2008-2009.

Therefore, it is advisable to model such a situation, that is, to perform some type of **stress testing** and to estimate changes in capital requirements in case of adverse economic developments. Due to the limited granularity of available data, simplified stress tests were selected at a **5% and 10% rate of a net loss of receivables**. The net loss after the PD and LGD factors is taken into account, including the seizure and repression of leasing items:

- Stress test on the Equity / Balance Sheet indicator shows the situation of the impairment of receivables by 5% or 10% and cover of this entire loss by reducing equity. Thus, the balance sheet total will be reduced by the corresponding amount of assets (impairment of receivables) and equity. Then the updated Equity / Balance Sheet ratio is calculated.

- Stress Test on Equity / Receivables indicator also shows a 5% or 10% reduction in receivables and cover of this entire loss by reducing equity. The equity and debt indicators are therefore reduced by the corresponding amount. Then the updated Equity / Receivables ratio is calculated.

So these tests are **much more pessimistic** than Leaseurope's assumptions (see above). The results of these simplified stress tests for major leasing companies on the Czech market are shown in Table 4 and Figure 3:

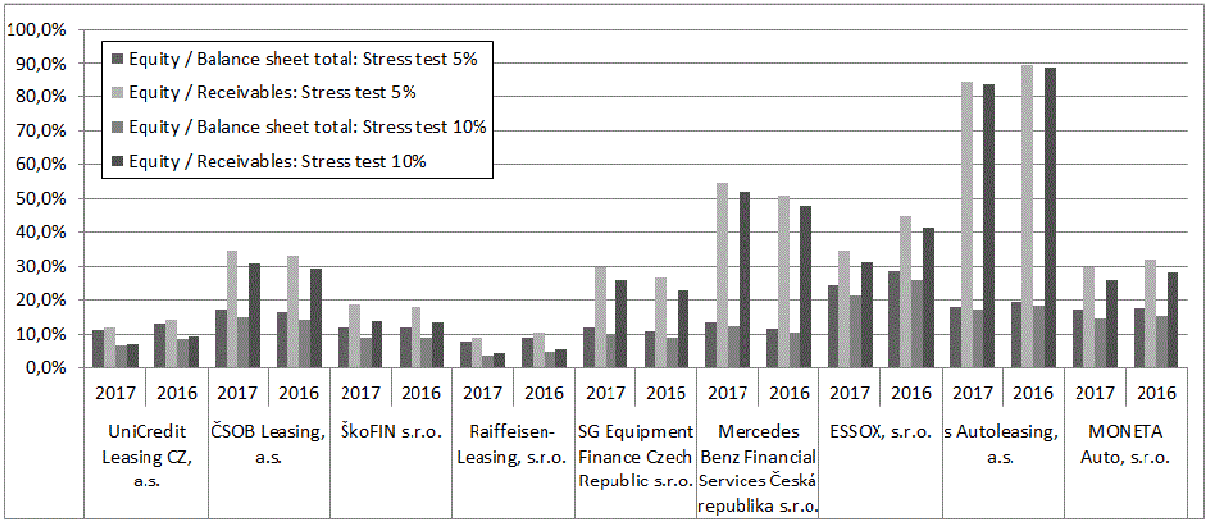
**Table 4** Simplified stress tests of capital adequacy of leasing companies in the Czech Republic

| **Leasing company** | **UniCredit Leasing CZ, a.s.** | | **ČSOB Leasing, a.s.** | | **ŠkoFIN s.r.o.** | | **Raiffeisen-Leasing, s.r.o.** | | **SG Equipment Finance Czech Republic s.r.o.** | |
|---|---|---|---|---|---|---|---|---|---|---|
| **in CZK millions** | **2017** | **2016** | **2017** | **2016** | **2017** | **2016** | **2017** | **2016** | **2017** | **2016** |
| Equity / Balance sheet total: Stress test 5% | 11,1 % | 12,9 % | 17,1 % | 16,4 % | 12,1 % | 12,0 % | 7,8% | 8,8% | 11,8 % | 10,9 % |
| Equity / Receivables: Stress test 5% | 12,0 % | 14,0 % | 34,6 % | 32,9 % | 18,4 % | 17,9 % | 9,0% | 10,2 % | 29,8 % | 26,8 % |
| Equity / Balance sheet total: Stress test 10% | 6,5% | 8,5% | 14,9 % | 14,2 % | 8,9% | 8,8% | 3,4% | 4,5% | 9,9% | 8,9% |
| Equity / Receivables: Stress test 10% | 7,1% | 9,2% | 31,0 % | 29,2 % | 13,9 % | 13,4 % | 4,0% | 5,3% | 25,9 % | 22,7 % |

| Leasing company | Mercedes Benz Financial Services s.r.o. | | ESSOX, s.r.o. | | s Autoleasing, a.s. | | MONETA Auto, s.r.o. | |
|---|---|---|---|---|---|---|---|---|
| **in CZK millions** | **2017** | **2016** | **2017** | **2016** | **2017** | **2016** | **2017** | **2016** |
| Equity / Balance sheet total: Stress test 5% | 13,5% | 11,4% | 24,1% | 28,5% | 17,9% | 19,2% | 17,1% | 17,7% |
| Equity / Receivables: Stress test 5% | 54,8% | 50,8% | 34,7% | 44,5% | 84,6% | 89,5% | 29,9% | 32,1% |
| Equity / Balance sheet total: Stress test 10% | 12,4% | 10,4% | 21,2% | 26,0% | 17,0% | 18,3% | 14,5% | 15,2% |
| Equity / Receivables: Stress test 10% | 52,2% | 48,1% | 31,1% | 41,4% | 83,8% | 88,9% | 26,0% | 28,3% |

Source: author

**Figure 3** Simplified Stress Tests of Capital Adequacy of Leasing Companies in the Czech Republic




Source: author

As can be seen, already in the case of a 5% loss of Equity / Balance Sheet indicator, Raiffeisen-Leasing (7,8% for 2017 numbers) falls below the threshold foreseen by Salonen (2011) and Phaur (2013) and nears the limit set by Leaseurope (2018a,b). Some other companies (UniCredit Leasing, ŠkoFIN, SG Equipment Finance, Mercedes Benz Financial Services) are at around 12%. The Equity / Receivables indicator is again more favorable, but even here the relatively weakest capital position of Raiffeisen-Leasing is evident.

In the case of a more extreme stress test with a net loss of 10% of receivables, Raiffeisen-Leasing, as the relatively weakest of the monitored group of companies, already records values (3,4% for 2017 numbers) below the threshold foreseen by Leaseurope (2018a,b) in both ratios. On the other hand, the view of the results of the parent company Raiffeisenbank in the Czech Republic for 2017, according to the 2017 Annual Report of Raiffeisenbank (Raiffeisenbank, 2018), shows that this bank has enough equity capital not only for its own needs (CZK 23,1 billion equity compared to the CZK 10,4 billion of total regulatory capital), but also to cover the needs of its subsidiary leasing company. Therefore, the relatively weaker capital position of Raiffeisen-Leasing is not a serious issue.

Also the results of the largest leasing company in the Czech Republic UniCredit Leasing are not optimal (10% Stress test on Equity / Balance sheet total: 6,5% for 2017 numbers), even though they fulfill the assumptions of Leaseurope (2018a,b) for IRB-Advanced Approach, which is used within the Unicredit Group, as stated in UniCredit Bank's Annual Report 2017 (Unicredit Bank, 2018).

Particular mention should be made of the situation of Mercedes Benz Financial Services and sAutoleasing, whose asset structure is somewhat atypical compared to other leasing companies, with trade receivables shares of only about 26% and 22% respectively of the assets of these companies in 2017. The largest share of assets (in both cases around 57%) consisted of tangible fixed assets. For this reason, the differences between Equity / Balance sheet and Equity / Receivables differ considerably for Mercedes Benz Financial Services and sAutoleasing. For the other monitored leasing companies, receivables have a larger share of assets (in the case of UniCredit Leasing even almost 93%) and the differences between the Equity / Balance sheet and Equity / Receivables ratios are significantly smaller. See Table 4 for details.

It should also be noted that this contribution is devoted solely to the factual fulfillment of the capital requirements imposed on the leasing company and not to the associated costs. Such research could be of interest in the future, but it would probably require access to data that is not commonly published (e.g. to assess the cost of equity and equity of individual companies).

## 4 Conclusions

This article shows that large leasing companies in the Czech Republic are usually equipped with a sufficient amount of equity, both to cover capital adequacy requirements in the current situation and in the event of a significant loss of net receivables. Only a few companies could, in the event of a deeper crisis (expressed in the modelled case by a very pessimistic estimate of a 10% loss of net receivable), reach the thresholds and just one company would probably not be able to meet these requirements without additional equity injections. However, its parent bank in the Czech Republic would be able to meet these requirements with a great reserve.

Thus, it can be stated that for ČLFA member companies, the result of Leaseurope's efforts to mitigate capital requirements for leasing companies is not critical. Even the failure of these efforts (and thus the obligation of the leasing companies to hold a higher amount of equity) would not jeopardize their functioning. However, as mentioned above, this contribution did not aim to assess the impact of these capital requirements on costs.

## References

ČLFA (2019a). *Zpráva o stavu a vývoji nebankovního leasingového, úvěrového a factoringového trhu v ČR v roce 2018*. Retrieved from: https://www.clfa.cz/data/dokumenty/830-2018zprava.doc.

ČLFA (2019b). *Kdo jsme*. Retrieved from: https://www.clfa.cz/o-nas/kdo-jsme.

ČNB (2018). *Zpráva o finanční stabilitě 2017/2018*. Retrieved from: https://www.cnb.cz/cs/financni-stabilita/zpravy-fs/zprava-o-financni-stabilite-2017-2018/index.html.

ČSOB Leasing (2018). *Annual report 2017.* Retrieved from: https://or.justice.cz/ias/ui/vypis-sl-detail?dokument=53251887&subjektId=124976&spis=76009.

ESSOX (2018). *Annual report 2017.* Retrieved from: https://or.justice.cz/ias/ui/vypis-sl-detail?dokument=53528532&subjektId=709228&spis=424824.

Hartmann-Wendels, T., Honal, M. (2010). Do economic downturns have an impact on the loss given default of mobile lease contracts? An empirical study for the german leasing market. *Kredit und Kapital*, vol. 43, pp. 65–96.

Leaseurope (2018a). *Leaseurope response to the European Commission consultation on the finalisation of Basel III*. Retreived from: http://www.leaseurope.org/uploads/documents/PSC/pp180412_LEA_Basel%20IV.pdf.

Leaseurope (2018b). *Prudential Treament of Leasing*. Retreived from: https://nvl-lease.nl/wp-content/uploads/2018/11/Leaseurope-Leaflet-Prudential-Treament-of-Leasing-Proposal.pdf.

Leaseurope (2019). *Leaseurope Key Facts and Figures 2017.* Retrieved from: http://http://www.leaseurope.org/uploads/documents/LeaseuropeFF_17_PRINT.pdf.

Mercedes-Benz Financial Services (2018). *Annual report 2017.* Retrieved from: https://or.justice.cz/ias/ui/vypis-sl-detail?dokument=53935046&subjektId=472665&spis=127742.

MONETA Auto (2018). *Annual report 2017.* Retrieved from: https://or.justice.cz/ias/ui/vypis-sl-detail?dokument=56523407&subjektId=78493&spis=248358.

Raiffeisen-Leasing (2018). *Annual report 2017.* Retrieved from: https://or.justice.cz/ias/ui/vypis-sl-detail?dokument=53548913&subjektId=671627&spis=118285.

sAutoleasing (2018). *Annual report 2017.* Retrieved from: https://or.justice.cz/ias/ui/vypis-sl-detail?dokument=53424314&subjektId=76121&spis=80377.

SG Equipment Finance Czech Republic (2018). *Annual report 2017.* Retrieved from: https://or.justice.cz/ias/ui/vypis-sl-detail?dokument=53379675&subjektId=158110&spis=130897.

ŠkoFIN (2018). *Annual report 2017.* Retrieved from: https://or.justice.cz/ias/ui/vypis-sl-detail?dokument=53671227&subjektId=710387&spis=101608.

UniCredit Leasing CZ (2018). *Annual report 2017.* Retrieved from: https://or.justice.cz/ias/ui/vypis-sl-detail?dokument=52783816&subjektId=68377&spis=73360.

Phaure, H. (2013). *Basel III Regulation and effect on leasing market*. Working paper presented at Eurolease forum 2013 Milan.

Raiffeisenbank (2018). *Annual report 2017.* Retrieved from: https://or.justice.cz/ias/ui/vypis-sl-detail?dokument=55049297&subjektId=445917&spis=74749.

Salonen, J. M. S. (2011). *Basel III potential impacts to bank owned leasing company foundation and strategy*. Retrieved from: http://www.leaseurope.org/uploads/documents/events/seminar_for_lessors/2011/Jukka%20Salonen.pdf.

Schmit, M., Degouys, C., Delzelle, D., Stuyck, J., Wautelet, F. (2003). *Credit risk in the leasing business – a case study of low probability of default*. Retrieved from: https://pdfs.semanticscholar.org/c9cf/e83252673341f6fb121213fba8c83dbe2eac.pdf?_ga=2.261124363.721889384.1556884783-770817054.1556884783.

Svítil, M. (2011). *Řízení finančního rizika při financování investic leasingem*. Doctoral thesis. Brno: Ekonomicko-správní fakulta MU.

Unicredit Bank (2018). *Annual report 2017.* Retrieved from: https://or.justice.cz/ias/ui/vypis-sl-detail?dokument=55061306&subjektId=47976&spis=76109.

# Structural Breaks in Consumer's Behavior according to their Demand for Credits and Deposits

**Martin Svoboda[1], Annika Rüder[2], Noel Opala[3], Gennadij Seel[4]**

[1] Masaryk University
Faculty of Economics and Administration, Department of Finance
Lipová 41a, 60200 Brno, Czech Republic
E-mail: Martin.Svoboda@econ.muni.cz

[2] Masaryk University
Faculty of Economics and Administration, Department of Finance
Friedenstraße 39, 22089 Hamburg, Germany
E-mail: Annika.Rueder@web.de

[3] Masaryk University
Faculty of Economics and Administration, Department of Finance
Gutenbergstraße 47, 45473 Mülheim an der Ruhr, Germany
E-mail: noel.opala@gmx.de

[4] Masaryk University / FOM University of Applied Sciences
Faculty of Economics and Administration, Department of Finance
Leimkugelstraße 6, 45141 Essen, Germany
E-mail: gennadij.seel@fom-net.de

***Abstract:*** *Dealing with strategic maturity transformation and the consequences for balance sheet structures leads to a most relevant question in interest rate risk management and measurement for banks worldwide: Are there any structural breaks in consumer's behavior to their demand of credits and deposits? According to such structural breaks, the predictability of future balance sheet structure is relevant for the return forecast and the funding plan. Most of the strategic maturity transformation positions are deposits by private consumers or credited to private consumers. Throughout, risk measure methods, financial forecasts and the Asset Liability Management apply the return and risk prediction under constant action of the consumers. Changed maturity preferences cannot take balance sheet structure and interest rate risk measurement into account. This article answers the question if there is a structural break of consumer's preferences in the maturity of their deposits or the credit term. Therefore, different time series from the Deutsche Bundesbank, concerning the German bank markets, get analyzed with a CUSUM-test. We test if the change of the new business volume has a constant mean or identical coefficients in case of multivariate new business volumes. This research confirms the hypothesis that there are breaks in the change of the new business volume.*

*Keywords: structural breaks, behavioral finance, credit and deposits, future balance sheet and maturity structure*

*JEL codes: G21, G32, G40, G41*

## 1 Introduction

Common interest rate risk measurement methods and also interest rate risk management tools often assume a constant balance sheet structure (Svoboda et al., 2018a, pp. 712 ff.; Svoboda et al., 2018b, pp. 511 ff.). For example, the Historical Simulation calculates present value changes of the current portfolio using the changes of the historical yield curve. (Schierenbeck et al., 2008, pp. 96 ff.; Jendruschewitz, 1999, pp. 64 ff.). But there are many other examples of the assumption of constant consumer's behavior.

Although there is a clear assumption of a constant balance sheet structure−as a result of the assumed unchanged customer behavior−some researches identity several indications that state a changed customer behavior (Rüder, 2018a, Rüder 2018b, Deutsche

Bundesbank, 2016, p. 21]. Especially German institutes tend to strategic high maturity transformation position (Reuse, 2019, pp. 11 ff.). Therefore, short term sight deposits and long-term credits are sometimes preferred for more than 15 or 20 years (Deutsche Bundesbank, 2018, p. 58). Such transformation strategies can result in high risks or low returns if the consumer behavior change and a new risk-return-ratio arise out of the of changed maturity preferences.

First of all, it should be analyzed if a structural break of consumer's behavior exists and if adjustments of the current risk measurement methods are required. Furthermore, the nature of changes (for example linear or exponential) should get analyzed (Rüder 2018b, pp. 316 ff.).

The following academic aspects should be answered:

a) *Is there a structural break in the demand for sight deposits and housing loans with an initial rate fixation of over ten years?*
   *4* We did a univariate CUSUM-test of the new business volume of sight deposits and housing loans with an initial rate fixation of over ten years with data of the German Bundesbank as a representative sample for the consumer's behavior of the whole German market.
b) *Assuming the product interest rates causes the demand for sight deposits and housing loans: Is there a structural break in the relation of product interest rate and volume?*
   5 We defined a multivariate CUSUM-test towards the relation of product interest rate and the new business volume of sight deposits and housing loans. The product interest is the explanatory variable; the new business volume is the dependent variable. The two models provide a deep insight into the new business volume depending on the product interest.

## 2 Consequences of structural breaks for bank management

Let it be supposed that there are one or several structural breaks in consumer's behavior, which affect the balance sheet structure. For example, private customers change their maturity preference for deposits and prefer sight deposits instead of deposits with a long maturity. In contrast, the assumption of a constant balance sheet structure is applied in practice, and therefore, the management tools and risk measurement methods seem to be not adequate for the business context.

First of all, the current risk measurement methods like the Historical Simulation, the Variance/Covariance approach, the Monte-Carlo-Simulation or the state-of-the-art Copula approach usually use a constant portfolio or constant cash flows to quantify the interest rate risk of the banking book. (Svoboda et al., 2018a, pp. 712 ff.; Svoboda et al., 2018b, pp. 511 ff.). Lower demand for sight deposits results in a higher risk, because the expected liabilities are not available for refinancing the assets in the expected maturity. Reverse, if there is a change in the term structure of the cash flows, let us assume the customers prefer longer initial maturities of housing loans, the interest rate risk of the banking book increases too. The expansion of risk is caused by the longer cash flow of the credits. A risk management method, which is based on the assumption that the portfolio is constant, underestimates the risk.

Also, funding and balance sheet structure planning are often based on a constant balance sheet structure. The expectations of the development of the new business volume are often taken into account as an additional calculation. Generally, these planning of the new business volume typically refers to two perspectives of planning (Haug, 2016, pp. 146 ff.; Boka, 2016, pp. 186 ff.):

- The needs of the bank for assets and liabilities within strategic preferences and business opportunities.
- The given market volume and business environment.

A change of consumer's behavior is truly difficult to predict. Moreover, to base the Asset Liability Management and the financial forecast on these predictions, the confidence interval must be rarely high. A misspecification of consumers behavior causes an under- or overestimation of financial needs of liabilities or assets, which may have a negative impact on the return. Hence, the planning is typically based on constant economic and behavioral surroundings. Particularly in the low-interest phase, an exact calculation appears to be economically necessary.

Furthermore, positions with an indefinite capital or interest rate lock-in period must be specified for return and risk calculation. Besides, to the business needs of such calculation, there is also a supervisory requirement for such positions (BaFin, 2017 and EBA, 2018, pp. 24 ff.). These positions are calculated with a gliding-portfolio-approach or elasticity approach. In a gliding-portfolio approach, a replication portfolio is built and opportunity interest rates are derived. For example, the consumer's behavior got measured with 25% of a gliding-ten-year-portfolio and 75% of gliding-four-years-portfolio. The determination of the mixing ratios according to the principle of margin constancy can be based on two methods, which should complement one another; a historical analysis based on the previous interest rate adjustment and an analysis with a redefinition of the product and terms policy.The elasticities provide a statistical approach to the sensitivity of the consumers on changing product interests and yields. A changing behavior proofed by a structural break could cause a higher or a lower risk, which may have an impact on the return and the balance sheet structure (Seel and Svoboda, 2019, pp. 237 ff.).

Of course, the given examples do not only affect a special type of risk e.g. interest rate risk (especially in the Banking Book = IRBB). A change in consumer's preference could affect also the liquidity and credit risk.

Also, a sudden preference for sight deposits leads to high call-off risk (Enthofer and Haas, 2016, pp. 859 ff.). Another case could be a misspecification of the refinancing plan, which affects liquidity costs. Additionally, a higher preference for housing loans with a long initial maturity results in increased credit risk.

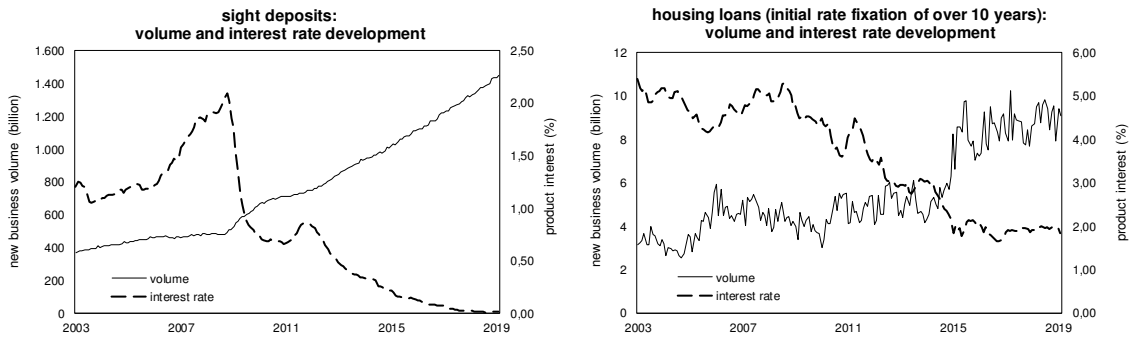
Even though we focused on the consequences of structural breaks in consumer's behavior, there could also be a level shift or a simple trend indicated. These changes in growth rates also cause an adjustment of the management tools and risk measurement methods.

## 3 Data and Methodology

### Used Data

Focused on structural breaks, we use different time series from the Deutsche Bundesbank. The dataset from the Deutsche Bundesbank as the central bank in Germany provides a wide range on the German Market with a long history and a good data quality. The potential reporting population includes all domestic finance institutions in Germany and is composed of a sample of around 200 institutions spread across different strata. (Deutsche Bundesbank, 2017, p. 4). We focus on the sight deposits and housing loans of German banks. The housing loans are collateralized, and the initial rate fixation is over ten years. We use the volume and the product interest of both product specifications. The time series covers a history from 2003 up to 2019 with monthly data points (Deutsche Bundesbank, 2019). Figure 1 shows the development of volume and interest rate of sight deposits and housing loans from 2003 and 2019.

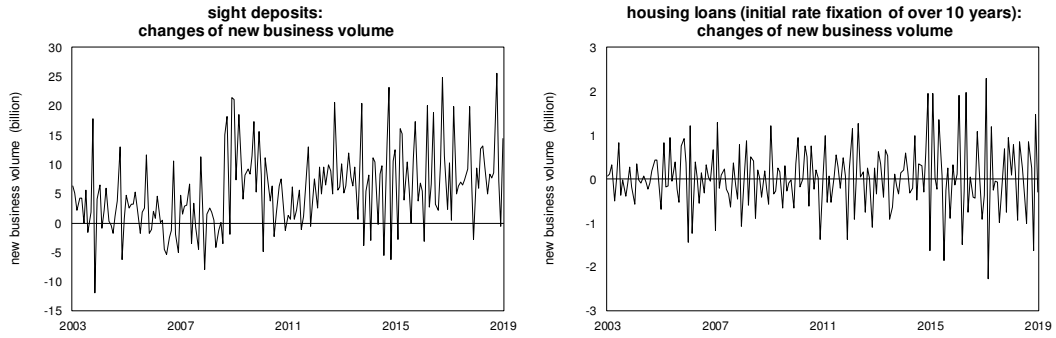
**Figure 1** Volume and Interest Rate Development of Sight Deposits and Housing Loans from 2003 to 2019




Source: Deutsche Bundesbank (2019)

Besides, we use the differences in the change of the new business volume. The use of differences is an advantage because trends were removed from the data.

**Figure 2** Absolute Differences of the New Business Volume Development of Sight Deposits and Housing Loans from 2003 to 2019




Source: Deutsche Bundesbank (2019)

## Description of Methodology

We use the cumulative-sum-test (CUSUM-test), which is a test for identifying structural breaks in time series. The test assesses the stability of the recursive residuals of a regression model and tests if the cumulative sum of the residual excesses a specific boundary, defined for the CUSUM-test (Schmid and Trede, 2006, pp. 221 ff.; Dreger et al., 2014, pp. 179 ff.).

An excess shows a structural break of the time series. Although the range excess of the cumulative sum provides a structural break, the test assumes that the structural break already occurs when the cumulative sum growth towards the excess limit. Concerning the test statistic, the null hypothesis assumes a constant coefficient over time. A great advantage of the CUSUM-test is the test diagram, which usually contains more information than a test statistic (Schmid and Trede, 2006, pp. 221 ff.; Dreger et al., 2014, pp. 179 ff.).

Based on the dataset, first, we perform a univariate CUSUM-test for both time series. The univariate CUSUM-test only take the new business volume of sight deposits or housing loans into account. The product interest rate is not considered in the univariate CUSUM-test. According to research question b) we perform a multivariate CUSUM-test with the new business volume as the dependent variable and product interest as the explanatory variable. Hence, the model indicates a change in consumer's behavior depending on their behavior in borrowing money or holding sight deposits. If there is a structural break in

the regression, the relationship of product interest rate and new business volume has changed, and new preferences seem to be relevant.

## 4 Discussing the results

Starting with the univariate analysis of the sight deposits, we observe a stagnant level of sight deposits from 2003 up to 2007/2008 (see Figure 1). This time could be a sort of a breaking point. On the one hand, we could name the financial crisis as a significant crisis event this year. On the other hand, the level of sight deposits increases strongly after 2007. Although the product interest rate decreases the rate of change of the volume of the sight deposits rises strongly. Also, the monthly change of new business volume of sight deposits increases, too (Figure 2). Since 2007 the absolute rate of change of the new business volume shows mostly a positive trend. This positive change indicates a growing cumulative sum of the residuals too. The empirical fluctuation process of the univariate CUSUM-test shows an excess of the boundary in about 2007, so the alternative hypothesis of the univariate CUSUM-test of the sight deposits should be confirmed. There is a structural break with the first excess in September 2008 Besides, in October 2014, there seems to be a second structural break. Although the graphic indicates a second break in 2014, optimizing the model by maximizing the Bayesian Information Criteria results in only one breaking point.

Concerning the univariate analysis of the housing loans (Figure 3, top right), the CUSUM-test shows no structural breaks. Although the time series of the housing loans shows a constant growth in business volume since 2003, the change in the new business volume is mostly constant and fluctuates around 0 billion euro. The absolute rate of change seems, therefore, constant within a rejection of the alternative hypothesis of the univariate CUSUM-test.

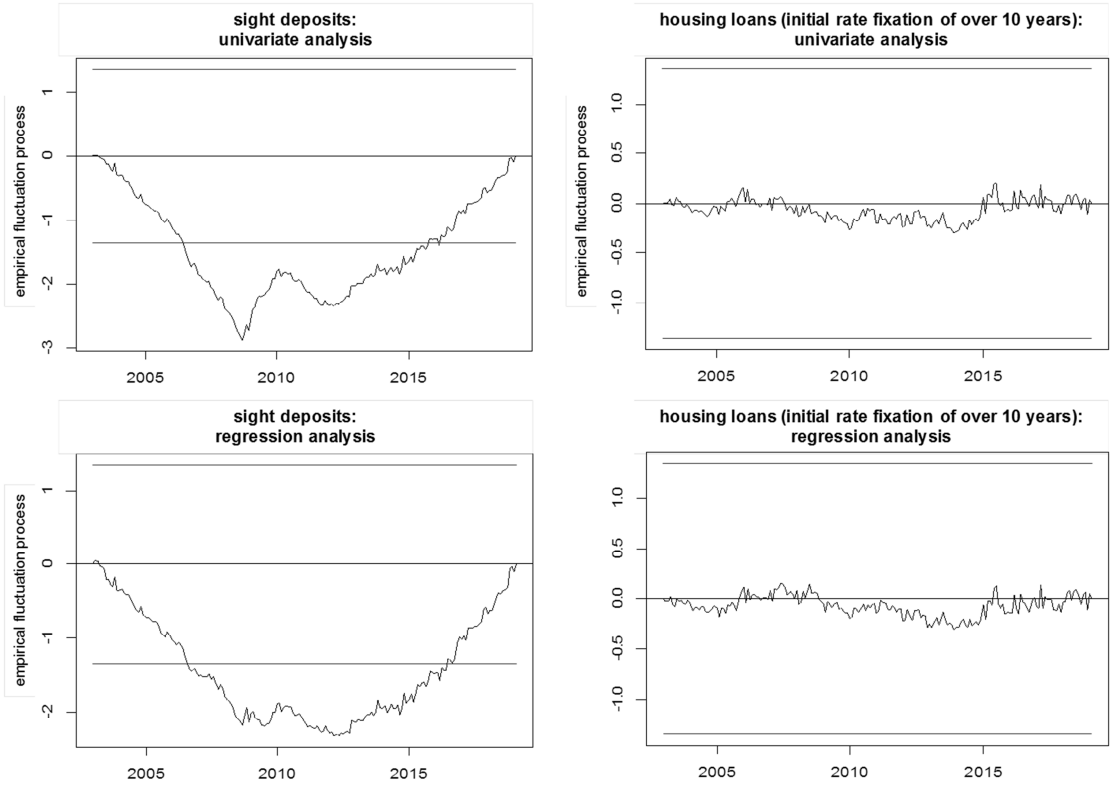
Starting with the multivariate CUSUM-test of the volume of the sight deposits as the dependent variable and the interest rate of the sight deposits as the explanatory variable (Figure 3, bottom left), the test shows a structural break too. The breaks are nearly identical to the univariate CUSUM-test of the sight deposits. There is a structural break in October 2014. Resulting from the multivariate CUSUM-test, the test indicates a structural break in consumer's behavior and is not caused by a change in the product interest rate. Hence, there is a structural break in the consumer's behavior.

The multivariate CUSUM-test of the housing loans and the product interest rate shows no structural break in the time series. The alternative hypothesis should be rejected. Hence, the consumer's behavior on demanding housing loans is nearly constant. The absolute rate of change in the new business volume fluctuates around zero billion euro (Figure 2). The univariate and multivariate CUSUM-test show identical test results.

This leads to the conclusion that there is not macro prudential risk in a higher growth rate of the new business volume of housing loans. Although the demand for housing loans and the relationship between the change of volume and the product interest rate is nearly constant/has no significant structural change. Besides, there is a one-time level shift in the demand for housing loans.

The structural breaks in the sight deposits indicate a change in consumer's behavior. Besides, there is a supervisory need to extend the models because of a nonexistent constant behavior of consumer's demand of sight deposits. Out of this, the common tools and assumption are not able to integrate a non-constant consumer's behavior. This could result in a misspecification of common risk and financial forecasts.

**Figure 3** Empirical Fluctuation Process of the Univariate and Multivariate CUSUM-tests




Source: own calculations

## 5 Conclusion

Summing up the main results lead to the following aspects:

- There is a structural break in consumer's behavior in demanding sight deposits.
- The structural break is caused by consumer's behavior and could not reduce to a change in the product interest rate.
- There is no structural break in consumer's behavior in demanding housing loans.
- The management tools like refinancing plans, risk, and return forecast should take a change in consumer's behavior into account.

Last, the academic questions should be answered:

a) *Is there a structural break of in the demand for sight deposits and housing loans with an initial rate fixation of over ten years?*
   *6* Yes, there is a structural break of the sight deposit volume. But there is no structural break of the housing loan volume.
b) *Assuming the product interest rates causes the demand for sight deposits and housing loans: Is there a structural break in the relation of product interest rate and volume?*
   *7* The multivariate CUSUM-test indicates a structural break in the volume of sight deposits and the product interest rate, but there is no structural break in the multivariate regression model of the housing loans.

For further research, there are more time series to test for structural breaks. Furthermore, the extension of the risk measurement methods and the management tools like refinancing plans and risk and return forecasts need a lot of research for an adequate consideration of structural breaks and non-constant consumer's behavior.

## References


Boka, N. (2016). Berücksichtigung von Kapitalplanungsprozess und Basel III im Risikotragfähigkeitskonzept. In. Reuse, S., ed., *Praktikerhandbuch Risikotragfähigkeit*. 2nd ed., Heidelberg: Finanz Colloquium, pp. 180 – 206.

Bundesanstalt für Finanzdienstleistungsaufsicht (short: BaFin) (2017). *Annotated text of the Minimum Requirements for Risk Management (MaRisk) in the version of 27. 10. 2017*. Rundschreiben 09/2017 (BA) vom 27. 10. 2017. Retrieved from: https://www.bafin.de/SharedDocs/Downloads/DE/Rundschreiben/rs_1709_MaRisk_english.pdf?__blob=publicationFile&v=5 (Accessed 25th May 2019).

Deutsche Bundesbank (2016). *Finanzstabilitätsbericht 2016: Makroökonomisches und finanzielles Umfeld begünstigt Aufbau von Risiken*. Retrieved from: https://www.bundesbank.de/resource/blob/665130/c8232c913e349e8e6debc1b9ccc1f4eb/mL/2016-finanzstabilitaetsbericht-data.pdf (Accessed 25th May 2019).

Deutsche Bundesbank (2017). *Monatsbericht – Juli 2017: Neuerungen in der MFI Zinsstatistik*. Retrieved from: https://www.bundesbank.de/resource/blob/615546/a652eb6f7b3dcdf9589578d326730086/mL/2017-07-zinsstatistik-data.pdf (Accessed 3th May 2019).

Deutsche Bundesbank (2018). *Finanzstabilitätsbericht 2018: Makroökonomisches und finanzielles Umfeld in Deutschland*. Retrieved from: https://www.bundesbank.de/resource/blob/766402/ae2c3a9afbc12eac760a9c48d119af44/mL/2018-finanzstabilitaetsbericht-data.pdf (Accessed 25th May 2019).

Deutsche Bundesbank (2019). *BBK01.SUD201, BBK01.SUD101, BBK01.SUD219, BBK01.SUD119*. Retrieved from: https://www.bundesbank.de/dynamic/action/de/statistiken/zeitreihen-datenbanken/zeitreihen-datenbank/759778/759778?listId=www_s510_rzmfi (Accessed 3th May 2019).

Dreger, C., Kosfeld, R., Eckey, H. (2014). *Ökonometrie – Grundlagen – Methoden – Beispiele*, 5th ed., Wiesbaden: Springer Gabler.

EBA (2018). *Guidelines on the management of interest rate risk arising from non-trading book activities*. EBA/GL/2018/02. 19 July 2018. Retrieved from: https://eba.europa.eu/documents/10180/2282655/Guidelines+on+the+management+of+interest+rate+risk+arising+from+non-trading+activities+%28EBA-GL-2018-02%29.pdf (Accessed 25th May 2019).

Enthofer, H., Haas, P. (2016). *Asset Liability Management/Gesamtbanksteuerung*. Vienna: Linde Verlag.

Haug, M. (2016). Ausgestaltung einer Risikostrategie. In: Reuse, S., ed., *Praktikerhandbuch Risikotragfähigkeit*. 2nd ed., Heidelberg: Finanz Colloquium, pp. 137–156.

Jendruschewitz, B. (1999). Value at Risk – Ein Ansatz zum Management von Marktrisiken in Banken. In: Heidorn, T., Cremers, H., Moormann, J., ed., *Diskussionsbeiträge zur Bankbetriebslehre, Band 7: Value at Risk – Ein Ansatz zum Management von Marktrisiken in Banken*. 2nd ed. Frankfurt: Bankakademie Verlag.

Reuse, S. (2019). Definition und Ausprägung des Zinsänderungsrisiko. In: Reuse, S., ed., *Zinsrisikomanagement*. 3rd ed. Heidelberg: Finanz Colloquium, pp. 11–24.

Rüder, A. (2018a). *Integrierte Steuerung von Zins- und Bilanzstrukturrisiken – Erweiterung bestehender Konzepte zur angemessenen Abbildung von Volumens- und Zinseffekten*. Wiesbaden: Gabler Verlag.

Rüder, A. (2018b). Integrierte Steuerung von Zins- und Bilanzstrukturrisiken. In: Reuse, S., ed., *Zinsrisikomanagement*. 3rd ed. Heidelberg: Finanz Colloquium, pp. 315–342.

Schierenbeck, H., Lister, M., Kirmße, S. (2008). *Ertragsorientiertes Bankmanagement – Band 2: Risiko-Controlling und integrierte Rendite-/Risikosteuerung*. 9th ed. Wiesbaden: Gabler Verlag.

Schmid, F., Trede, M. (2006). *Finanzmarktstatistik*. Heidelberg: Springer Verlag.

Seel, G., Svoboda, M. (2019). Abbildung variabler Produkte – neue Erkenntnisse. In: Reuse, S., ed., *Zinsrisikomanagement*. 3rd ed. Heidelberg: Finanz Colloquium, pp. 213 – 237.

Svoboda, M., Reuse, S., Rüder, A., Boka, N. (2018a). Interest Rate Risk in the Banking Book (IRRBB) – Comparing Variance/Covariance with Historical Simulation and several Copula Functions with Focus on the actual EBA Guidelines. In: *Proceedings of 15th International Scientific Conference European Financial Systems*. Czech Republic: Brno, June 2018, pp. 712-721.

Svoboda, M., Reuse, S., Rüder, A., Boka, N. (2018b). Interest Rate Risk in the Banking Book (IRRBB) – Forecast quality of the EBA scenarios comparing to the Historical Simulation. In: *Proceedings of the 9th International Scientific Conference Managing and Modelling of Financial Risks*. Czech Republic: VŠB-TU of Ostrava, 5th–6th September 2018, pp. 511–520.

# Countercyclical Capital Buffer as a Macroprudential Instrument and its Implementation in Selected EU Countries

**Łukasz Szewczyk**

University of Economics in Katowice
Department of Banking and Financial Markets
1 Maja St. 50, 40-287 Katowice, Poland
E-mail: lukasz.szewczyk@ue.katowice.pl

***Abstract:*** *Countercyclical capital buffer has become one of the most important instruments that aim to ensure that banking sector capital requirements take account on the macro-financial environment in which banks operate. In EU it was implemented through the Directive 2013/36/EU on access to the activity of credit institutions and the prudential supervision of credit institutions and investment firms and it has become an important factor that affects cyclical systemic risk by smoothing fluctuations in the credit cycle. The main objective of this study is to show the macroprudential goals of this instrument and mechanisms of its impact on banks. The emphasis will also be put on its methodology and analysis of the existing experience in selected EU countries that decided to activate it. A main research method used in this paper is critical analysis of the literature connected with this subject and reports issued by institutions that form financial safety nets on a national and international level. Results of this research will help to understand current problems connected with this instrument and its perspectives.*

*Keywords: macroprudential policy, countercyclical buffer, Basel III*

*JEL codes: G21, G28, G01*

## 1 Introduction

Countercyclical capital buffer is a very important tool which enables macroprudential oversight of financial system stability. It was introduced to strengthen the financial systems and to enable it to cope with external shocks caused by the credit cycle. The role of macroprudential supervision is to monitor the changes that may happen in the financial system in order to identify ant mitigate systemic risk, which is the risk of collapse of the entire financial system. The results of such risk are severe for the economy and during global financial crisis the attention of policymakers focused on this problem more broadly. In de Larosiere Report published in 2009 it was pointed out that regulators and supervisors focused on the micro-prudential supervision of individual financial institutions and not sufficiently on the macro-systemic risks of a contagion of correlated horizontal shocks. Strong international competition among financial centers also contributed to national regulators and supervisors being reluctant to take unilateral action (de Larosiere et al., 2009).

Macroprudential instruments are still in the construction phase. One of them is countercyclical buffer (CCyB) which was introduced by the Basel Committee on Banking Supervision in order to strengthen the resilience of financial system, both on a national and global levels. Its main goal is to reduce the pro- cyclicality in the financial system. By this, it affects and mitigates the systemic risk.

The main objective of this article is to show the mechanisms of this instrument, its goals and the existing experience in Sweden (which was the first to activate it) and Poland.

## 2 Macrorpudential tools as a part of new regulatory framework

Global financial crisis led to establishment of new regulatory framework within EU. The introduction of the Capital Requirements Directive (CRD IV) and the Capital Requirements Regulation (CRR) changed the approach to risk assessment in credit institutions and gave the authorities new instruments to maintain a stable financial market. Those legal acts were the result of so called Basell III issued by the Basel

Committee on Banking Supervision in 2010. The new framework doesn't aim only at microprudential oversight but it's also concentrated on macroprudential policy which is necessary for the proper functioning of the financial system and that enables it to perform its functions (money creation and money flow between different entities).

Basel III, which was issued in 2010 and revised in 2011 introduced some important regulatory capital instruments and tools. It established new minimum common equity and Tier 1 requirements and added an additional layer of common equity (the capital conservation buffer which is an obligatory capital that credit institutions must hold as an addition to their minimum capital requirements), a leverage ratio and additional capital requirements for systemically important banks. It also introduced liquidity management instruments: liquidity coverage ratio and a longer-term net stable funding ratio (Barth and Miller, 2018, p. 5). Among those instruments introduced after the global financial crisis, there was countercyclical capital buffer as a tool strictly designed to mitigate systemic risk in the financial system.

In general, macroprudential policy aims at maintaining financial stability which can be defined in terms of robustness of the financial system to external shocks. The second approach to financial stability emphasizes the endogenous nature of financial distress and describes financial stability in terms of resilience to shocks originating within the financial system (Galati and Moessner, 2011, p. 6).

Bank of England noted that in general terms, macroprudential policy should aim at the stable provision of financial intermediation services – payment services, credit intermediation and insurance against risk – to the economy, trying to avoid the type of boom-bust cycles in the supply of credit and liquidity that were manifested during the recent financial crisis (Bank of England, 2009). The main difeferences between macro- and microprudential policy is shown in table 1.

**Table 1** Macro- versus microprudential perspectives

| | **Macroprudential** | **Microprudential** |
|---|---|---|
| **Proximate objectives** | Limit financial system- wide distress | Limit distress of individual institutions |
| **Ultimate objective** | Avoid macroeconomic costs related to financial instability | Consumer protection |
| **Correlations and common exposures across institutions** | important | not important |
| **Calibration of prudential controls** | In terms of system- wide risk (top- down) | In terms of risk of individual institutions (bottom- up) |

Source: (Galati and Moessner, 2011, p. 7)

It is important to add that in the debate about the role of macroprudential policy a lot is said about possible tools that can have an impact on the financial stability. Along with micro- and macroprudential instruments also monetary and fiscal policy is important to foster stability of the financial system (table 2).

**Table 2** Alternative set of tools to foster financial stability

| | **Goal** | **Tools** |
|---|---|---|
| **Microprudential policy** | Limit distress of individual institutions | Quantity/ quality of capital, leverage ratio |
| **Macroprudential policy** | Limit financial system- wide distress | Countercyclical buffer |

| | | |
|---|---|---|
| **Monetary policy** | Price stability<br>Liquidity management | Policy rates, repos<br>Collateral policies, interest on reserves |
| **Fiscal policy** | Build fiscal buffers in good times | Measures to reduce debt levels |

Source: (Galati and Moessner, 2011, p. 8)

The instruments which have macro- effect on the financial system may be categorized in a various ways. An example of such taxonomy is presented in table 3.

**Table 3** Macroprudential instruments

| **Risk measurement methodologies** | **examples** |
|---|---|
| **By banks** | Risk measures calibrated through the cycle |
| **By supervisors** | Cyclical conditionality in supervisory ratings of firms; communication of official assessments of systemic vulnerability and outcome of macro stress tests; developing of measures of systematic vulnerability |
| **Regulatory capital** | Systemic capital surcharge; reduce sensitivity of capital requirements to current point in the cycle; increased regulatory capital requirements for particular exposure types |
| **Risk concentration limits** | Quantitative limits to growth of individual types of exposures |
| **Insurance mechanisms** | Pre-funded systemic risk insurance schemes financed by levy related to bank asset growth beyond certain allowance; Pre-funded deposit insurance with premia sensitive to macro (systemic risk) in addition to micro (institution specific) parameters |

Source: (Galati and Moessner, 2011, p. 10)

It is also important to remember that macro-prudential and monetary policies may have complementary, conflicting or independent outcomes on financial and price stability (Beau et al., 2012). This problem is presented in table 4.

**Table 4** Possible conflicts between macro-prudential policy and monetary policy

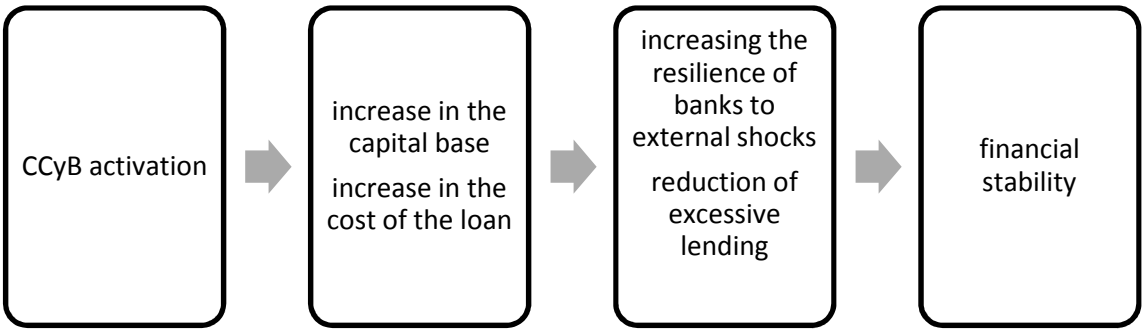
| | **Inflation above target** | **Inflation close to target** | **Inflation below target** |
|---|---|---|---|
| **Financial boom** | Complementary | Independent | Conflicting |
| **No imbalance** | Independent | Independent | Independent |
| **Financial bust** | Conflicting | Independent | Complementary |

Source: (Beau et al., 2012, p. 10)

## 3 Methodology of the countercyclical buffer

The countercyclical buffer aims to ensure that banking sector capital requirements take account of the macro-financial environment in which banks operate. It will be used by national jurisdictions when excess aggregate credit growth is judged to be associated with a build-up of system-wide risk to ensure the banking system has a buffer of capital to protect it against future potential losses (BIS, 2011). The mechanism of CCyB is presented on figure 1.

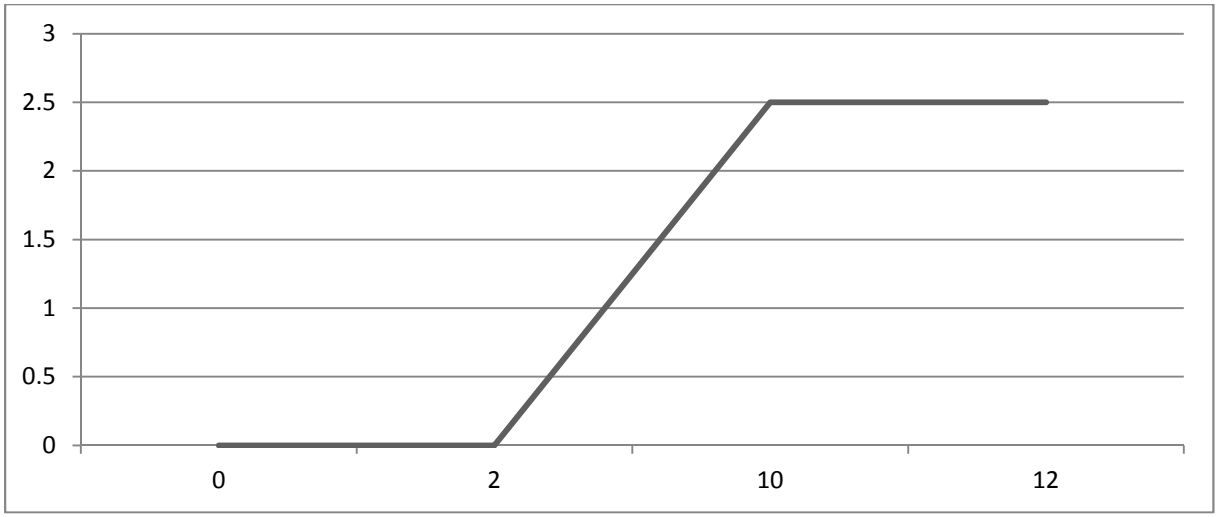
**Figure 1** Countercyclical Buffer Mechanism




Source: (Dobrzańska and Kurowski, 2019, p. 12)

The Basel Committee's approach is based on the credit gap which is a measure of the deviation of the ratio of credit-to-GDP from its long-term trend. A first step in establishing the credit gap is to calculate the ratio between aggregate credit to the private sector and GDP. The aggregate credit should be defined as broadly as possible (it should also capture credits not granted through traditional bank loans). The long-term trend for the ratio of credit-to-GDP is calculated as a next step. The credit gap is the difference between the ratio and the calculated trend, and measures the deviation from trend in percentage points. A large, positive credit gap indicates that credit has increased to an excessive level in relation to GDP. It can imply that risks in the financial system have increased and that there is a reason to activate or increase the countercyclical capital buffer. In the last step, the credit gap is transformed to a buffer guide. A quantitative rule specifies how the credit gap and buffer guide are to stand in relation to each other. According to the rule, the buffer guide shall be greater than zero when the credit gap is higher than 2 per cent, and then increase linearly with the credit gap until the buffer reaches its maximum level (e.g. 2.5 per cent of the risk-weighted exposure amount) when the credit gap reaches 10 per cent (figure 2). As mentioned, 2.5 per cent does not constitute the maximum level for the countercyclical buffer rate because the national authorities may set a higher level of CCyB if needed [Finansinspektionen, 2014, p. 13].

**Figure 2** The Level of the CCyB




Source: (Tente et al., 2015, p. 14)

The rules for setting the countercyclical buffer rate for the Member State is the responsibility of a public authority designated by each Member State (table 5).

**Table 5** List of national designated authorities in EU Member States

| National authority | Member State |
|---|---|
| **Central bank** | Belgium, Bulgaria, Czech Republic, Cyprus, Estonia, Ireland, Greece, Lithuania, Hungary, Malta, Portugal, Slovakia, United Kingdom, Estonia, Croatia, Italy, the Netherlands, Slovenia |
| **Supervision authority** | Finland, Germany, Sweden, Latvia, Luxemburg, Austria |
| **Ministry of Finance** | Denmark, Poland |
| **Collective authority** | France, Romania |

Source: (Dobrzańska and Kurowski, 2019, p. 15)

The setting of CCyB level is a result of the calculation of a buffer guide. The buffer guide should reflect the credit cycle and the risks due to excess credit growth in every country (so it is connected with systemic risk). It is based on the deviation of ratio of credit-to-GDP from its long term trend (credit gap).

Each designated authority should announce the quarterly setting of the countercyclical buffer rate by publication on its website. It should contain such information as:

- the applicable countercyclical buffer rate,
- the relevant credit-to-GDP ratio and its deviation from the long term trend,
- the calculated buffer guide,
- a justification for the buffer rate (Directive, 2013/36/EU).

Since 1 January 2016 designated authorities have had the obligation to determine the countercyclical buffer ratio. CRD IV directive allowed to earlier application of the instrument. A few countries published first decisions in this area earlier (2014-2015). Among them were: Czech Republic, Croatia, Denmark, Finland, Lithuania, Latvia, Slovakia, Sweden and Great Britain, but only Sweden had the ratio different than 0% (Dobrzańska and Kurowski, 2019).

Sweden was the first country in EU that decided to introduce countercyclical buffer. The decision was made in September 2014. Before that, the discussion about the level of the buffer had been held in Financial Stability Council. The level of CCyB was set at 1% and it was effective since September 2015. The credit gap was positive at that time and the level of CCyB calculated according to BCBS methodology should be 1,25% (so, higher than the level set by the Swedish authority). The decision to set the buffer at a non- zero level was the consequence of the fact that the credit-to-GDP ratio was on a historically high level (150%). It was mainly the result of very high corporate and households lending over the past years. Another threat to financial stability was the high level of indebtedness of Swedish households (175% of disposable income). Those factors decided to activate the buffer but not in its full level as suggested in the BCBS methodology. Such decision was motivated by the following arguments:

- house prices were not overestimated,
- there were no external imbalances in the Swedish economy as a whole,
- tier 1 capital in Swedish banks was on an appropriate level and it had a tendency to increase,
- the interest ratio which shows the proportion of household disposable income spent on interest expenses had shown a downward trend for years (Dobrzańska and Kurowski, 2019, p. 21).

The buffer has been raised three time since then. What is interesting, the Swedish authorities decided to do it despite the fact that the credit gap has been decreasing (table 6). It was explained by the fact that the credit growth rate was higher than the GDP growth rate and it could be a threat to financial stability. Sweden has become the first country in the world which set up the CCyB rate at the maximum level (in 2018).

**Table 6** Main parameters of CCyB in Sweden

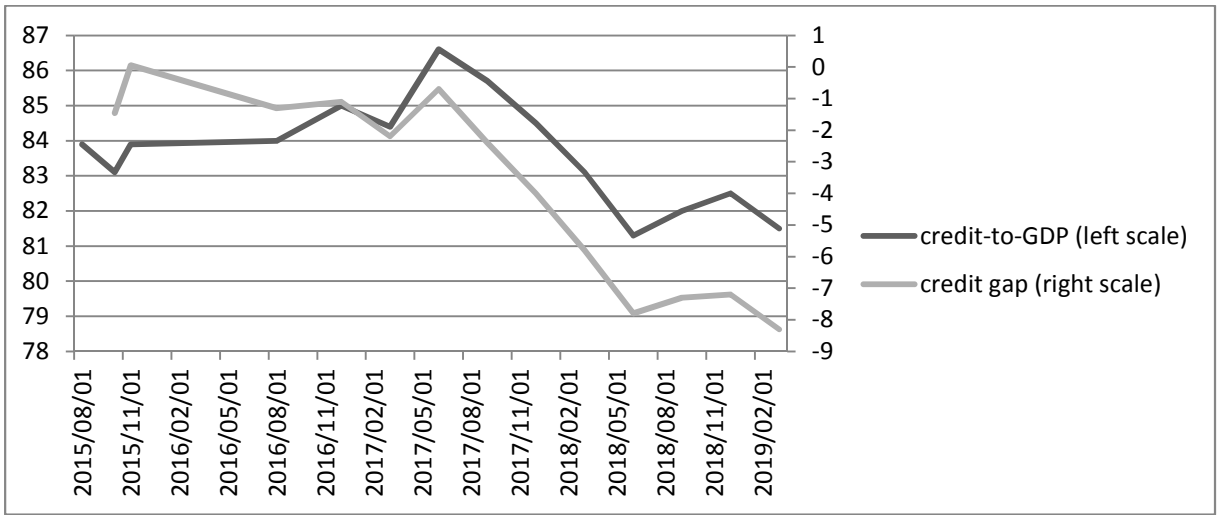
| Decision date | CCyB rate | Credit-to-GDP | Credit gap | Buffer guide |
|---|---|---|---|---|
| **08.09.2014** | 1 | 151,3 | 6 | 1,25 |
| **22.06.2015** | 1,5 | 148,6 | 6,8 | 1,5 |
| **14.03.2016** | 2 | 147 | 3,6 | 0,5 |
| **18.09.2018** | 2,5 | 158,67 | 2,34 | 0,11 |

Source: European Systemic Risk Board (2019)

The functioning of CCyB in Poland is determined by the Act of financial system macro-prudential supervision and crisis management in the financial system (Ustawa, 2015). Minister of Finance is responsible for setting up the level of CCyB following the recommendation of the Financial Stability Committee, which is a macro-prudential authority in Poland. The level of CCyB in Poland is 0%, which is a consequence of macroeconomic indicators levels, ie. credit-to-GDP and negative credit gap (figure 3). Other reasons to keep the level of CCyB at 0% are:

- buffer guide is at 0%,
- early warning models show that there is low possibility of the crisis caused by the excessive lending,
- the intensity of systemic risk is not high (which is confirmed by the low level variables connected with a situation on a real estate market or risk evaluation) (Dobrzańska and Kurowski, 2019, p. 36-37).

**Figure 3** Macroeconomic Indicators Levels in Poland




Source: : European Systemic Risk Board (2019)

As of today (June 2019) only five Member States set a CCyB on a level other than 0%. Among them are Sweden (2%), Lithuania (0,5%), Great Britain (1%), Czech Republic (1,25%) and Slovakia (1,25%). Few countries decided to activate the buffer (it will be effective form a specific date within 12 months after it was announced). These include Bulgaria, France, Ireland and Luxembourg.

## 4 Conclusions

Countercyclical capital buffer is an important instrument that may preserve financial stability. Because it is a relatively new instrument there isn't much experience connected with its functioning. Nowadays its methodology is based mainly on BCBS guidelines but its specifics may differ from one jurisdiction to another. On the example of Sweden it can be seen that there isn't always a positive correlation between the level of the buffer and credit-to-GDP or credit gaps ratios. The systemic risk may also be assessed by using a

different set of indicators. The question is, which of them are the most relevant? This question opens up new research possibilities for the future.

## References


Bank of England (2009). *The role of macroprudential policy*. A Discussion Paper. Retrieved from: https://www.bankofengland.co.uk/-/media/boe/files/paper/2009/the-role-of-macroprudential-policy.pdf.

Barth, J. R., Miller, S. M. (2018). On the Rising Complexity of Bank Regulatory Capital Requirements: From Global Guidelines to their United States (US) Implementation. *Journal of Risk and Financial Management*, vol. 11 (4), pp. 1-33.

Beau, D., Clerc, L., Mojon B. (2012). Macro-prudential policy and the conduct of monetary policy. *Banque de France, Working Paper*, vol. 390.

BIS (2011). *Basel III: A global regulatory framew/ork for more resilient banks and banking systems*. Retrieved from: http://www.bis.org/publ/bcbs189.pdf.

Directive 2013/36/EU of the European Parliament and of the Council of 26 June 2013 on access to the activity of credit institutions and the prudential supervision of the credit institutions and investment firms, amending Directive 2002/87/EC and repealing Directives 2006/48/EC and 2006/49/EC (text with EEA relevance). *Official Journal of the European Union no L 176/338*.

Dobrzańska, A., Kurowski, Ł. (2019). Antycykliczny bufor kapitałowy jako instrument polityki makroostrożnościowej Dotychczasowe doświadczenia w Unii Europejskiej. *Bezpieczny Bank*, vol. 1(74), pp. 8-42.

Finansinspektionen (2014). *Regulations regarding the countercyclical buffer rate*. Decision Memorandum. Retrieved from: https://www.esrb.europa.eu/pub/pdf/other/140910_Decision_memorandum_CCB_Sweden.pdf?4ed26e2358ae71830daedadb070dce1f.

Galati, G., Moessner, R. (2011). Macroprudential policy- a literature review. *BIS Working Papers*, vol. 337, pp. 1-38.

Tente, N., Stein, I., Silbermann, L., Deckers, T. (2015). *The countercyclical capital buffer in Germany: Analytical framework for the assessment of an appropriate domestic buffer rate.* Deutsche Bundesbank. Retrieved from: https://www.bundesbank.de/resource/blob/617868/6a3e844955eb265699751037bc6633a0/mL/the-countercyclical-capital-buffer-data.pdf.

de Larosière, J. et al. (2009). *The High-Level Group of Financial Supervision in the EU.* Report (2009), Brussels. Retrieved from: https://ec.europa.eu/info/system/files/de_larosiere_report_en.pdf.

*Ustawa z dnia 5 sierpnia 2015 r. o nadzorze makroostrożnościowym nad systemem finansowym i zarządzaniu kryzysowym w systemie finansowym*, Dz. U. 2019, poz. 483.

European Systemic Risk Board (2019). *Countercyclical capital buffer.* Retrieved from: https://www.esrb.europa.eu/national_policy/ccb/html/index.en.html.

# Impact of Indebtedness on the Company Performance: Comparison of Merged and Non-Merged Companies

**Petr Valouch, Josef Nesleha**

Faculty of Economics and Administration, Department of Finance
Lipova 41a, 602 00 Brno, Czech Republic
E-mail: petr.valouch@econ.muni.cz
josef.nesleha@econ.muni.cz

***Abstract:*** *The object of the study is the influence of the merger on the company performance. Company performance might be measured by various indicators, such as profitability, various forms of the company profit, liquidity, etc. In this paper, we have taken into account another possibility (less conventional) how the company performance might be evaluated – indebtedness. The goal of the study is to verify whether there is a relationship between the company performance of companies that merged and those which did not merge. The dataset consists of 276 merged companies and 234 companies that did not merge. Concerning methodology, the test is based on non-parametric tests, particularly Wilcoxon Matched Pairs Test and Sign Test.*

*Keywords: Merger, indebtedness, statistics, influence*

*JEL codes: G34, M41*

## 1 Introduction

In recent decades the ever-growing number of mergers trying to increase the efficiency of merging companies has prompted the constant interest of researchers seeking to identify the causes of failed mergers, as well as the reasons for the successful completion of this integration process. Many empirical studies suggest that the general view is that mergers tend to increase shareholder wealth but decreases efficiency for the target firm (Li, 2016). Evaluations of efficiency and economic impacts of mergers have been gaining in significance recently and have become a subject of a number of economic studies. Some studies deal with merger efficiency, in general, e.g. (Lang, 2003, Gugler et al., 2003, Kamerbeek, 2010, Crane, 2011), other studies focus on merger efficiency and economic impact research only in a particular sector of the economy (Weech-Maldonado, 2002, Kjekshus and Hagen, 2007, Gugler and Siebert, 2007, He-Boong et al., 2008). The competitive effects of mergers between asymmetric firms were researched by Thomas (Thomas, 2004). However, the first studies of the efficiency of mergers in the Czech Republic have only emerged in recent years, their problems are being either in a short period of analysis or in their narrow focus only on the sub-sector of the Czech economy (Valouch et al., 2015, Režňáková and Pěta, 2016). Another reason for missing deeper analysis is due to the complicated access to the financial statements and economic results of mergers. Moreover, markets usually do not distinguish between acquisitions and mergers, which are then considered synonymous. For this paper we will use the definition of mergers as outlined by Arnold (2013). Mergers are „the combining of two business entities under common ownership". The less important company loses its identity and becomes part of the more important corporation, which retains its identity. A merger extinguishes the merged corporation, and the surviving corporation assumes all the rights, prerogatives and obligations of the merged entity.

In our paper, we focus on the indebtedness of companies that merged and those which did not merge. Our goal is to identify whether the merger has an impact on the indebtedness level of merged companies in the period of five years after the merger.

## 2 Methodology and Data

With a focus on the set target, the methodology has been based on quantitative analysis of the collected dataset. As we measure the impact of merger on the company performance (the measured criterion is the company total indebtedness), two datasets

are employed. The first dataset consists of companies merged in the analysed period of time, in total this dataset amounts 276 valid and complete observations. The other one, consisting of companies that did not merge consists of 234 complete observations.

The first dataset consists of 276 companies merging between 2001 and 2010. The sample was collected using data from the Trade Bulletin and Trade Register of the Czech Republic. The second dataset consists of 234 companies which did not merge, and the data has been collected for the period of time. The dataset consists of various companies when it comes to the specialization of the companies (no particular areas were excluded or eliminated), as well as location (within the Czech Republic) or size (only micro accounting units were excluded). Mergers conducted by non-profit organizations were excluded from the dataset. The data consists only of companies whose main goal is to generate profit.

The original intention has been a usage of parametric tests (t-test). They would allow us to find out if there is a difference between the first and the second moment, in our case between the moment of the merger and five years after that moment. The same procedure would be run when it comes to the companies that did not merge in the analysed period of time. In other words, for these companies we would run a pair of tests, in the first moment ("the zero moment") and five years after.

The test is based on the following null hypothesis ($H_0$) and the alternative hypothesis ($H_1$):

- $H_0$: The level of Indebtedness is the same for both of the analyzed moments
- $H_1$: The level of Indebtedness differs in both the analyzed moments

Nevertheless, looking at Table 1 and Table 2, the normality (a crucial assumption of t-test) fails for both of the datasets. In all cases the p-value reaches zero (or is close to zero), declining the null hypothesis.

**Table 1** Results of the normality test of merged companies

| Variable/Statistics | Computed value of statistics | p-value |
|---|---|---|
| **Indebtedness (0)/D** | 0.1658 | <0.01 |
| **Indebtedness (0)/SW-W** | 0.5202 | 0.0000 |
| **Indebtedness (5)/D** | 0.2471 | <0.01 |
| **Indebtedness (5)/SW-W** | 0.415 | 0.0000 |
| **Indebtedness (difference)/D** | 0.2743 | <0.01 |
| **Indebtedness (difference)/SW-W** | 0.4283 | 0.0000 |

Source: Own computation, processed in STATISTICA

**Table 2** Results of the normality test of companies without merger

| Variable/Statistics | Computed value of statistics | p-value |
|---|---|---|
| **Indebtedness (0)/D** | 0.2837 | <0.01 |
| **Indebtedness (0)/SW-W** | 0.4267 | 0.0000 |
| **Indebtedness (5)/D** | 0.145 | <0.01 |
| **Indebtedness (5)/SW-W** | 0.6727 | 0.0000 |
| **Indebtedness (difference)/D** | 0.2555 | <0.01 |
| **Indebtedness (difference)/SW-W** | 0.4938 | 0.0000 |

Source: Own computation, processed in STATISTICA

As a result of the non-compliance with normality tests and with focus on the previously stated hypothesis, non-parametric statistics have been run. In order to enhance the validity of results, the following two tests have been conducted for each data group:

- Wilcoxon Matched Pairs Test
- Sign Test

These tests are employed as all the normality tests have failed. The original intention was to used parametric statistical methods (particularly, t-tests), yet their main assumption –

normality – has not been fulfilled. From our point of view, the best alternative is the usage of non-parametric tests, working on a similar procedure.

## 3 Results and Discussion

The results of this contribution consist of two parts. The first part is devoted solely to results of merged companies, particularly the comparison between the moment of the merger and five years later. The logic of the other part is the same, only the companies that not merged are used. As stated before, the reason for this is to show if the same trend has been measured in case of merged companies and companies which did not merge.

**Table 3** Descriptive statistics for Indebtedness at the moment of the merger and the Indebtedness after five years

| Variable | Valid N | Mean | Median | Standard Dev. |
|---|---|---|---|---|
| **Indebtedness (0)** | 277 | 0.542 | 0.5554 | 0.5738 |
| **Indebtedness (5)** | 276 | 0.5451 | 0.5169 | 0.7469 |

Source: Own computation, processed in STATISTICA

Before the particular tests are run, the basic descriptive statistics have been computed. They are shown in table 3. The first insight in the data reveals that there is a slight decrease in the level of Indebtedness between the first moment (the moment of the merger) and the between the second moment (five years after the merger). In spite of the fact the mean remains almost unchanged, there is a decline in the median. The number has decreased by approximately 7 – 8 %, from the original 0.555 to approximately 0.517. This is a sign that the indicator has followed a positive movement between the first and the second moment.

**Table 4** Results of the Wilcoxon Matched Pairs Test

| Pair of Variables | Valid N | T | Z | p-value |
|---|---|---|---|---|
| **Indebtedness (0) & Indebtedness (5)** | 276 | 15908.00 | 2.4148 | 0.0157 |

Source: Own computation, processed in STATISTICA

The outputs of the Wilcoxon Matched Pairs Test confirm the previous assumption. Taking into consideration the low p-value (and the significance level in the amount of 0.05 (5%)), the null hypothesis has been rejected. This means that there is a significant difference between both moments. In other words, the test has verified the previous assumption – merged companies have managed to reduce their indebtedness in the course of five years after the merger.

**Table 5** Results of the Sign Test

| Pair of Variables | Valid N | Percent v<V | Z | p-value |
|---|---|---|---|---|
| **Indebtedness (0) & Indebtedness (5)** | 276 | 42.7536 | 2.3475 | 0.0189 |

Source: Own computation, processed in STATISTICA

The same conclusion has been reached in the second test, the Sign Test. The computed p-value is lower than the significance level as well, meaning that the null hypothesis is rejected in favour of the alternative hypothesis. Such a result can be interpreted in the same way – merged companies managed to downsize the level of indebtedness between the moment of the merger and the following five years.

To support the validity of the computed results, the same procedure has been conducted for a dataset of companies that did not merge. As well as in the previous case, the first table summarizes basic descriptive statistics of the dataset.

**Table 6** Descriptive statistics for Indebtedness at the first and at the second moment

| Variable | Valid N | Mean | Median | Standard Dev. |
|---|---|---|---|---|
| **Indebtedness (0)** | 234 | 0.5748 | 0.4529 | 0.5376 |
| **Indebtedness (5)** | 234 | 0.7037 | 0.5944 | 0.8852 |

Source: Own computation, processed in STATISTICA

On contrary to the previous dataset, there has been measured a slow increase in the level of the company total indebtedness. This can be observed both, in case of the mean and the median. When it comes to the mean, it has rocketed to 70% from the original 57%, while the median reaches almost 60% (from the original 45%).

**Table 7** Results of the Wilcoxon Matched Pairs Test

| Pair of Variables | Valid N | T | Z | p-value |
|---|---|---|---|---|
| **Indebtedness (0) & Indebtedness (5)** | 234 | 9808.00 | 3.8003 | 0.000145 |

Source: Own computation, processed in STATISTICA

As well as in the previous case (merged companies), the same procedure has been run in case of the second dataset – companies that did not merge. Table 7 summarizes the results of the first test (Wilcoxon Matched Pairs Test). The p-value in this test is very close to zero, meaning that the null hypothesis is rejected. The same conclusion has been observed in the first dataset (merged companies), however, in this case the conclusion is different. Looking back at Table 6 we can see that there is a contradictory development of the company indebtedness. While in the first dataset has been spotted a decrease in this variable, when it comes to the companies which did not merge, the trend is the opposite. In the first moment the median of the company indebtedness was around 45%, in the second moment (five years later) this number almost reaches 60%.

The same conclusions might be seen in the last test, Sign Test. Table 8 sums up its results and it is obvious that the null hypothesis has been rejected as well as the p-value is lower than the chosen significance level.

**Table 8** Results of the Sign Test

| Pair of Variables | Valid N | Percent v<V | Z | p-value |
|---|---|---|---|---|
| **Indebtedness (0) & Indebtedness (5)** | 234 | 38.4615 | 3.4647 | 0.000531 |

Source: Own computation, processed in STATISTICA

The presence of both the data files has proven to be legitimate. In both cases, the data has managed to revert disprove the null hypothesis and has confirmed that average values of indebtedness are not the same in the first and the second measured moment. While in the case of merged companies the tests confirmed a significant decrease of the variable, the contradictory movement has been observed in terms of the companies that did not merge. Such a conclusion is valuable for further investigation of the impact of mergers on the company performance and opens new possibilities for further investigation.

In further research, it will be appropriate to focus on the analysis of other financial indicators, especially in the areas of profitability, liquidity, activity and cash flow. Only if the same conclusions as for indebtedness are confirmed for these groups of indicators, it can probably be concluded that the merger brings positive or negative effects on the merger companies' performance during a certain period after the merger.

At the same time, it is useful to take into account the fact that other indicators, particularly macroeconomic indicators should be considered. In our research, so far, we have investigated companies that did not merge and merged companies. Yet there is a lack of other influences that might have had an impact on the company performance,

such as the situation on the labour market, GDP, quality and changes in the legal system, overall success and performance of the economy, unemployment, economic growth and other similar influences.

## 4 Conclusions

It is clear from the results of our study that in the area of debt there are significantly different results for the merged companies and those who did not merge during the analyzed period. In the five years following the merger, there is no significant change in debt for merged companies. Respectively, a slight decrease in the indicator has been measured. The value dropped from approximately 55.5 % to less than 51.7 %. This difference although the difference does not seem to be huge has been confirmed as a statistically significant difference.

By contrast, a significant increase in indebtedness is apparent in the comparative sample of companies that did not merge in the analysis period. In this case, the difference between the first and the second moment has reached approximately 15% (from the original 45.3% to 59.4%, measured at the second moment, five years after the first one).

The merger thus appears to allow companies to mitigate the growth rate of debt and strengthen the rate of equity involvement in financing the assets of the merged companies. Only the analysis of other financial indicators, especially in the area of profitability, liquidity and cash flow, can answer the question of whether this fact is positive or rather negative. The results of our paper allow us to formulate the hypothesis that mergers have a significant impact on the financial situation of the merged companies in the five years after the merger. In order to confirm it, it is necessary to test more financial indicators in the future, from which it will be clear whether this applies across different types of financial indicators and in particular to confirm whether the effect of the merger on these indicators is positive and supports the financial performance of the merged companies or, conversely, negative.

## Acknowledgement

This article is one of the research outputs of the project MUNI/A/0921/2018 "*Financial Literacy in the Czech Republic*" making of Masaryk University in Brno, Faculty of Economics and Administration, Department of Finance.

## References

Act no. 125/2008 Coll., on transformations of trading companies and cooperatives.

Arnold, G. (2013). Chapter 20 Mergers. In: *Corporate Financial Management*. England: Pearson Essex.

Crane, D. A. (2011). Rethinking merger efficiencies. *Michigan Law Review*, vol. 110(3), pp. 347-391.

Gugler, K., Mueller, D., Burcin Yurtoglu, R., Zulehner, C. (2003). The effects of mergers: An international comparison. *International Journal of Industrial Organization*, vol. 21(5), pp. 625-653.

Gugler, K., Siebert, R. (2007). Market power versus efficiency effects of mergers and research joint ventures: Evidence from the semiconductor industry. *The Review of Economics and Statistics,* vol. 89(4), pp. 645-659.

He-Boong, K., Stoeberl, P. A., Seong-Jong, J. (2008). Measuring comparative efficiencies and merger impacts of wireless communication companies. *Benchmarking*, vol. 15(3), pp. 212-224.

Kamerbeek, S. (2010). Merger performance and efficiencies in horizontal merger policy in the United States and the European Union. *Journal of Advanced Research in Law and Economics,* vol. 1(1), pp. 16-41.

Kjekshus, L., Hagen, T. (2007). Do hospital mergers increase hospital efficiency? Evidence from a National Health Service country. *Journal of health services research & policy*, vol. 12(4), pp. 230-235.

Lang, D. W. (2003). The future of merger: What do we want mergers to do: Efficiency or diversity? *The Canadian Journal of Higher Education*, vol. 33(3), pp. 19-46.

Li, T. (2016). A study on the impact of mergers & acquisitions on shareholders' wealth and efficiency. *SHS Web of Conferences*, vol. 25. Retrieved from: https://www.shs-conferences.org/articles/shsconf/abs/2016/03/shsconf_icitce2016_02013/shsconf_icitce2016_02013.html.

Režňáková, M., Pěta, J. (2016). Efficiency of Mergers of Mechanical Engineering Companies in the Czech Republic. *Review of Economic Perspectives*, vol. 16(4), pp. 361-374.

Sedláček, J. (2010). Analysis of the Development of Intangible Assets in the Czech Enterprises and their Impact on Financial Position and Performance. *Journal of Economics*, vol. 58(4), pp. 375-391.

Steker, K., Otrusinová, M. (2012). Current problems of consolidation in the Czech Republic. In: *Proceedings of the 5th International Scientific Conference on Finance and the Performance of Firms in Science, Education and Practice*. Zlín: UTB FME, pp. 542-550.

Thomas, C. J. (2004). The competitive effects of mergers between asymmetric firms. *International Journal of Industrial Organization*, vol. 22(5), pp. 679-692.

Valouch, P., Sedláček, J., Králová, M. (2015). Impact of Mergers of Czech Companies on their Profitability and Returns. *Journal of Economics*, vol. 63(4), pp. 410-430.

Weech-Maldonado, R. (2002). Impact of HMO mergers and acquisitions on financial performance. *Journal of Health Care Finance,* vol. 29(2*),* pp. 64-77.

Zinecker, M., Rajchlová, M. (2013). Rizikový a rozvojový kapitál v České republice – Manažerské know-how a jeho transfer. *Journal of Economics*, vol. 61(3), pp. 283-297.

# Local Debt Burden at LAU2 Level in the EU countries

**László Vértesy**

Budapest University of Technology and Economics
Faculty of Economic and Social Sciences, Department of Finance
Magyar Tudósok körútja 2. Building Q; 1118 Budapest, Hungary
vertesy@finance.bme.hu

***Abstract:*** *This paper examines the magnitude and relevance of local debt burden at a subnational: LAU2 level, for identifying some relevant correlation and country groups. According to the official Eurostat figures the total debt amount of the local governments worth € 847.4 billion in 2017, which is 6.7 % of the EU28's general government gross debt. Therefore, public debt is still a quotidian topic in economics, most countries worldwide face its management challenges. The research is based on legal and economic methodology with quantitative analysis, because of the cross-disciplinary nature of the topic. An overwhelming proportion (64.8 %) of it is denominated in loans, since it is simpler and easier for municipalities to borrow money from the financial intermediaries, and they are able to provide suitable coverages. The confidence in local bonds is low, for temporary financial difficulties the account payable solution is preferred. In some Mediterranean and Nordic countries state or local government-owned specialised financial institutions were established; and despite of creation at different times, they share many similarities. Since the different structures and the level of fragmentation of decentralization, relevant categories for the indebtedness may not be identified, only loose connection can be established. Generally, in countries with larger and more populous LAU2s with greater fiscal autonomy, the sum of the local debt is not so high, but for a single municipality or for a local citizen, it still means a higher burden. Parallel to this, a public administration with small municipalities bears a larger total sum, but this is dispersed among the numerous cities and villages, therefore the debt burden for a single local authority is not significant.*

*Keywords: local governments, local debt, local borrowing, public debt, debt management*

*JEL codes: H63, H74, G18*

## 1 Introduction

According to the official Eurostat (2018) figures the total debt amount of the local governments worth € 847.4 billion in 2017, which is 6.7 % of the EU28's general government gross debt (€ 12,504 bn). Therefore, public debt is still a quotidian topic in economics, most countries worldwide face its management challenges. For EU member states this problem has pivotal importance both from a legislative and from an economic point of view; the Maastricht Treaty contains certain provisions on public finances, which are binding for the EU member states, and governing benchmark for other countries for sound monetary and fiscal policy. Specifically, Article 126 and 140 of the Treaty on the Functioning of the European Union prescribes that general government debt shall be not exceeding 60 % of the gross domestic product. Regardless of this, however, a country with a higher level of debt can still adopt the euro provided its debt level is falling steadily. This extenuates the economic importance of effective budgetary management of local governments, since their debt also needs to be calculated into the national public debt, according to the unified methodology (Eurostat, 2016). The paper examines the magnitude and relevance of local debt burden in the framework of sustainable public finances at a subnational: LAU2 level, for identifying some relevant correlation and country groups.

## 2 Methodology and Data

The research is based on legal and economic methodology with quantitative analysis, because of the cross-disciplinary nature of the topic. Even the law and finance approach

can be important (Schnyder, 2016). The legal method based on the classical interpretation types (grammatical or textual), historical, logical, systematic) of the relevant supranational and for some practical cases the national law sources, which are completed by the teleological and constitution conformity (Stelmach and Brozek, 2006). For comparison, the EU regulations (e.g. stability pact or debt brake rules) are an important initiation.

After the finical crises (2008-2009), for strengthening the financial stability and discipline, most of the EU countries passed legislation on public finances (Denison and Guo, 2015). The intervention at LAU2 level focused on different limitations:

- balanced local budget and/or a defined reduction goal: Austria, Estonia, Finland, Greece, Italy, Netherlands, Poland, Portugal, Slovakia, Spain, Sweden, UK: England, Scotland and Wales;
- authorisation of the borrowing: Belgium, Croatia, France, Luxembourg, Slovenia, UK: Northern Ireland, Romania;
- both: Czech Republic, Denmark, Germany, Hungary, Ireland, Latvia.

Within the constitutional reform, Hungary introduced the balanced budgeting and for any borrowing by local governments the consent of the Government is required (Bethlendi, 2018); Italy incorporated the constitutional budget stability.

The debtors are local governments, local self-governments, municipalities with fiscal autonomy. In the European Union classification, it means the lower levels of Local Administrative Units (LAU level 2, formerly NUTS level 5), which consisted of municipalities or equivalent units in the 28 EU Member States, which are:

- administrative for reasons such as the availability of data and policy implementation capacity;
- a subdivision of the NUTS 3 regions covering the whole economic territory of the Member States;
- appropriate for the implementation of local level typologies included in Tercet, namely the coastal area and DEGURBA classification.

**Table 1** Facts on LAU2 in the EU Member States 2017-2018

| | **# Lau** | **# change** | **% change** | **Max population** | **Min population** | **Average population** | **Total population** |
|---|---|---|---|---|---|---|---|
| BE | 589 | 0 | 0.0% | 522,301 | 89 | 19,297 | 11,365,834 |
| BG | 265 | 0 | 0.0% | 1,323,637 | 835 | 26,799 | 7,101,859 |
| CZ | 6,258 | 5 | 0.1% | 1,280,508 | 0 | 1,690 | 10,578,820 |
| DK | 99 | 0 | 0.0% | 602,481 | 78 | 58,068 | 5,748,769 |
| DE | 11,13 | 60 | 0.5% | 3,574,830 | 0 | 7,411 | 82,521,653 |
| EE | 213 | 0 | 0.0% | 426,538 | 99 | 6,171 | 1,314,463 |
| IE | 3,441 | 0 | 0.0% | n.a. | n.a. | n.a. | n.a. |
| EL | 6,134 | 0 | 0.0% | 664,046 | 0 | 1,764 | 10,818,380 |
| ES | 8,124 | 13 | 0.2% | 3,182,981 | 5 | 5,733 | 46,572,132 |
| FR | 35,46 | * | * | 2,206,488 | 1 | 1,871 | 66,231,156 |
| HR | 556 | 0 | 0.0% | 790,017 | 239 | 7,707 | 4,284,889 |
| IT | 7,983 | 172 | 2.2% | 2,873,494 | 30 | 7,590 | 60,589,445 |
| CY | 615 | 0 | 0.0% | n.a. | n.a. | n.a. | n.a. |
| LV | 119 | 0 | 0.0% | 641,423 | 1,036 | 16,388 | 1,950,116 |
| LT | 60 | 60 | 100% | 545,280 | 3,097 | 47,465 | 2,847,904 |
| LU | 105 | 0 | 0.0% | 114,303 | 780 | 5,625 | 590,667 |
| HU | 3,155 | 0 | 0.0% | 1,752,704 | 8 | 3,105 | 9,797,561 |
| MT | 68 | 68 | 100% | 22,314 | 229 | 6,477 | 440,433 |
| NL | 388 | 1 | 0.3% | 844,947 | 941 | 44,025 | 17,081,507 |
| AT | 2,100 | 0 | 0.0% | 1,867,582 | 47 | 4,178 | 8,772,865 |
| PL | 2,478 | 19 | 0.8% | 1,753,977 | 1,323 | 15,510 | 38,432,992 |
| PT | 3,092 | 9 | 0.3% | 66,250 | 43 | 3,416 | 10,562,178 |
| RO | 3,181 | 7 | 0.2% | 2,102,912 | 125 | 6,986 | 22,222,894 |
| SI | 212 | 11 | 5.2% | 288,919 | 367 | 9,745 | 2,065,895 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| SK | 2,926 | 0 | 0.0% | 103,473 | 7 | 1,858 | 5,435,343 |
| FI | 311 | 2 | 0.6% | 635,181 | 96 | 17,695 | 5,503,297 |
| SE | 290 | 0 | 0.0% | 935,619 | 2,454 | 34,466 | 9,995,153 |
| UK | 400 | 400 | 100 | 1,073,045 | 2,203 | 157,759 | 61,368,314 |
| Total: | 99,76 | 827 | 0.8% | 3,574,830 | 0 | 5,054 | 504,194,519 |

Source: Eurostat (2018): Correspondence table LAU – NUTS 2016, EU-28 and EFTA / available Candidate Countries

By the other subjects, the debt is owed by one party: the borrower/debtor, to a second party: the lender/creditor. The owners of the debts, the creditors need to be divided into two main categories upon the type of the debt. In the case of bonds, they can be anyone: natural person; private and public, domestic or foreign, international legal persons. Credits and loans can be provided usually and only by banks, since these are considered as a business activity by the law. In some Mediterranean states: France: Agence France Locale (2013; Saoudi, 2016), Italy: Cassa Depositi e Prestiti (1850, Bassanini, 2015), Portugal: Fundo de Apoio Municipal (2014, Tavares, 2014), Spain: Fondo de Liquidez Autonómica (2012, Téllez, 2016) and Nordic countries: Denmark: KommuneKredit (1898), Norway: KBN Kommunalbanken (1926), Sweden: Kommuninvesti Sverige AB (1986), Finland: Municipality Finance PLC (1989, Edholm et al., 2016) state or local government-owned specialised financial institutions can be found or established recently. Despite of creation at different times, they share many similarities (Hulbert and Vammalle, 2016):

- they are not-for-profit entities whose sole purpose is to provide sub-national governments competitive funding;
- they hold large market shares of sub-national government lending in their respective countries;
- they are owned by the sub-central or the central government, and they benefit from various forms of "last resort" support mechanisms;
- they provide funding exclusively via the international bond markets, rather than via deposits;
- they have low-risk credit portfolios.

Besides the legal methodology, the paper employs some comparative statistics (OECD and Eurostat) to evaluate the certain results upon figures, because it is even important to match the provisions with the economic performance. The debt means usually something, especially money, that is owed to someone else, or the state of owing something, that can be expressed in monetary value. The meaning of money should be interpreted broadly, because municipalities prefer in practice loans, bonds, notes, and mortgages, which are all typical types of debt. It is also a crucial point that which assets can be calculated or not (as a coverage) in the debt management of local governments (Bitner, 2008). According to the general principles and practice, the assets which can be calculated towards debt settlement: that portion of the assets which is over and beyond the non-marketable registered assets as defined by the law, and is over the assets necessary for the provision of basic services for the citizens. The other types are the assets which may not be calculated towards debt settlement: non or limited marketable assets defined by the law, assets related to the performance of a public tasks to which the state grants and contributes, revenues and funds of local government associations, supports and grants awarded to implementation of public tasks, or – for social considerations – flats and non-housing premises (which have been transferred from state ownership to local government ownership).

**Figure 1** The Amount of Local Government Debts (Million €)

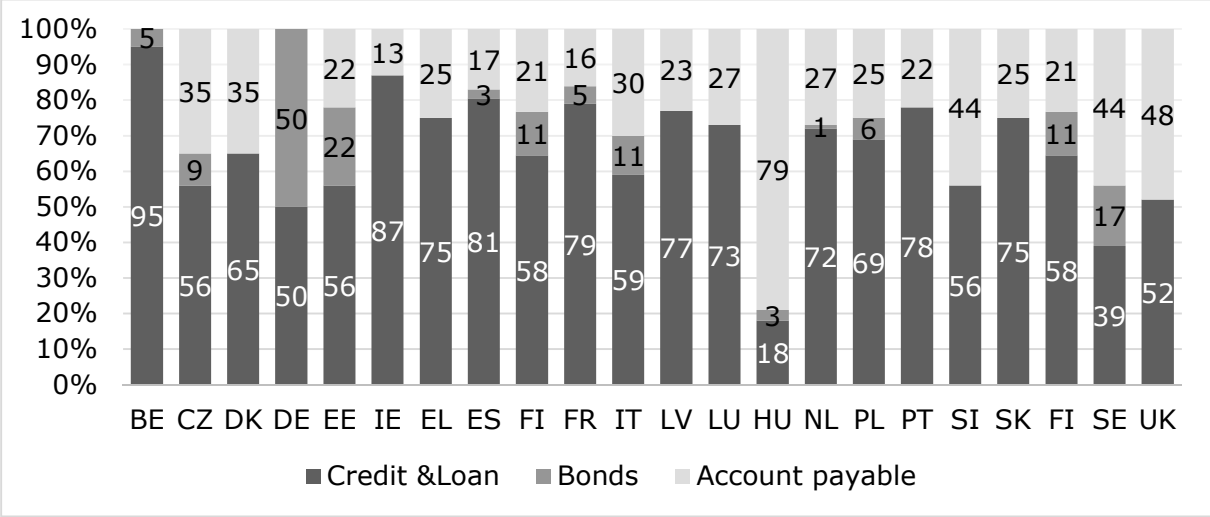

Source: Own compilation based on Eurostat (2018): Local government debt [gov_10dd_logd]

In a macroeconomic context, the general government debt consists of the central and the local government debt, therefore EU member states raise attention to the financial obligations of the municipalities, which need to be calculated into the public debt. According to the official Eurostat figures the total debt amount of the local governments worth € 847.4 billion in 2017, which is 6.7 % of the EU28's general government gross debt (€ 12,504 bn). A significant reduction can be identified because in 2011 it was 13 % of the public debt. In some European countries, unsustainable local government debt has emerged as a problem during and after the financial crises, as a consequence of the central transfer reductions (Greece, Ireland, Italy, Portugal, Spain, Romania, United Kingdom) (Davey, 2011). In these instances, actions must be taken to correct any fundamental imbalance between responsibilities and resources. This also applies to the often-murky financial relationships between municipal budgets and those of their utility companies, public service provider institution (e.g. local public education, healthcare). The treemap demonstrates that four European countries bear the largest local government debt. More than two-thirds of this belongs to four countries: France (€ 201.8 bn, 23 %), Germany (€ 147.2 bn; 17 %), Italy (€ 128.2 bn; 15 %) and the United Kingdom (€ 107.3 bn, 12 %). These are the largest countries in the European Union, with the highest population. Furthermore, with the Netherlands (€ 56.1 bn; 7 %) and Sweden (€ 50.4 bn; 6 %), it rises more than four-fifths (81.5 %).

## 3 Results and Discussion: Debts and local governments

In the examined European countries, an overwhelming proportion of the local government debt is denominated in loans, the average is 64.8 %. Another significant rate belongs to the accounts payable: 29.5 %, and only 11.8 % in bonds. Due to this fact, it is simpler and easier for municipalities to borrow money from financial intermediaries and are able to provide suitable coverages. While there is a lower or a lack of confidence in local bonds and securities, therefore collecting money directly from the market is more difficult (Dzigbede, 2016). In some certain countries special funds, financial institutions, agencies were established by the state or the municipalities for local government financing.

**Figure 2** Structure of Local Government Debts



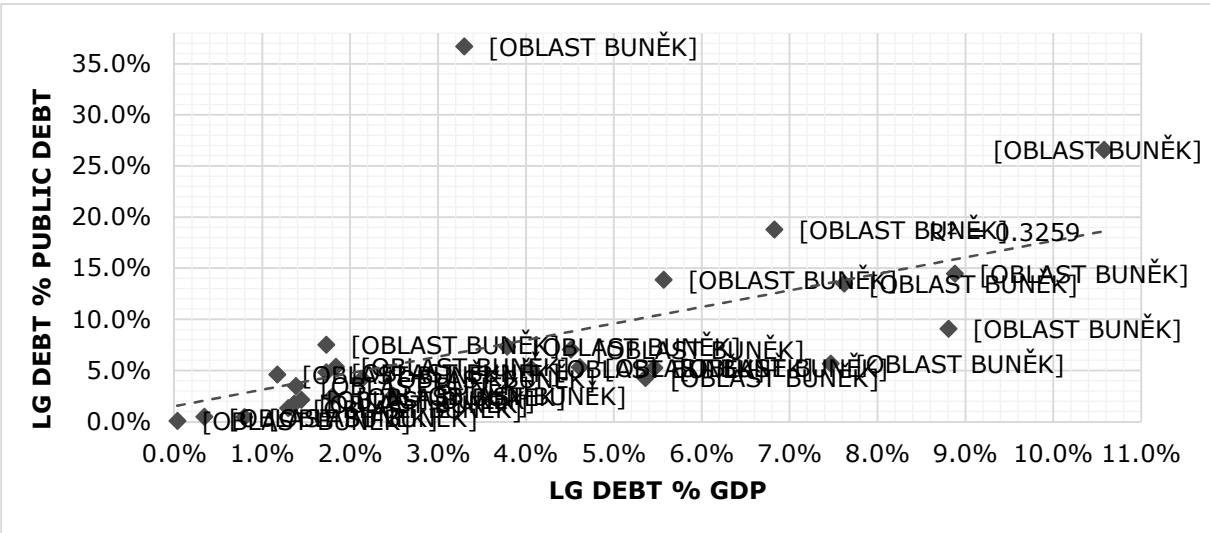

Source: Own compilation based on the OECD subnational government country profiles 2017.

Sometimes it can be observed, that after when the local government cannot borrow more money from the banking system, switches to bonds. For example, in Hungary, the municipalities started with loans (in 2006 € 1.55 billion in loans and only € 0.07 billion in bonds), and after 2007 more and more bonds were issued (Aczél and Homolya, 2011). By 2010 the debt in bonds nearly was the same amount as credits and bills of exchange (€ 2.12 vs. 1.96 billion) (HUN Report, 2013). In Estonia the same situation can be found: the share of loans for municipal outstanding debt accounted for 56%, that of bonds, 22%, the remaining part is made up "other accounts payable (OECD, 2017).

According to the legal relation, it is generally subject to contractual terms regarding the amount and timing of repayments. In the case of loans, the suitable coverage is important for the lender, who usually sets up strict conditions, which have a restrictive impact on the local budget, however, it is easier for the local government to borrow a higher amount in a short time. The bonds are the other typical debt obligation, for which the conditions are defined by the issuing municipality, thus the lenders have no influence on them, but it is a slower process to accumulate the necessary amount (Dalton, 2013).

In itself, the size of the debt is not enough information and is not so high as to jeopardize the credit rating (Spearman, 2007). Hence it is more interesting to take into consideration its burden for a single municipality or for a citizen (per capita).

**Figure 3** Local Government Debts as a Percentage of GDP and of Public Debt

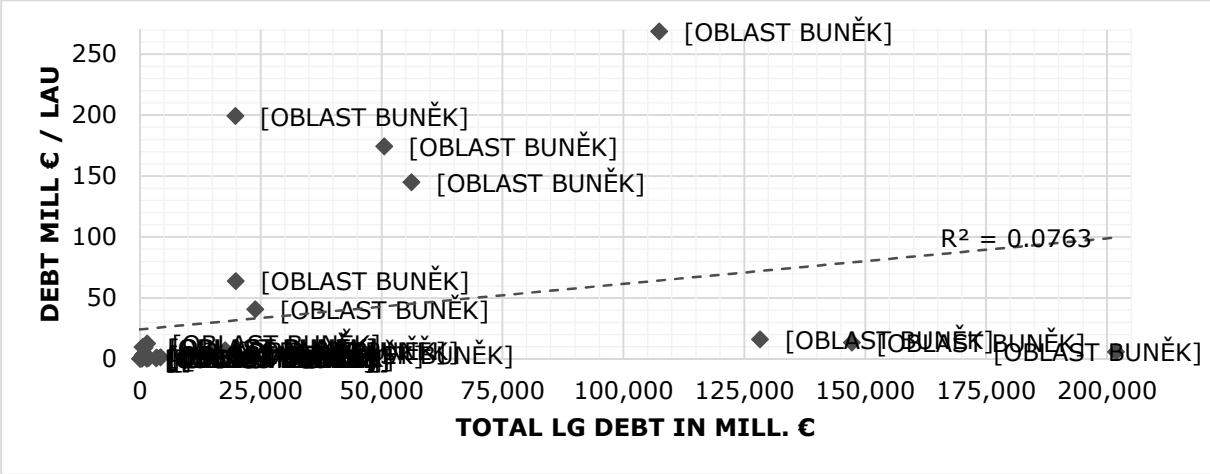


Source: own compilation based on Eurostat Government finance statistics [gov_10dd_logd], [gov_10dd_cgd] and OECD National Accounts Statistics http://dx.doi.org/10.1787/888933531611 and http://dx.doi.org/10.1787/ 888933531630

According to the statistics, the ratio to the GDP or to the public debt of the local government debts show great variation, therefore there is no determining correlation ($R^2$ = 0.32 only) between them. The average rate in the European countries is approximately 3.8 % of the GDP and 6.7 % of the public debt. In small and central, southern European countries, both of them below the average, in which over 90 % of their debts belong to the central government. But it is worth to be mentioned that Eastern European local governments are financially strongly dependent on central state transfers, therefore the deterioration of local government finances can be partially attributed to EU funds: the co-financing requirements place a huge financial burden on local governments which are already striving to find sufficient resources for the provision of local services (Medve-Bálint – Bohle, 2016). In two cases the debt ratio is close to zero (Greece, Hungary). There is an exception of them: Estonia, where the local government debt is 36.7 % of the public debt, but according to the GDP is still low, 3.3 %. In the case of some leading European country (United Kingdom, France, Italy) the municipality debts are over 10 %, but according to the high public debt, it does not mean a great burden in the indebtedness. The French and Italian local government systems are similar, both of them centralised countries, with the small fragmented system. The third group contains the Scandinavian countries, in Finland, Sweden, Denmark the local government debt proportion is higher, especially in Sweden, where it is 10.6 % of the GDP and 26.6 % of the public debt. In these countries, the municipalities have strong fiscal autonomy.

The total local debt and divided by the number of LAU level easily represents the different structures of the local government system of the EU member states. According to the number of LAU 2 level in the member states, the debt burden draws attention to another kind of problem. Due to the large differences, there is only a loose correlation ($R^2$ = 0.07 only) between the sum of the local government debts and per LAUs. Even country groups can be identified, by the structure of the local government system (Nallathiga, 2012).

**Figure 4** Local Government Debts in Million € and per LAUs

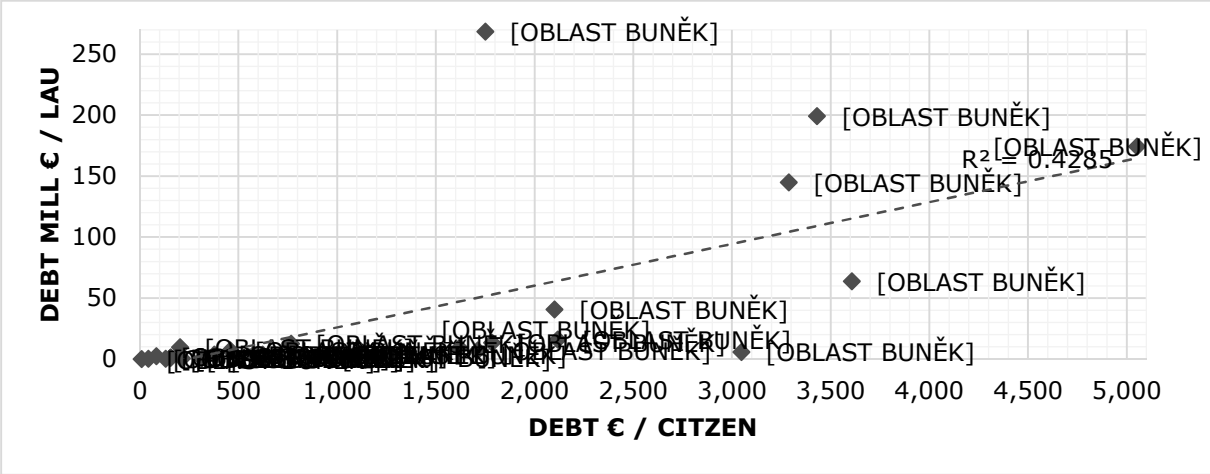



Source: own compilation based on Eurostat (2018): Correspondence table LAU – NUTS 2016, EU-28 and EFTA / available Candidate Countries and Local government debt [gov_10dd_logd]

Especially in Denmark can be observed that the sum of local government debt is not so high (only € 19.7 bill.) but for a single municipality is significant: € 199.2 million. This can be noticed in the case of the Netherlands or Sweden. The highest debt burden can be found in the United Kingdom, where the total amount and the debt per local government are the greatest: € 268.5 billion. It is a consequence of the fact, that in these countries, there are only a few local governments: Denmark (99), the Netherlands (388) or in

Sweden (290) or in the UK (400). But it is even interesting, that the debt burden per a municipality is low in French, German and Italian local governments, because of the small, fragmented, rather decentralized local government system (Finžgar and Brezovnik, 2019): France (35,462), Germany (11,135) and Italy (7,983). In the southern and CEE countries the total amount and the debt per local government is not significant, as a result of the low level of the local debt, and the small fragmented settlement network (number of LAU 2 level): Greece (6,134), Czech Republic (6,258), Hungary (3,155), Slovakia (2,926), Austria (2100). The position above the dotted line means, that in a local government system with strong autonomy the lower total amount of local debt, for the single municipalities the local debt burden is still significant; while the countries which are small fragmented, bear a larger sum, but this is dispersed among the numerous cities and villages.

**Figure 5** Local Government Debts in Million € per LAU, and € per Citizen




Source: own compilation based on Eurostat (2018): Correspondence table LAU – NUTS 2016, EU-28 and EFTA / available Candidate Countries and Local government debt [gov_10dd_logd]

On the other hand, it is worth to compare how great is this burden for a single local citizen (per capita). The southern and CEE countries are located in the same place; therefore, the small amount of local government debt is not significant for the local residents (Kuri, 2014). Except in Lithuania (€ 1,618) and Austria (€ 1,710), which can be explained by the lower population. But in this context, some countries have rearranged. The highest debt burden per a citizen can be identified in Sweden: € 5,052 per capita. The same shift can be recognized in the case of Finland (€ 3,606), Denmark (€ 3,403) or in the Netherlands (€ 3,288). Even Belgium moved in the same direction, according to a higher debt per citizen: € 2100. In France (€ 3,047), Italy (€ 2,116) and Germany (€ 1,784) or the United Kingdom (€ 1,749) the opposite can be observed, with the highest total amount of local government debt, the burden is lower, thanks to the larger population. In the beginning, Estonia was highlighted, but it is worth to be mentioned, that for a municipality (€ 758.1 million) and per a citizen (€ 576) the local government debt is low. According to similar differences, there is no interpretable ($R^2$ = 0.42 only) relation between the local government debts per LAUs and per local capita.

## 4 Conclusions

The amount of local government debts is still a quotidian, but not a major problem, the average ratio in the European countries is approximately 3.8 % of the GDP. After the constitutional, legal and fiscal reforms, the local debt ratio to the public debt, from 13 % fell back to 6.7 %. Although it is not a significant macroeconomic obstacle for most of the EU member states to meet the Maastricht criteria on macro, general government level, few countries are faced with difficulties. The local government debt in Estonia 36 %, in Sweden 26 % or in Denmark 18.8 % of the public debt, while in Finland and in France it is close to 9 % of the GDP. The total local debt worth € 847.4 billion, which four-fifth

belongs to six countries (France, Germany, Italy, the United Kingdom, the Netherlands and Sweden).

In itself, the size of the debt is not enough information, because not the indebtedness is the real problem but the financing of it. Under the most favourable circumstances, the debt is proportional in size and rate of growth in its tax base; does not extend past the useful life of the facilities that it finances; is not used to balance the operating budget; does not require repayment schedules that put excessive burdens on operating expenditures; and is not so high as to jeopardize the credit rating. If the local government faces with the higher debt, but it has a balanced budget and enough revenues, resources to pay off the loans and bonds, then the debt behaves just as a temporary burden.

An overwhelming proportion (64.8 %) of it is denominated in loans, since it is simpler and easier for municipalities to borrow money from the financial intermediaries, and they are able to provide suitable coverages. In some Mediterranean and Nordic countries, state or local government-owned specialised financial institutions were established; and despite of creation at different times, they share many similarities. The confidence in local bonds is low (nearly six times less: 11.8 %), because the lenders cannot participate in the condition-determination, and the local budget has not the same collateral-power as the central budget, government. Account payable usually only a temporary solution in the case of financial difficulties (29.5 %).

Since the different structures and the level of fragmentation of decentralization, relevant categories for the indebtedness may not be identified, only loose connection can be established. The sum and proportion of local government debt compared to the total public debt, or per LAU and citizen do not indicate a clear relationship. Generally, in countries with larger and more populous local governments with greater fiscal autonomy (the United Kingdom, Denmark, the Netherlands or Sweden) the sum of the local government debt is not so high, but for a single municipality or for a local citizen, it still means a higher burden. Parallel to this, a public administration system with small fragmented local government (Mediterranean, Central and Eastern European countries) bears a larger total sum, but this is dispersed among the numerous cities and villages, therefore the debt burden for a single local authority is not significant.

## References


Aczél, Á., Homolya, D. (2011). Risks of the indebtedness of the local government sector from the point of view of financial stability. *MNB Bulletin*, October 2011, vol. 6(3), pp. 7-14.

Bassanini, F. (2015). La politica industriale dopo la crisi: il ruolo della Cassa Depositi e Prestiti. *L'industria*, Il Mulino, Bologna.

Bethlendi, A., Lentner, C. (2018). Subnational Fiscal Consolidation: The Hungarian Path from Crisis to Fiscal Sustainability in Light of International Experiences. *Sustainability*, vol. 10.

Bitner, M., Krzysztof S., Cichocki, K. S. (2008). Effectiveness of debt management in local governments. *Better Government Programme for Ernst & Young,* Polska, 2008.

COM/2016/0788: Proposal for a Regulation of the European Parliament and of The Council amending Regulation (EC) No 1059/2003 as regards the territorial typologies (Tercet) COM/2016/0788 final - 2016/0393 (COD), 2016.

Dalton, H. (2013). *Principles of Public Finance*, Routledge.

Davey, K. ed. (2011). *Local Government in Critical Times: Policies for Crisis, Recovery and a Sustainable Future*. Council of Europe, p. 43.

Denison, D. V., Guo, Z. (2015). Local Government Debt Management and Budget Stabilization. In: Yilin Hou ed.: *Local Government Budget Stabilization*. Springer International Publishing, p. 121.

Dzigbede, K. D. (2014). *Essays in State and Local Government Debt Management*: Networks, Strategic Refinancing and Regulatory Disclosure. Dissertation, Georgia State University, 2016. p. 23-24.

Edholm, Z., Lundberg, K., Malmberg, J. (2016). *Finansiella marknadsprogram i kommunal sektor*, Örebro universitet, Handelshögskolan.

Eurostat (2013, 2016). *Manual on Government Deficit and Debt* – Implementation of ESA 2010.

Finžgar, M., Brezovnik, B. (2019). Direct international comparison of EU member states fiscal decentralization systems, *Transylvanian Review of Administrative Sciences*, No. 56 E/2019, pp. 41-59.

Hulbert, C., Vammalle, C. (2016). *Monitoring Sub-central Governments' Debts: Practices and Challenges in OECD Countries*. OECD-RIFDE, p. 9.

HUN Report (2013). *The local governments' credit and bonds* on the basis of Hungarian local government reports 2005-2013.

Kuri, T. (2014). Financial System and the Local Government in European Countries. *European Scientific Journal*, February 2014, special ed. vol. 1.

Medve-Bálint, G., Bohle, D. (2016). Local Government Debt and EU Funds in the Eastern Member States: The Cases of Hungary and Poland. *MaXCaP Working Paper Series*, p. 22.

Nallathiga, R. (2012). The System of Local Government Finance: A Study of Select Countries. *NIFM Journal of Public Financial Management*, vol. IV(2), pp. 39-50.

OECD (2015). *The State of Public Finances 2015: Strategies for Budgetary Consolidation and Reform in OECD Countries.* DOI: https://dx.doi.org/10.1787/9789264244290-en.

OECD (2017). *Subnational government country profiles for Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Italy, Latvia, Luxembourg, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, United Kingdom*.

Saoudi, M. (2016). *Un nouvel instrument financier de développement des territoires*. L'Agence France locale, Collège international des sciences du territoire (CIST), Grenoble.

Schnyder, G. (2016). *The Law and Finance School: What Concept of Law*? King's College London, 2016.

Spearman, K. (2007). *Financial Management for Local Government*. Routledge, p. 99. and pp. 361-362

Stelmach, J., Brozek, B. (2006). *Methods of Legal Reasoning*. Springer, p. 148.

Tavares da Silva, S., Santos, M. C. (2014). O Fundo de Apoio Municipal – algumas considerações, In: *Questões Atuais de Direito Local* No. 4 Outubro/Dezembro 2014.

Téllez, M. D., Pérez, J. J. (2016). *La financiación de las comunidades autónomas más allá del sistema de financiación autonómica*. Banco de España.

# The Changes in the Polish Tax System and their Influence on the Tax Evasion

**Radosław Witczak[1], Tomasz Florczak[2]**

[1] University of Lodz
Faculty of Economics and Sociology, Institute of Finance
Rewolucji 1905r Street Number 39, 90-255 Lodz, Poland
E-mail: radoslaw.witczak@uni.lodz.pl

[2] University of Lodz
Faculty of Economics and Sociology, Institute of Finance
Rewolucji 1905r Street Number 39, 90-255 Lodz, Poland
E-mail: tomasz.florczak@uni.lodz.pl

***Abstract:*** *One of the phenomena that can be observed in the economy is tax evasion. The most important way to combat tax evasion is the change of the tax system. The aim of the article is to indicate and evaluate the main changes in the Polish tax system in the last years and their influence on the tax evasion. The analysis of main changes in the Polish tax system was given. The reform of the tax administration and tax proceedings was described. The changes in the VAT were given. The changes in the income taxes were presented. The different estimations of the shadow economy were discussed. Research showed that the increase of revenues from VAT and income taxes was caused not only by the increase of the consumption and production (GDP) but also was an effect of the changes in the tax system .*

*Keywords: tax fraud, tax administration, VAT, income taxes*

*JEL codes: H24, H25, H26,K34*

## 1 Introduction

Tax frauds become more and more important issue. Especially the tax frauds in VAT are discussed as public finance problem. The problem of tax frauds concerns also income taxes. It makes the economic conditions of doing business more difficult for the honest taxpayers and it is possible to make them bankrupt. Therefore they need to be protected from unfair competition from institutions which cut their tax liabilities in illegal way. Moreover, some taxpayers use aggressive tax planning to avoid the taxes. Such activities diminish the revenues of the public sector. In order to protect the interests of the State Treasury and to ensure fair competition in the economy, measures must be available to prevent the occurrence of such attempts. The most important way to combat tax evasion is to change the tax system. This is why the varieties of instruments which should help the tax administration to reduce the scale of gray economy were proposed by the EU or OECD like BEPS. In Poland after the election and change of government in 2015 the combat with tax frauds and aggressive tax planning became a key issue. The changes in the tax system aimed to increase the level of the tax revenues. The aim of the article is to indicate and evaluate the main changes in the Polish tax system in the last years and their influence on the tax evasion.

## 2 The changes in the Polish tax system

The problem of shadow economy (Schneider and Raczkowski, 2013) or VAT gap (Kotlińska, 2018) is discussed in literature data. In our opinion the discussion on the changes of the tax fraud in Poland requires firstly analysis of changes in the tax system. The changes can be classified into following groups:

- the reform of tax administration and tax procedures,
- changes in common tax provisions,
- changes in vat,
- changes in income taxes,

- changes in penalties.

An important step to combat the tax evasion was the reform of tax administration and tax procedures in march 2017. Before the reform in 2017 the tax administration consisted of the central (governmental) and the local tax administration (Melezini and Teszner, 2018). The governmental tax administration consisted of the tax offices, fiscal control offices, customs offices. All of them were subordinated to the Ministry of Finance but each one controlled the taxpayers independently from each other. The tax offices were collecting most of the central taxes and some local taxes as well. They were able also to control the taxpayers. The fiscal control offices were responsible only for controlling of taxpayers (including local taxes) but in practice the fiscal control concentrated on controlling central taxes. Customs offices were responsible not only for collecting duties but also for some taxes like excise taxes. The local tax administration is independent from the governmental tax administration. It is responsible for collecting some local taxes like property taxes and has minor role in the tax system. The reform of the tax administration concerned the central (governmental) tax administration and the tax procedures. The National Revenue Administration was created. The new administration is responsible for governmental tax administration including tax offices and custom - fiscal offices (as the merger of fiscal control offices and customs offices). The tax offices still may control taxpayers. The custom - fiscal offices are responsible for controlling taxpayers. National Revenue Administration organizes the information system for the control purposes and ensure cooperation with the information systems of all subordinated offices. National Revenue Administration also draws up the control plans (Zdunek, 2018). The reform of tax administration was involved with changes in tax proceedings. The custom - fiscal offices may use so called duty-fiscal control (a type of tax control procedure) to investigate the taxpayers who commit the tax fraud. In the framework of the duty-fiscal control the competences of tax administration were broaden, for example they are able not only to investigate the documents but also search persons, rooms, detain persons (Różycki, 2018). The quality of tax administration may improve the effectiveness of tax collection. This is why, they have to poses adequate instruments to combat the tax fraud.
The next group are changes in common tax provisions, which concern all taxpayers. In 2016 a general anti-abuse rule was implemented into the Polish tax system. According to some opinions the implementation of a general anti-abuse rule was a kind of prevention activity. The amount of tax proceedings using the general anti-abuse rule has been very low. However, there have been approximately 1000 rejections of the request for tax interpretations. Generally, the taxpayer may request for issuing the individual tax interpretations in the Polish tax system. The tax authority rejects the request if the factual state of affairs concerns a general anti-abuse rule. The number of rejections of the request for tax interpretations could show, that some part of them could concern aggressive tax planning schemes. Therefore the implementation of a general anti-abuse rule had an important effect for diminishing the tax avoiding and increasing the tax revenues (Dzwonkowski, 2019). Another important change was implementation of Standard Audit File for Tax. The taxpayers have to keep tax books electronically and disclose accounting data in a given standard format. However, the obligation of sending Standard Audit File for Tax was adopted before the election in 2015. The big firms were obliged to send Standard Audit File for Tax in July 2016 and small taxpayers from the beginning of 2018 (Dzwonkowski, 2019). Implementing the STIR in 2018 to the Polish tax system is another example of instrument aiming to diminish the tax fraud. The tax authority is able to block a banking account of taxpayers suspected of taking part in the tax fraud (Dzwonkowski, 2019).

There were also some changes in the VAT in the last 3 years. The provisions registration of VAT taxpayers were changed. The tax administration under some specific conditions (for example if the data provided in the application for registration are inaccurate) is able to reject the application for registration as a VAT taxpayer. The aim of this provision was to make more difficult the missing trader fraud. The time of submitting the tax record was shorten. The taxpayers are obliged to submit their tax returns to the revenue office

monthly. So far, they were able to submit the tax returns quarterly. Only small taxpayers may submit the tax returns quarterly. The tax liability of acquirer in special cases were widen in 2017. The split payment mechanism implemented from July 2018 is one of the instrument aimed to decrease the carousel fraud. It is not obligated for taxpayers. However, the taxpayers who entered for the split payment diminishes its tax liability of acquirer (Michalik, 2019).

There have been a lot of changes in the income taxes. Some of them concerned detailed issues. The aim of new provisions were also to close the tax loops used by the taxpayers especially big companies. According to the tax administration an important solution to diminish the tax fraud is supporting cashless payments. Therefore the cash payments only to the limit of 15000 PLN (approximately 3750 euro) may be deductible costs from 2016 (Jasiński, 2016). An important issue is the transfer pricing. Although, the provision on the basis of length-arm rule existed before 2016 the Ministry of Finance decided to add new obligation. The documentation for transfer pricing purposes was implemented more precisely. Different obligation were introduced in respect of master files, country files, local files. The new or more detailed transfer pricing obligations could make income shifting more difficult. So the risk of adjustment to the transfer prices by the tax administration for companies which earlier have shifted income increased (Dmoch, 2018). A limitations to the deductibility of interest come into force. These provisions, which in principle are aimed at limiting the transfer of income, in effect lead to an increase in the taxation level of taxpayers using debt financing (Kordiak, 2019). Apart from discussed problems following issues were changed (Dmoch, 2018): taxation of partnership-joint-stock company, controlled foreign company rules and rules to tackle hybrid mismatches, retrieve of different kind of assets.

Another change in the tax system was the increase of responsibility for fiscal offences and petty offences on the basis of the Fiscal Penal Code or Penal Code. Especially they concerned the missing trader fraud (carousel fraud). For exampling for falsifying VAT invoice the punishment is up to 25 years of imprisonment. Some tax experts claim that the increase of punishment had also influence of diminishing the tax fraud (Pokojska, 2019). In our opinion the offender calculate the risk of coming out the crime but also they calculate the level of punishment. Therefore the increase of the punishment level may also influence the level of shadow economy.

## 3 Methodology

The influence of changes in the Polish tax system on tax evasion can be measured in many ways. In the article were used three research methods:

- descriptive study including critical attitude to the tax acts and literature
- review of research on the shadow economy,
- linear regression method.

An element of the study is the indication of estimates of informal economy developed by various entities. The second method allows to show the impact of GDP growth and consumption on tax revenues of the state budget. To determine this effect, the linear regression method was used, which takes the following form (1).

$$y = \mathrm{ax} + \mathrm{b} \tag{1}$$

The functional form was obtained by using the least squares method (2).

$$min \sum_{i=1}^{n} (y_i - ax_i - b)^2 \tag{2}$$

The determination of the linear regression function was used after checking the correlation between variables. On the other hand, the evaluation of the function estimation was made using the determination coefficient (3).

$$R^2 = r_{xy}^2 \tag{3}$$

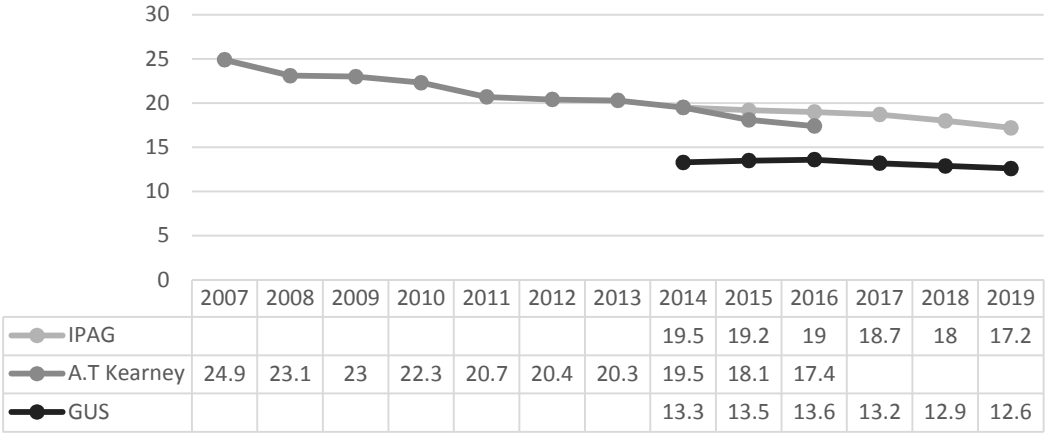
## 4 Results and Discussion

The results of the research aimed at identifying changes in the state budget revenues from taxes (including PIT, CIT, VAT) and their possible connection with the introduction of legal acts limiting the shadow economy. The results present estimated values of indicators:

- share of shadow economy in the Polish economy (in %),
- estimated calculation of the CIT gap (in PLN bln),
- estimated calculation of the VAT gap (in PLN bln),
- share of VAT, PIT, CIT in GDP (in %).

On figure 1, there is the share of shadow economy in the Polish economy (in %). The chart shows the estimations of three different institutions.

**Figure 1** Share of Shadow Economy in the Polish Economy (in %)




| | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| IPAG | | | | | | | | 19.5 | 19.2 | 19 | 18.7 | 18 | 17.2 |
| A.T Kearney | 24.9 | 23.1 | 23 | 22.3 | 20.7 | 20.4 | 20.3 | 19.5 | 18.1 | 17.4 | | | |
| GUS | | | | | | | | 13.3 | 13.5 | 13.6 | 13.2 | 12.9 | 12.6 |

Source: unregistered employment in Poland in 2017, Główny Urząd Statystyczny, Warsaw 2019; Unregistered employment in Poland in 2014, Główny Urząd Statystyczny, Warsaw 2015; Fundowicz J., Łapiński K., Wyżnikiewicz B., Szara strefa 2018, Instytut Prognoz i Analiza Gospodarczych, Warsaw 2018; Fundowicz J., Łapiński K., Wyżnikiewicz B., Wyżnikiewicz D., Szara strefa 2019, Instytut Prognoz i Analiza Gospodarczych, Warsaw 2019; Digital Payments and the Global Informal Economy, ATKearney.

According to the data from figure 1, it can be stated that the size of the shadow economy decreased according to the estimations of all institutions investigating this phenomenon. According to ATKearney's estimations the biggest changes were around 2010. On the other hand researches of GUS and IPAG estimate that the biggest decrease in the share of shadow economy in GDP can be observed after 2016. The impact may be the result of introduced legal acts changes in 2016. It's especially important because the aim of these changes was closing the gaps in the Polish tax system.

Next research area is estimated value of the corporate income tax gap presented in table 1. The only available data was published by Polish Economic Institute (Polski Instytut Ekonomiczny; PIE) (see table 1).

**Table 1** Estimated value of CIT gap (in bln PLN)

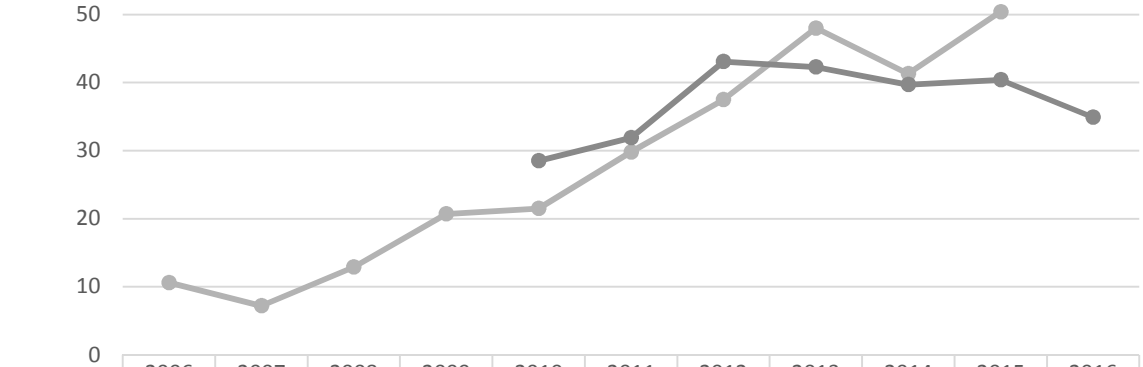
| Year | Gap from national accounts | Foreign gap | KAS gap | Total CIT gap |
|---|---|---|---|---|
| **2015** | from 32,4 to 44 | 4,5 | 1,5 | from 38,4 to 50 |
| **2016** | from 3,6 to 13,3 | 4,4 | 0,7 | from 8,7 to 18,4 |
| **2017** | from 1,8 to 12,2 | 8,5 | 0,7 | from 11,0 to 21,4 |

Source: Horyzont optymalizacji – geneza, skala, struktura luki w podatku CIT, Polski Instytut Ekonomiczny, Warsaw 2019

The table 1. shows the changes of CIT gap within three years. Values presented in the table are only the estimations of PIE. It means, that the true size of CIT gap in shadow

economy can be higher or lower. The table 1. shows the decrease in part CIT gap connected with national accounts. Through three years the foreign part of CIT gap has increased almost twice. On the other hand the part connected with National Revenue Administration (KAS - Krajowa Administracja Skarbowa) has bottom out to 0,6 bln PLN. The value of all CIT gap fluctuated widely through three researched years. In the year 2017 its value is about 11-21,4 bln PLN. That decrease can be caused by changes in Polish tax system. Also the gap in VAT was estimated (see figure 2)

**Figure 2** Estimated Calculation of the VAT Gap (in bln PLN)

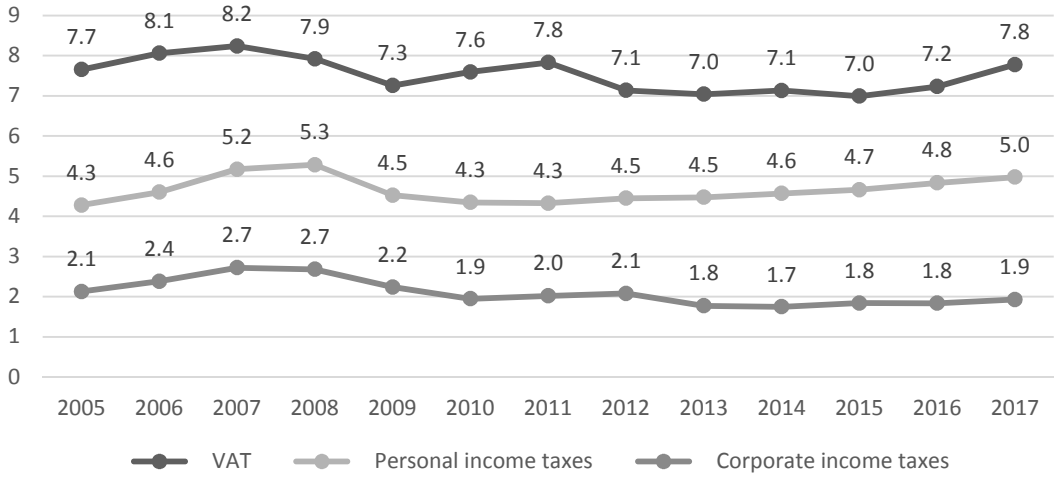



| | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| PWC | 10.6 | 7.2 | 12.9 | 20.7 | 21.5 | 29.8 | 37.5 | 48.0 | 41.3 | 50.4 | |
| PIE | | | | | 28.5 | 31.9 | 43.1 | 42.3 | 39.7 | 40.4 | 34.9 |

Source: Luka podatkowa w VAT – jak to zwalczać?, PWC, Warsaw 2014; Zmniejszenie luki VAT w Polsce w latach 2016-2017. Przyczyny – środki - dalsze perspektywy, Polski Instytut Ekonomiczny, Warsaw 2018

The figure 2. presents the VAT gap in Polish tax system estimated by two different institutions: PWC and PIE. The data are only available to 2016 and the influence of changes in Polish tax system cannot be observed. Values published by PWC shows increase in VAT gap and peak in years 2010-2013. According to PIE research the gap fluctuated up to 2015 and decreased in 2016. The figure 3 shows the shares of VAT, PIT, CIT in GDP

**Figure 3** Shares of VAT, PIT, CIT in GDP (in %)




Source: Eurostat Database, ec.europa.eu/Eurostat/data/database (Accessed on 28. 05. 2019)

Within the figure 3. are contained shares of VAT, PIT, CIT in GDP. The shares of these taxes in GDP had decrease after the year 2007-8. It could be caused by the tax evasion.

The changes in the Polish tax system could increase the share of tax revenues in GDP level. In years 2015-2017 can be observed increase in shares of researched taxes in GDP.

In opinion of some researchers the increase of tax revenues is not the result of changes in tax system. They look for the relationship between tax revenues increase and increase of GDP. Some claim that the increase of household consumption (the effect of one of the Polish social programs) caused the increase of tax revenues. The following research is an attempt to determine the relationship between these values. The forecast was made on basis of linear regression method. For the tested variables, the function patterns were obtained:

- For relationship between VAT revenues and GDP (the economic growth described as GDP affects the increase of tax revenues)
  $y = 0{,}0574x + 24749$ (1)
- For relationship between VAT revenues and household consumption (bigger consumption as the result of one of polish government's program can affect the tax revenues from VAT)
  $y = 0{,}1018x + 19353$ (2)
- For relationship between PIT revenues and GDP (the economic growth described as GDP affects the increase of tax revenues)
  $y = 0{,}0422x + 5411{,}5$ (3)
- For relationship between PIT revenues and household consumption (bigger consumption as the result of one of polish government's program can affect the tax revenues from PIT – the program also increases the household revenues)
  $y = 0{,}0736x + 2442{,}6$ (4)

The Table 2 shows the results of the study of the relationship between VAT revenues and GDP as well as between VAT revenues and household consumption.

**Table 2** The results of the study of the relationship between VAT revenues and GDP as well as between VAT revenues and household consumption.

| Year | VAT (actual value) | Forecast based on GDP value | | Forecast based on total consumption value | |
|---|---|---|---|---|---|
| | | VAT (forecast) | Difference between actual value and forecast | VAT (forecast) | Difference between actual value and forecast |
| **2005** | 75 783 | 81601,86 | -5818,86 | 81962,75 | -6179,75 |
| **2006** | 86 204 | 86156,90 | 47,10 | 85888,67 | 315,33 |
| **2007** | 97 848 | 92917,53 | 4930,47 | 91155,29 | 6692,71 |
| **2008** | 101 876 | 98569,36 | 3306,64 | 99117,68 | 2758,32 |
| **2009** | 99 562 | 103513,74 | -3951,74 | 104089,79 | -4527,79 |
| **2010** | 109 717 | 107709,11 | 2007,89 | 108449,07 | 1267,93 |
| **2011** | 122 647 | 114684,70 | 7962,30 | 115910,30 | 6736,70 |
| **2012** | 116 265 | 118278,00 | -2013,00 | 119926,72 | -3661,72 |
| **2013** | 116 607 | 119854,77 | -3247,77 | 120670,57 | -4063,57 |
| **2014** | 122 671 | 123501,68 | -830,68 | 123130,77 | -459,77 |
| **2015** | 125 836 | 128082,09 | -2246,09 | 125048,99 | 787,01 |
| **2016** | 134 554 | 131576,83 | 2977,17 | 128665,84 | 5888,16 |
| **2017** | 154 656 | 138935,62 | 15720,38 | 135938,94 | 18717,06 |

Source: Own elaboration based on Eurostat Database, ec.europa.eu/Eurostat/data/database (Accessed on 28. 05. 2019)

The table 2. is divided into two parts: actual value of VAT; forecast of VAT value based on research. Forecast is the result of own research based on linear regression method. The linear function is valuable with determination coefficient (R) equal to 0,9337 for dependence between VAT and GDP and 0,9274 for the dependence between VAT and household consumption. The results of research show that there are big differences

between real value of VAT and the forecasts made on basis of linear regression method. The values of differences are the evidence, that we cannot tell that the increase of VAT revenues depends mainly on GDP level or on consumption. The Table 3 shows the results of the study of the relationship between PIT revenues and GDP as well as between PIT revenues and household consumption.

**Table 3** The results of the study of the relationship between PIT revenues and GDP as well as between PIT revenues and household consumption.

| Year | PIT (actual value) | Forecast based on GDP value | | Forecast based on total consumption value | |
|---|---|---|---|---|---|
| | | PIT (forecast) | Difference between actual value and forecast | PIT (forecast) | Difference between actual value and forecast |
| **2005** | 42 377,0 | 47209,25 | -4 832,25 | 47708,59 | -5331,59 |
| **2006** | 49 228,0 | 50558,07 | -1 330,07 | 50546,97 | -1318,97 |
| **2007** | 61 403,0 | 55528,43 | 5 874,57 | 54354,67 | 7048,33 |
| **2008** | 67 940,0 | 59683,61 | 8 256,39 | 60111,36 | 7828,64 |
| **2009** | 62 078,0 | 63318,68 | -1 240,68 | 63706,14 | -1628,14 |
| **2010** | 62 818,0 | 66403,08 | -3 585,08 | 66857,84 | -4039,84 |
| **2011** | 67 768,0 | 71531,47 | -3 763,47 | 72252,20 | -4484,20 |
| **2012** | 72 516,0 | 74173,24 | -1 657,24 | 75156,01 | -2640,01 |
| **2013** | 74 124,0 | 75332,47 | -1 208,47 | 75693,81 | -1569,81 |
| **2014** | 78 617,0 | 78013,65 | 603,35 | 77472,50 | 1144,50 |
| **2015** | 83 861,0 | 81381,12 | 2 479,88 | 78859,35 | 5001,65 |
| **2016** | 89 943,0 | 83950,43 | 5 992,57 | 81474,28 | 8468,72 |
| **2017** | 98 969,0 | 89360,55 | 9 608,45 | 86732,63 | 12236,37 |

Source: Own elaboration based on Eurostat Database, ec.europa.eu/Eurostat/data/database (Accessed on 28. 05. 2019)

Within the table 3. contents the research on the relationship between budget revenues from PIT and GDP and relationship between budget revenues from PIT and household consumption. Forecast is the result of own research based on linear regression method. The linear function is valuable with determination coefficient (R) equal to 0,887 for dependence between PIT and GDP and 0,8539 for the dependence between PIT and household consumption. The results of research show that there are quite big differences between real value of PIT and the forecasts made on basis of linear regression method. This allows to assume that the increase of PIT revenues depends not only on GDP or household consumption but also was a result of combating tax frauds.

## 5 Conclusions

The changes in the tax system are aimed to increase the level of the tax revenues. They concerned both the diminishing the tax evasion and tax avoidance. The data show that the share of shadow economy decreased in years 2015-017. Our research shows that the increase of tax revenues from VAT and income taxes was caused not only by the increase of the consumption and production (GDP) but also was an effect of changes in the tax system. It is questionable if all these changes has improved effectiveness of tax system from the point view of the taxpayers. They have increased the level of taxation imposed on firms or the level of obligations. The cost of changes for taxpayers could be the issue of further researches. It is advisable to research in more details the impact of implementation of a general anti-abuse rule on the increase of tax revenues. Another issue which should be researched in more details are the effects of the changes concerning transfer pricing.

## Acknowledgments

We would like to thank dr Witold Śmigielski for support. The research was financed by the grant for conducting research of development works aimed at the development of young scientists from the funds of the Ministry of Science and Higher Education.

## References

Dmoch, W. (2018). *Podatek dochodowy od osób prawnych. Komentarz.*, Warszawa: electronic edition.

Dzwonkowski, H. (2019). *Ordynacja podatkowa. Komentarz.,* 8th ed. Warszawa: C.H. Beck**.**

GUS (2016). *Rachunki narodowe GUS według sektorów i podsektorów instytucjonalnych w latach 2011–2014*, Warszawa: Główny Urząd Statystyczny.

Jasiński, W. (2016). Podstawą jest szybkość działania. *Rzeczpospolita dated 14.03.2016,* electronic edition.

Kordiak, M. (2019). Z rozliczeniem odsetek i różnic kursowych wiążą się kłopoty. *Rzeczpospolita dated 06.05.2019*, pp. D5.

Kotlińska, J. (2018). Podatek od towarów i usług i jego ściągalność w Polsce. *Ekonomista,* vol. 5, pp. 595-617.

Melezini, W., Teszner K., (2018). *Krajowa Administracja Skarbowa. Komentarz*. Warszawa: Lex, electronic edition.

Michalik, T. (2019). *VAT 2019*, Warszawa: Legalis, electronic edition.

Pokojska, A. (2019). Więcej elastyczności w karaniu za fikcyjne faktury. *Gazeta Prawna dated 19.05.2019,* pp. B3.

Raczkowski, K., Schneider, F. (2013). Sfera nieoficjalna w gospodarce, „Infos" nr 21 (158) z 21.11.2013 r., Biuro Analiz Sejmowych, Warszawa 2013.

Raczkowski, K., Schneider, F. (2013). Size and Development of the Shadow Economy and of Tax Evasion within Poland and of Its Neighbouring Countries from 2003 to 2013: Some New Facts. In: Raczkowski, K., Schneider, F., ed. (2013), *The Economic Security of Business Transactions. Management in Business*, Oxford: Chartridge Books Oxford.

Różycki, K. (2018). *Kontrola celno-skarbowa*, Warszawa: Wolters Kluwer, pp. 47-124.

Zdunek, A. (2018). Krajowa Administracja Skarbowa - konsolidacja służb skarbowych i celnych w celu uszczelnienia systemu podatkowego. In: Brzeziński, B., ed., *Nowe narzędzia kontrolne, dokumentacyjne i informatyczne w prawie podatkowym: poprawa efektywności systemu podatkowego*, Wolters Kluwer.

# Methodological Aspects of Assessing the Fiscal Sustainability of the Russian Federations' Regions in Modern Economic Conditions

**Sergey Yashin[1], Nadezhda Yashina[2], Nataliya Pronchatova-Rubtsova[3], Oksana Kashina [4], Bogomolov Sergey[5]**

[1, 2, 3, 4, 5] Lobachevsky State University of Nizhny Novgorod
Institute of Economics and Entrepreneurship, [1] Management and Public Administration Department, [2, 3, 4, 5] Department of Finance and Credit
Bolshaya Pokrovskaya street 37, 603000 Nizhny Novgorod, Russian Federation
E-mail: [1] jashinsn@yandex.ru, [2] sitnicof@mail.ru, [3] pronat89@mail.ru, [4] oksana_kashina@mail.ru, [5] bogomolov@iee.unn.ru

***Abstract:*** *In the conditions of economy volatility, the increased sensitivity of the fiscal system of the state to negative impacts and limited financial resources, the need to improve the quality of public finance management through the rational use of mobilized revenues and optimization of public spending is becoming more pressing. In this regard, the goal of the study is to develop a methodology for assessing the fiscal sustainability of regions in modern economic conditions to ensure sustained economic growth and development of the country, contributing to improving the population well-being. The paper considers the features of the regional budgets analysis based on a specially formed system of fiscal sustainability indicators. The study is based on a systems approach that allows analyzing various aspects of fiscal sustainability assessment in modern economic conditions. The authors propose to calculate indicators, reflecting the peculiarities of financing human capital and productive economy sectors, the specifics of the income structure and budget management efficiency. Used methods of economic, systems analysis and mathematical statistics. The methodology has been tested on a sample of official data on the execution of consolidated regional budgets from open databases of the Federal State Statistics Service, the Federal Tax Service and the Federal Treasury of the Russian Federation for 2016-2018. The result of the methodology application is the ordering of the Russian regions based on the value of the final normalized indicator for assessing the fiscal sustainability. The study practical significance lies in the ability to perform a comparative analysis of regions according to the degree of their fiscal sustainability, both in territorial and in time, which contributes to the timely adoption of effective management decisions aimed at preventing losses of fiscal sustainability and improving the budget management quality.*

*Keywords: fiscal sustainability, final normalized indicator, budget management, efficiency, population well-being*

*JEL codes: H21, H61, H68, H7, I31*

## 1 Introduction

The key goal of fiscal policy is to ensure stable growth rates of the economy and to increase the potential for the country's balanced development. One of the important tasks of the RF Government for 2019-2020 lies in rational use of collected taxes and duties and optimization of public expenditure in order to ensure improvement of population well-being (Kornilov et al., 2017), despite the existing negative internal and external financial factors. Negative impacts include: the sensitivity of domestic economic conditions to the external environment, including oil price fluctuations, significant inflation expectations, high effective long-term interest rates. Fiscal sustainability of regions depends on a stable trajectory of economic growth: dynamics of GDP, development of export-oriented industries as well as domestic demand-driven and investment-oriented sectors, buoyancy of capital investments, positive dynamics of personal income, real-terms wage growth.

A wide range of studies are devoted to evaluating the effectiveness of fiscal policy. Fiscal sustainability is a key indicator of the quality of fiscal policy pursued, but at present,

there is no consensus among scientists on the substance of fiscal sustainability and methods for its assessment.

Fiscal sustainability is often described as the condition that can be opposed to fiscal crises, the most dangerous of which is public debt default. Therefore, many researchers interpret fiscal sustainability through the prism of debt indicators and the effectiveness of public debt management. IMF specialists (IMF, 2002; Burnside, 2005) define fiscal sustainability as the ability to service and repay all debt obligations in full without having to introduce major changes to fiscal policy.

Long-term fiscal sustainability is to be studied separately. Blanchard et al. (1990) believe that fiscal sustainability is characterized by the government's ability to achieve the initial level of public debt in the long term. Maintaining long-term fiscal sustainability requires an approach, which allows to ensure that public debt does not grow at a faster rate than economy growth. Fiscal sustainability describes a certain fiscal regime with a specific structure and specific public revenues and expenditures. Kudrin and Sokolov (2017) pay considerable attention to the requirements, which effective fiscal rules must meet in the current conditions. Thus, they believe that tax rules should allow to adapt the budget to the requirements for financing structural changes in the economy and to retain control over long-term fiscal sustainability.

Fiscal sustainability should be regulated in a gradual and steady manner, as the economic system takes a long time to adapt to the changing business conditions. Frequent changes in fiscal policy can cause higher uncertainty for economic actors, especially under the conditions of internal and external financial constraints.

Fiscal sustainability is largely determined by a balanced budget; otherwise, even minor shocks can cause its vulnerability, which will lead to a curtailment of consumer spending, investment and debt financing offer (Barrell et al., 2006). Loss of fiscal sustainability is associated not only with budget deficits (Manasse and Roubini, 2005), but also with not being ready to overcome temporary macroeconomic shocks (exchange rate fluctuations, higher borrowing costs, limited credit resources). To reduce the sensitivity of the public finances to such risks, it is necessary to ensure that debt of the corporate and banking sectors does not exceed the critical level. A retrospective analysis shows that often a bank crisis with inertia of several years is followed by a public finance crisis (Reinhart and Rogoff, 2011). Assessing the sustainability of public finances in the context of macroeconomic shocks requires methods, the essence of which boils down to a comprehensive stress test of finances. In the context of crisis phenomena, the key in the field of fiscal policy is to transform the budget mechanism into an effective tool for macroeconomic stabilization and to use all public spending reserves to finance economy development and human capital (Bogolib, 2015).

Methodological aspects of assessment of fiscal sustainability were further explored in the works of Horne (1991) and Blanchard et al. (1990) that revealed insights into the general concept of fiscal sustainability and proposed specific indicators for its assessment. It was based on the government's 'inter-temporal budget constraints.' The indicators show whether chronic differences between revenues and expenditures will arise if economic development follows a known trend.

At present, we can distinguish a whole group of researchers (Brady and Magazzino, 2019; Krajewski et al., 2016; Hakkio and Rush, 1991; Gabriel and Sangduan, 2011) who analyze the sustainability of public finances by actively using cointegration methods allowing to reveal a long-term relationship between government expenditures and government revenues. Thus, Krajewski et al. (2016) revealed that despite the financial turmoil, 10 countries in Central and Eastern Europe demonstrate the existence of a long-term relationship between revenues and expenditures and have statistically relevant parameters of the fiscal reaction function. This indicates that the public finances in these countries are sustainable despite the crisis. However, the analysed group of countries shows sustainability only in a weak sense, which may pose a threat to public finances in the future.

The Russian practice does not have a single unified approach to defining and assessing fiscal sustainability. There is no systemic legal regulation, but compliance with the requirements set forth in the Budget Code of the Russian Federation for the condition of territorial budgets is often interpreted as the basis for ensuring fiscal sustainability (Yashina et al., 2013). Methods of assessing the financial sustainability of budgets have gained widespread use: they are based on the analysis of the revenue and expenditure parts of the budget as well as payables using the integral indicators method (Kolesov, 2000; Yashina et al., 2013), arc log elasticity metrics (Lapushinskaya, 2001) and correlation analysis (Yashin and Yashina, 2003).

The problem of the absence of transparent standardized methods to measure fiscal sustainability actualizes the need to study and develop new methodological approaches to conducting a comprehensive qualitative and quantitative assessment of fiscal sustainability (Yashina et al., 2018).

**The purpose of the study** is to develop a method for assessing fiscal sustainability of regions in modern economic conditions, the results of which will be useful for the country's economic growth and development and improvement of the population well-being. The study object is the consolidated budgets of the regions. The study subject is the budget management methods and tools of constituent entities of the Russian Federation. The theoretical significance is to develop scientific and theoretical foundations of budget management in terms of measuring fiscal sustainability of regions. The practical significance is to enable the government authorities of all levels to use methods of assessing fiscal sustainability of regions in order to make effective management decisions to generate budget revenues, to ensure effectiveness of expenditure financing, to manage public debt and to implement an effective mechanism of inter-budgetary relations.

## 2 Methodology and Data

The study is based on a multi-criteria analysis of fiscal sustainability (FS) in modern economic conditions.

We propose the following principles for assessing FS of regions of the RF in modern economic conditions: the principle of balanced reference values; the principle of completeness of coverage of formation of the revenue and expenditure parts of the budget; the principles of quality and reliability of indicators.

It is proposed to implement the fiscal sustainability assessment method on a step-by-step basis: "1" — assessment of the study object → "2" — collection of source information → "3" — determination of reference values → "4" — calculation of indicators → "5" — analysis of the level of fiscal sustainability of regions → "6" — scientifically grounded interpretation of indicators → "7" — specific recommendations for ensuring a medium and high level of fiscal sustainability of regions. Conclusions about the current condition of the territorial budgets are made by assessing the uniformity of approximation of indicators to the expert generated reference values.

To measure FS, the following methodical tools are proposed (Table 1).

**Table 1** The System of Indicators to Assess Fiscal Sustainability (FS) of Regions

| No. | Indicator | Calculation | Improvement (1)/deterioration (2) of FS when the values increase |
|---|---|---|---|
| 1 | 2 | 3 | 4 |
| 1 | **Financial independence ratio (K1)** | (TR + NTR)/R | 1 |
| 2 | **Financial stability ratio (K2)** | TR/R | 1 |
| 3 | **Own revenues to financial aid ratio (K3)** | (TR + NTR)/FA | 1 |

| | | | |
|---|---|---|---|
| 4 | **Social expenditure financed by own revenues ratio (K4)** | (TR + NTR)/SE | 1 |
| 5 | **Production sectors financed by own revenues ratio (K5)** | (TR + NTR)/NE+HPU | 1 |
| 6 | **Administration costs to total expenditures ratio (K6)** | GM/E | 2 |
| 7 | **Human capital investment ratio (K7) — social expenditures to total expenditures ratio** | SE/E | 1 |
| 8 | **Interest expense ratio (K8)** | DS/TR | 2 |
| 9 | **Debt burden ratio (K9)** | PD/TR | 2 |
| 10 | **Total debt load ratio (K10)** | PD+DS/TR | 2 |
| 11 | **Tax debt ratio (K11)** | TD/TR | 2 |
| 12 | **Potential reserve for financing social expenditures (K12)** | TD/SE | 1 |

*Abbreviations: TR — tax revenues, NTR — non-tax revenues, R — total revenues, FA — financial aid, PD- public debt, DS — debt servicing, E — total expenditures, TD — arrears in respect of taxes and duties, SE — social expenditures (expenditure on healthcare, education, social policy, physical education, sports, culture, cinematography), GM — expenditure on general government matters, NE — expenditure on national economy, HPU — expenditure on housing and public utilities.*

Source: prepared by the authors.

*For comprehensive assessment of FS, we determine a final normalized indicator of FS ($FNI_{FS}$) using an additive model.* It is necessary to carry out the normalizing and standardization of individual indicators to lose their dimension, while maintaining the structure of changes in individual ratios. This allows to compare and present them in a single unified coordinate system for convergence at $FNI_{FS}$. To "clear" the indicators, we group them on the following basis: when some of them increase, fiscal sustainability of the regions improves (1); when others increase, it leads to deterioration in fiscal sustainability of the regions (2) (Table 1, column 4) (Yashina et al., 2018).

First group (improvement (1) of FS when the values increase)

$$K_{ijn} = \frac{Kij\ max - Kij}{Ki\ max - Ki\ min} \quad (1)$$

Second group (deterioration (2) of FS when the values increase)

$$K_{ijn} = \frac{Kij - Ki\ min}{Ki\ max - Ki\ min} \quad (2)$$

where $K_{ij}$ — the calculated value of the *i*-th ratio in the system of fiscal sustainability ratios in the *j*-th region,

$K_{ijn}$ — the normalized value of the *i*-th ratio in the system of fiscal sustainability ratios in the *j*-th region,

$K_{i\ max}$ — the highest calculated value of the *i*-th ratio in the sample,

$K_{i\ min}$- the lowest calculated value of the *i*-th ratio in the sample.

The proposed indicators allow to compare the FS levels of constituent entities of the Russian Federation with completely different structural characteristics. FS means the budget condition at which the values of the indicators included in the system of indicators for assessing the FS of regions are within the range of conditionally satisfactory values and characterized by positive dynamics. To measure the FS level of constituent entities of the Russian Federation, it is necessary to set normative values for ratios characterizing the relative indicators of the planned and actual budget values. Normative values of indicators are determined on the basis of planned and actual average values set on the basis of groups of constituent entities of the Russian Federation. This setting of FS levels is based on expert judgment and results from practical application.

## 3 Results and Discussion

The practical implementation of the method was based on the results of the annual execution of the consolidated budgets of 85 regions of the Russian Federation in 2016-2018. Table 2 shows selected relative indicators of fiscal sustainability assessment of constituent entities of the Russian Federation based on the reporting data of the Federal State Statistics Service of the Russian Federation, the Federal Tax Service of the Russian Federation and the Federal Treasury of the Russian Federation.

**Table 2** Current Values of Selected Relative Indicators of Fiscal Sustainability Assessment of Constituent Entities of the Russian Federation, 2016-2018 (fragment)

| RF Region | K1 | | | K5 | | | K6 | | | K7 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2016 | 2017 | 2018 | 2016 | 2017 | 2018 | 2016 | 2017 | 2018 | 2016 | 2017 | 2018 |
| **Zabaikalsky region** | 0.68 | 0.69 | 0.62 | 3.78 | 3.85 | 4.00 | 0.08 | 0.09 | 0.09 | 0.68 | 0.69 | 0.71 |
| **Perm region** | 0.88 | 0.87 | 0.89 | 4.63 | 4.00 | 4.12 | 0.07 | 0.07 | 0.07 | 0.71 | 0.68 | 0.67 |
| **Republic of Mordovia** | 0.66 | 0.68 | 0.70 | 1.97 | 1.77 | 2.50 | 0.09 | 0.08 | 0.09 | 0.51 | 0.49 | 0.54 |
| **Republic of Tatarstan** | 0.89 | 0.89 | 0.87 | 2.52 | 2.53 | 2.56 | 0.05 | 0.05 | 0.06 | 0.56 | 0.53 | 0.56 |
| **Saint Petersburg** | 0.95 | 0.96 | 0.96 | 2.64 | 2.51 | 3.06 | 0.05 | 0.05 | 0.05 | 0.55 | 0.57 | 0.59 |
| **Murmansk region** | 0.91 | 0.90 | 0.89 | 4.85 | 4.62 | 4.36 | 0.07 | 0.07 | 0.07 | 0.68 | 0.68 | 0.66 |
| **Republic of Kabardino-Balkaria** | 0.52 | 0.47 | 0.45 | 2.25 | 1.99 | 2.32 | 0.08 | 0.08 | 0.08 | 0.67 | 0.64 | 0.66 |
| **Karachay-Cherkess Republic** | 0.40 | 0.34 | 0.33 | 1.41 | 1.43 | 1.15 | 0.07 | 0.06 | 0.06 | 0.63 | 0.63 | 0.62 |
| **Republic of Ingushetia** | 0.14 | 0.19 | 0.18 | 0.49 | 1.13 | 1.21 | 0.05 | 0.06 | 0.06 | 0.58 | 0.73 | 0.69 |
| **Irkutsk region** | 0.86 | 0.86 | 0.87 | 3.79 | 3.65 | 4.75 | 0.07 | 0.07 | 0.07 | 0.66 | 0.66 | 0.70 |
| **Republic of Altai** | 0.30 | 0.31 | 0.30 | 1.01 | 1.33 | 1.42 | 0.08 | 0.08 | 0.07 | 0.60 | 0.64 | 0.66 |
| **Republic of Khakasia** | 0.77 | 0.80 | 0.74 | 4.48 | 6.10 | 5.40 | 0.07 | 0.07 | 0.07 | 0.70 | 0.68 | 0.71 |
| **Tyumen region** | 0.94 | 0.96 | 0.96 | 2.29 | 2.37 | 2.62 | 0.06 | 0.05 | 0.06 | 0.48 | 0.51 | 0.48 |
| **Khanty-Mansi Autonomous District** | 0.96 | 0.95 | 0.95 | 3.78 | 3.99 | 4.67 | 0.07 | 0.08 | 0.09 | 0.63 | 0.64 | 0.62 |
| **Yamalo-Nenetsk Autonomous District** | 0.98 | 0.98 | 0.92 | 2.60 | 2.78 | 3.09 | 0.06 | 0.06 | 0.06 | 0.49 | 0.49 | 0.51 |
| **Moscow** | 0.96 | 0.98 | 0.97 | 2.31 | 1.95 | 1.96 | 0.04 | 0.04 | 0.04 | 0.46 | 0.42 | 0.41 |
| **Kostroma region** | 0.75 | 0.75 | 0.66 | 2.67 | 2.91 | 2.94 | 0.08 | 0.08 | 0.09 | 0.60 | 0.60 | 0.63 |
| **Sevastopol** | 0.47 | 0.40 | 0.35 | 1.16 | 0.81 | 1.06 | 0.10 | 0.09 | 0.08 | 0.53 | 0.43 | 0.52 |
| **Republic of Crimea** | 0.34 | 0.37 | 0.31 | 0.70 | 0.74 | 0.61 | 0.05 | 0.04 | 0.04 | 0.50 | 0.44 | 0.44 |

Source: authors' calculations based on the data of the Federal State Statistics Service, the Federal Tax Service and the Federal Treasury of the Russian Federation.

Table 3 shows the ranking of regions by $FNI_{FS}$ values, from lowest to highest, with formation of FS classes based on expert judgment (class 1 — high, class 2 — medium, class 3 — low level of fiscal sustainability).

**Table 3** Ranking of Regions, Method Approbation, 2016-2018 (fragment)

| RF Regions | $FNI_{FS}$ | Rank | $FNI_{FS}$ | Rank | $FNI_{FS}$ | Rank | $FNI_{FS}$ | Rank |
|---|---|---|---|---|---|---|---|---|
| | 2016 | | 2017 | | 2018 | | 2016-2018 | |
| **FS Class 1** | 1.488 | 1 | 1.817 | 1 | 1.758 | 1 | 5.063 | 1 |
| **Khanty-Mansi Autonomous District** | 2.140 | 3 | 2.877 | 5 | 1.937 | 5 | 6.954 | 2 |
| **Yamalo-Nenetsk Autonomous District** | 2.114 | 2 | 1.956 | 2 | 2.902 | 2 | 6.973 | 3 |
| **Tyumen region** | 2.772 | 6 | 2.875 | 4 | 2.052 | 4 | 7.699 | 4 |
| **Murmansk region** | 2.631 | 5 | 2.901 | 6 | 3.018 | 6 | 8.550 | 5 |
| **Perm region** | 2.493 | 4 | 3.251 | 9 | 2.926 | 9 | 8.670 | 6 |
| **Irkutsk region** | 2.863 | 8 | 3.394 | 12 | 2.706 | 11 | 8.962 | 7 |
| | | | | … | | | | |
| **Saint Petersburg** | 3.159 | 12 | 3.556 | 18 | 2.575 | 13 | 9.290 | 10 |
| | | | | … | | | | |
| **Moscow** | 3.320 | 18 | 3.584 | 19 | 2.899 | 14 | 9.804 | 13 |
| **Republic of Tatarstan** | 3.161 | 13 | 3.417 | 14 | 3.298 | 21 | 9.876 | 14 |
| **FS Class 2** | 3.288 | 17 | 3.462 | 15 | 3.279 | 22 | 10.028 | 16 |
| | | | | … | | | | |
| **Zabaikalsky region** | 4.254 | 46 | 4.902 | 56 | 4.645 | 55 | 13.801 | 54 |
| | | | | … | | | | |
| **Republic of Khakasia** | 6.226 | 80 | 5.669 | 74 | 3.936 | 71 | 15.831 | 66 |
| | | | | … | | | | |
| **FS Class 3** | 5.336 | 67 | 5.479 | 70 | 5.592 | 78 | 16.407 | 72 |
| | | | | … | | | | |
| **Republic of Crimea** | 7.067 | 87 | 5.207 | 62 | 5.428 | 61 | 17.703 | 78 |
| | | | | … | | | | |
| **Kostroma region** | 6.438 | 83 | 5.936 | 77 | 5.798 | 80 | 18.172 | 81 |
| **Republic of Altai** | 6.319 | 82 | 6.003 | 78 | 6.547 | 81 | 18.870 | 82 |
| **Sevastopol** | 6.661 | 85 | 6.812 | 85 | 5.700 | 85 | 19.173 | 83 |
| **Karachay-Cherkess Republic** | 6.096 | 79 | 6.467 | 83 | 6.651 | 83 | 19.215 | 84 |
| **Kaliningrad region** | 6.520 | 84 | 6.927 | 86 | 6.302 | 86 | 19.749 | 85 |
| **Republic of Ingushetia** | 7.022 | 86 | 6.536 | 84 | 6.508 | 84 | 20.067 | 86 |
| **Republic of Mordovia** | 6.277 | 81 | 7.926 | 87 | 7.559 | 87 | 21.762 | 87 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Republic of Kabardino-Balkaria** | 16.272 | 88 | 8.431 | 88 | 21.245 | 88 | 45.948 | 88 |

Source: authors' calculations based on the data of the Federal State Statistics Service, the Federal Tax Service and the Federal Treasury of the Russian Federation.

The ranking results show that generally, the fiscal sustainability of regions remains relatively stable over time. This is evidenced by the country's average $FNI_{FS}$: in 2016 — 4.45, in 2017 — 4.51, in 2018 — 4.40. It is noteworthy that regions with the highest levels of fiscal sustainability include either oil-producing regions or those with a high concentration and diversification of large businesses. The country's average tax revenues received to the federal budget for the three years have increased by 30%, and in oil-producing regions up to almost 150%. The leaders in terms of increasing fiscal sustainability for the three years are: Khanty-Mansi Autonomous District, Yamalo-Nenets Autonomous District, Tyumen, Murmansk, and Irkutsk regions, Perm region. Obviously, the collectability of payments is dependent on oil production quotas and the global situation in the "black gold" market. According to the Government's forecasts, it is necessary to gradually cancel the export duty on oil and oil products (by 2024, it is planned to reduce its rate from 30% to 0, and to increase the mineral extraction tax rate). It should also be noted that the Khanty-Mansi, Yamalo-Nenets Autonomous Districts and the city of Moscow collectively account for almost half of all tax revenues. If we add St. Petersburg and Tatarstan, it comes to as high as 60%. Despite the fact that tax revenues are substantial, leading regions in terms of fiscal sustainability differ from leaders in terms of revenues. The same regions are also characterized by a high performance of public funding, which manifests itself in the increased number of medical doctors; increased capacity of outpatient clinics; reduced crime rates; reduced mortality rates; reduced share of utility networks to be replaced; higher environmental protection expenditure. The regions demonstrate a positive trend in the growth of budget-forming indicators, such as production volumes and a larger share of profitable enterprises. We should separately comment on the situation in the Crimea and the city of Sevastopol. Fiscal sustainability implies a high percentage of tax and non-tax revenues, but these regions are characterized by a high percentage of subsidies. The increased subsidies are aimed at ensuring a balanced budget, which is essentially managed in a 'manual mode.' The equalization of fiscal capacity is carried out by means of calculation based on the fiscal capacity level and the public spending index. In 2018, subsidies for partial reimbursement of additional expenditures aimed at increasing earnings of public sector employees increased. The Kostroma region, the Altai Republic, the Republic of Ingushetia, Mordovia, Karachay-Cherkess and Kabardino-Balkar are outsider regions, with most FS indicators being below a satisfactory level. For instance, Mordovia shows a high level of debt, and the Kostroma region receives large subsidies to equalize fiscal capacity.

## 4 Conclusions

1. No increase in the fiscal independence of the regions (2016-2018) was identified. The actual volume of regions' own revenues is not sufficient to finance their promised expenditures.

2. The system of vertical inter-budgetary flows used in the Russian Federation under the current conditions significantly reduces incentives not only to increase the revenue potential, but also to be interested in collecting tax payments, and generates a 'welfare mentality'.

3. Without decentralizing the relationship between the federation and the regions and ensuring that the revenue growth rates outpace the expenditure commitments, it will obviously be impossible to reverse the growing total debt burden trends in the regions.

4. Cutting the share of tax revenues allocated in favor of the regions makes it difficult to deliver the expenditure commitments and to ensure the increase in expenditure on economic development and human capital financing.

The proposed methodology is useful for application by government authorities at all levels to ensure financial monitoring in the regions in order to improve the efficiency of budget management and to prevent destabilization of public finances.

## References


Barrell, R., Davis, E. P., Pomerantz, O. (2006). Costs of Financial Instability, Household-sector Balance Sheets and Consumption. *Journal of Financial Stability*, vol. 2, pp. 194-216.

Blanchard, O., Chouraqui, J.-C., Hangemann, R., Sartor, N. (1990). The sustainability of fiscal policy: New answers to an old question. *OECD Economic Studies*, No. 15, pp. 7-36.

Bogolib, T. (2015). Fiscal policy as an instrument of macroeconomic stability. *Economic Annals-XXI,* vol. 3-4(1), pp. 84-87.

Brady, G.L., Magazzino, C. (2019). The sustainability of Italian fiscal policy: Myth or reality? *Economic Research-Ekonomska Istrazivanja,* vol. 32(1), pp. 772-796.

Burnside, C. (2005). *Fiscal Sustainability in Theory and Practice: a Handbook*. The World Bank, Washington, D.C.

Gabriel, V. J., Sangduan, P. (2011). Assessing fiscal sustainability subject to policy changes: A Markov switching cointegration approach. *Empirical Economics*, vol. *41*(2), pp. 371-385.

Hakkio, C. S., Rush, M. (1991). Is the budget deficit "too large?". *Economic Inquiry,* vol. 29(3), pp. 429-445.

Horne, J. (1991). Indicators of fiscal sustainability. *IMF Working Papers*, No. WP/91/5.

IMF (2002). *Assessing Sustainability*. Retrieved from: https://www.imf.org/external/np/pdr/sus/2002/eng/052802.pdf.

Kolesov, A. S. (2000). About the integral estimation of financial position of objects of the budgetary financing. *Finance*, vol. 6, pp. 9-11.

Kornilov, D., Yashina, N., Pronchatova-Rubtsova, N., Kashina, O. (2017). Research of Public Financing Efficiency of Social Well-Being in the Russian Federations' Regions: In: *Proceedings of the 14th International Scientific Conference European Financial Systems 2017*. Brno: Masaryk University, 2017, part 1, pp. 366-374.

Krajewski, P., Mackiewicz, M., Szymańska, A. (2016). Fiscal sustainability in central and eastern European countries - A post-crisis assessment. *Prague Economic Papers,* vol. 25(2), pp. 175-188.

Kudrin, A., Sokolov, I. (2017). Fiscal rules as an instrument of balanced budget policy. *Voprosy Ekonomiki*, vol. 11, pp. 5-32.

Lapushinskaya, G. K. (2001). Method of analysis of territorial budgets. *Finance*, vol. 9, pp. 18-20.

Manasse, P., Roubini, N. (2005). "Rules of Thumb" for Sovereign Debt Crises. *IMF Working Paper* 05/42.

Reinhart, C., Rogoff, K. (2011). From Financial Crash to Debt Crisis. *The American Economic Review*, vol. 101(5), pp. 1676-1706.

Yashin, S. N., Yashina, N. I. (2003). Some aspects of the analysis of the budget potential of municipalities. *Finance and credit,* vol. 5(119), pp. 35-44.

Yashina, N. I., Pojushcheva, E. V., Pronchatova-Rubtsova, N. N. (2013). Methodology improvement in the measurement of the budget stability of the Russian federation subjects: two approaches towards the assessment in modern social and economic conditions. *Finance and credit,* vol. 11, pp. 2-11.

Yashina, N., Pronchatova-Rubtsova, N., Petrov, S., Kashina, O. (2018). Methodical Approaches to the Formation of Model Budgets in order to Improve the Effectiveness of the Budget Process in Russia. In: *Proceedings of the 15th International Scientific Conference European Financial Systems 2018.* Brno: Masaryk University, pp. 857-864.

# Generational Shadow in Polish Family Firms - May Second Generation Change Anything?

**Robert Zajkowski[1], Ada Domańska[2], Beata Żukowska[3]**

[1]Maria Curie-Sklodowska University in Lublin
Faculty of Economics, Department of Banking
Maria Curie-Sklodowska sq. 5, 20-031 Lublin, Poland
robert.zajkowski@umcs.lublin.pl

[2]Maria Curie-Sklodowska University in Lublin
Faculty of Economics, Department of Banking
Maria Curie-Sklodowska sq. 5, 20-031 Lublin, Poland
ada.domanska@umcs.lublin.pl

[3]Maria Curie-Sklodowska University in Lublin
Faculty of Economics, Department of Banking
Maria Curie-Sklodowska sq. 5, 20-031 Lublin, Poland
beata.zukowska @umcs.lublin.pl

***Abstract:*** *In the paper the issue of the reciprocal impact of both first and second generation of the family on the family businesses was taken into consideration. The main attempt was to investigate whether in the companies in which 'generational shadow' effect exists, inheritors are able to have a stab at the company functioning. Hence the aim of this paper is to identify a potential impact of the second generation on the aspects of functioning of family businesses. The differences in the average perception of family business purposes were statistically analysed in two groups of companies: one – with a presence of only founders' generation and the other with a presence of two generations among company's owners. The main conclusion which was that a presence of the second generation of the family in the owners and managerial staff structure modifies partly the perception of long term objectives of family business functioning. On the other hand, it is necessary to reject the assumption that the presence of second generation of the family in the owners and managerial staff structure impairs the perception of objectives directed towards the family and family values. The results reveal that despite of the 'generational shadow' effect, the existence of the successors' generation might lead to particular changes in company's functioning and perception of various processes in family businesses.*

*Keywords: generational shadow, family firms, generations in family firm, family enterprise goals*

*JEL: C10, D91, L21*

## 1 Introduction

For years researchers have been considering, on the basis of the agency theory, the stewardship theory or other broadly prevalent theoretical concepts, different positive or negative aspects of coexistence of representatives of two family generations in the family firm (various managerial and operating aspects). For example, one such an issue was a question whether the composition of the Board in context of generational phase of the firm could dilute a family character (Arosa et al., 2010; Bammenset al., 2008; García-Ramos and García-Olalla, 2011). More detailed, the issue can be raised whether the second generation is able at least partly to replace the absence of the founder in decision's body or support decision processes in presence of predecessors (García-Ramos and García-Olalla, 2011), influence the tasks of the Board or can be influential in the long term company's strategy (Bertrand and Schoar, 2006; Gedajlovic et al., 2004). Davis and Harveston (Davis and Harveston, 1999; Davis and Harveston, 2001) introduced the idea of 'generational shadow'. They investigated and proved that the source of this phenomenon is incomplete succession in which the older generation continues to have a persistent impact on the business control. It should be mentioned that this phenomenon

is called as founder's shadow (Coutu and Kets de Vries, 2004) or as Kelly, Athanassiou and Crittenden have written - confining legacy (Kelly et al., 2000). Joint management of two generations, might be the result of incumbents' unwillingness to cede control (Pontet et al., 2007). This phenomenon can be explained by psychological reasons: retirement syndrome - difficulties in letting go because of fear of being superfluous, the threat of going from somebody to nobody overnight (Kets De Vries, 2003), personal attachment to the business (De Massis et al., 2008) or emotional resistance to choose successor among their children (Lansberg, 1999; Poza and Daugherty, 2013). Incumbents can be as well motivated by economic reasons and place their personal goals over family business (Gilding et al., 2015). Sometimes, in order not to lose the power incumbents sabotage the successor's efforts to establish their identity as a family business leader (Daspit et al., 2016). This influence could impose some restrictions on a latitude scope of successors and could become a potential source of conflicts. Ultimately, it can affect the dysfunction of the company. Physical presence of the incumbent may cause the successor frustration with its inability to assume control of the organization (Cater and Justis, 2009).

On the other hand, there is some evidence that "generational shadow" may be a source of positive effects such as respect for family values, directions of the development and standards presented by managers who represent the second generation of the family. Kelly, Athanassiou and Crittenden (Kelly, et al., 2000) pointed out that "legacy centrality" has both positive and negative effect on the behaviour of family members who represent the second generation. Furthermore, Davis and Harveston (Davis and Harveston, 1999; Davis and Harveston, 2001) confirmed that the influence of "generational shadow" is noticed to a greater extent when the first and second generation is analysed than in next ones (second-third and further). Sonfield and Lussier (Sonfield and Lussier, 2004) observed that the ways of taking decisions by the second generation were similar to the ways of the first generation functioning because they are moulded by the objectives and the methods introduced by the generation of the founders. Close to this conclusions where those presented by Davis and Harveston (Davis and Harveston, 2001) who pointed out that if "generational shadow" and "legacy centrality" are crucial components of family business, then both the first and second generation take into consideration the same objectives and apply the same decision methods which were implemented by the founders. However, it is worth noticing that this convergence of goals and expectations is supportive for the whole succession process. Its effectiveness depends on the mutual understanding and respect between generations (Handler, 1991). These two elements cannot occur immediately. They are developed in the home prior to the moment when successor entering the family business (Dumas et al., 1995; Keating and Little, 1997).

Cadieux (Cadieux, 2007) states that a succession process consists of four stages: initiation, integration, joint reign, and withdrawal. During these phases, the roles of successors and predecessors evolve interdependently, as both parties pursue to achieve the same goal – survival of the business. In the joint-reign phase predecessors might fulfil several roles: supervisor, teacher, protector, introducer, mobilizers and collaborators. As a teachers their sharing with successors their specific knowledge about company, as supervisors they delegate to them part of the duties, as protectors – keep an eye on their trials and errors. Filling the role of the introducers, predecessors mediate between successors and other actors (employees, business partners) in order to build between them more tight relations. Mobilising role is one of the most important, because it motivates successors to confirm their adequacy and indispensable skills. The role of collaborator occurs when successor feels confident in his or her decisions and presents adequate level of necessary knowledge. Regarding presented roles, joint-reign phase might be supportive not only for successors, who have their mentors on their side, but also for the whole company and its long-term goals orientation.

Nevertheless, Handler (Handler, 1994) pointed put, that the role of predecessor moves from sole operator (the most important family member in the organization) to monarch (leader who has power over others), to overseer-delegator, to consultant not formally included in organization structures. He also stresses that many predecessors stop at monarch role, and do not give enough space for their successors to assume the control

over their company. In that case, we can expect that family business objectives might be less directed into family and family values, as there is no genuine willingness to transfer company to the next generation.

The dynamic process of Polish family businesses development began after the regime and political system changes in 1989. The family businesses which were set up at that time are currently 30 years old with an average age of slightly over 20 years. That means that most of them are still owned and managed by the first generation (founders' generation), while the minority may indicate both the first and second generation in the company's structure. Only a marginal proportion of business entities could boost successful succession to the third and further generations. Due to the relatively short historical period of the existence of family businesses, there are few surveys and little expertise which refer to the changes in family businesses across generations. Furthermore, broader surveys in the field of "generational shadow" have not been conducted yet. The paper aims to identify a potential impact of the second generation on the aspects of functioning of family businesses as indicated below. Our survey was meant to verify the hypothesis which assumes that the presence of the second generation in the owners and managerial staff structure does affect a perception of major companies' objectives held by the group of Polish medium and big size family businesses. Two hypotheses were formulated:

H1. The presence of second generation of the family in the owners and managerial staff structure modifies the perception of long term objectives of family business functioning.

H2. The presence of second generation of the family in the owners and managerial staff structure impairs the perception of objectives directed towards the family and family values (including succession).

It is worth mention that for both hypotheses (H1, H2), null hypotheses exist that present opposite assumption (lack of differences in perception). We organised whole verification process to try to reject them statistically.

A verification of the hypotheses was conducted in line with the methodology applied below.

## 2 Research method

The above pointed hypotheses were verified on the basis of primary data collected within Polish National Science Centre Project No. 2012/07/B/HS4/00455 "Corporate governance, ownership structure and other financial issues of family enterprises in Poland and Austria - a comparative analysis". The process of original data collection was conducted with the use of CATI (Computer Assisted Telephone Interview) method. The survey agency made in total 12 155 phone calls to potential respondents who represented owners, CEOs and CFOs. As it turned out, 5 504 business entities disagreed to participate in the survey and 4 235 resigned during investigation. Finally, there were 785 questionnaires fully filled in. Hence the value of the total initial response rate for the collection process of purposive sample achieved only 6,2% (Hoogendoorn and Daalmans, 2009; DiSogra and Callegaro, 2009; Lederer, 2008).

Descriptive analysis of the sample reveal that 86,5% were established after 1989 (after introduction of the law that finally allowed private businesses in Poland). The average age of examined companies was 19 years, and most of them (78,2%) have operated for longer than 10 years. Enterprises were registered as private limited companies (60,9%), limited partnerships (25,7%), joint-stock companies (9,1%) or sole proprietorships (8%). Most of companies (97%) employed from 50 to 249 people (medium-size enterprises, according to EU classification). The average number of employees amounted to 122.

Given the main aim of the study, out of this group only family businesses were extracted. All entities recognised as family businesses were those which meet simultaneously the following conditions:

1. Family members owed more than 50% of equity share. By Chua, Chrisman and Sharma (Chua et al., 1999), such an approach is consistent with the majority of

definitions of family business, according to which family ownership is perceived as a major deciding factor for determining whether business entity is a family or non-family firm.
2. The Substantial Family Influence (SFI) coefficient exceeded value one. With the methodology proposed by Klein (Klein, 2000) this value allows to classify quite strictly an entrepreneur as a family firm.

Additionally, after exclusion of non-typical and incorrect data, the ultimate analyses were conducted on the group of 372 family businesses (medium and big size companies respectively).

Twelve different main objectives of the company's operating in short and long terms were analysed including the following: a long-term growth of the company's value, a short-term maximization of profits, maintenance the company's independence, maintaining high pace of the company's growth, maintaining the company's existence, minimization economic risk, maintaining or creating new workplaces, creating wealth or ensuring a high living standard for the main entrepreneur or his family, employment of family members in the company, transfer the company to next the generation, dissemination of the value system of the main entrepreneur and his family or maintaining family traditions and tight long-term relations with business partners. To measure the level of perception of the company's various purposes, the Likert scale was adopted where one means very high meaning and five - very low meaning. While processing original data, the scale was inverted so that higher values reflected a stronger level of a given objective. Subsequently, the average levels of perception of particular aspects were calculated. The calculations were made separately for companies which did not have representatives of the second family generation in the owners and managerial staff structure and for those that have the second generation of family members (Table 1). The differences in the average perception of family businesses purposes were analysed and verified statistically using Student's t-test.

**Table 23** Differences in evaluation of the goals importance between companies who have representatives of the second family generation in the owners and managerial staff and companies with representatives of first generation

| Family enterprise goals | | Goals importance | | | p |
|---|---|---|---|---|---|
| | | N | Mean | SD | |
| **A long-term growth of the company's value** | 1st generation | 234 | 4,209 | 0,836 | 0,009 |
| | 1st and 2nd generation | 124 | 3,952 | 0,978 | |
| **A short-term maximization of profits** | 1st generation | 238 | 3,265 | 1,202 | 0,756 |
| | 1st and 2nd generation | 117 | 3,222 | 1,226 | |
| **Maintainance the company's independence** | 1st generation | 236 | 4,360 | 0,960 | 0,321 |
| | 1st and 2nd generation | 121 | 4,463 | 0,847 | |
| **Maintaining high pace of the company's growth** | 1st generation | 243 | 4,062 | 0,823 | 0,064 |
| | 1st and 2nd generation | 122 | 4,230 | 0,790 | |
| **Maintaining the company's existence** | 1st generation | 242 | 4,727 | 0,576 | 0,057 |
| | 1st and 2nd generation | 121 | 4,826 | 0,402 | |
| **Minimization economic risk** | 1st generation | 238 | 4,252 | 0,819 | 0,208 |
| | 1st and 2nd generation | 121 | 4,132 | 0,912 | |
| **Maintaining or creating new workplaces** | 1st generation | 243 | 3,872 | 0,973 | 0,327 |
| | 1st and 2nd generation | 118 | 3,763 | 1,043 | |
| **Creating wealth or ensuring a high living standard for the main entrepreneur or his family** | 1st generation | 232 | 3,703 | 1,090 | 0,595 |
| | 1st and 2nd generation | 116 | 3,767 | 1,025 | |
| **Employment of family members in the company** | 1st generation | 203 | 2,995 | 1,083 | 0,047 |
| | 1st and 2nd generation | 103 | 2,728 | 1,148 | |
| **Transfer the company to next the generation** | 1st generation | 208 | 3,649 | 1,166 | 0,001 |
| | 1st and 2nd generation | 113 | 4,088 | 1,057 | |
| **Dissemination of the value system of the main entrepreneur and his family or maintaining family traditions** | 1st generation | 217 | 3,456 | 1,114 | 0,073 |
| | 1st and 2nd generation | 115 | 3,687 | 1,111 | |
| **Tight long-term relations with business partners** | 1st generation | 233 | 3,678 | 1,077 | 0,172 |
| | 1st and 2nd generation | 122 | 3,836 | 1,007 | |

Source: own study.

The figures in the table above portrayed noticeable differences amongst nominal values of means. Yet, only in some cases they occurred to be statistically significant and can allow us to drew conclusions.

More profound studies were carried out by implementation of logistic regression model with the same composition of variables supplemented by controls i.e. age of a company, number of employees and revenues and independent variable 0-1st generation and 1-1st and 2nd generation among company's owners and managerial staff (see table 2). Model occurred to be significant (Hosmer and Lemeshow test, p=0,047; Cox and Snell Rsquare 0,214; Nagelkerke Rsquare 0,293).

**Table 2** Logistic regression model for variable 0-1st generation and 1- 1st and 2nd generation among company's owners and managerial staff

| Variables | B | Wald | p. | Exp(B) |
|---|---|---|---|---|
| **Constant** | -3,733 | 3,839 | 0,050 | 0,024 |
| **IV** | | | | |
| **A long-term growth of the company's value** | -0,407 | 3,635 | 0,057 | 0,666 |
| **A short-term maximization of profits** | 0,057 | 0,158 | 0,691 | 1,059 |
| **Maintainance the company's independence** | 0,331 | 2,752 | 0,097 | 1,392 |
| **Maintaining high pace of the company's growth** | 0,331 | 4,306 | 0,038 | 1,392 |
| **Maintaining the company's existence** | 0,462 | 4,062 | 0,044 | 1,587 |
| **Minimization economic risk** | -0,003 | 0,000 | 0,990 | 0,997 |
| **Maintaining or creating new workplaces** | -0,159 | 0,664 | 0,415 | 0,853 |
| **Creating wealth or ensuring a high living standard for the main entrepreneur or his family** | -0,024 | 0,021 | 0,884 | 0,977 |
| **Employment of family members in the company** | -0,476 | 7,324 | 0,007 | 0,621 |
| **Transfer the company to next the generation** | 0,448 | 5,998 | 0,014 | 1,565 |
| **Dissemination of the value system of the main entrepreneur and his family or maintaining family traditions** | 0,380 | 3,865 | 0,049 | 1,463 |
| **Tight long-term relations with business partners** | 0,427 | 5,775 | 0,016 | 1,533 |
| **Controls** | | | | |
| **Age** | 0,029 | 1,566 | 0,211 | 1,030 |
| **Employment – 2013** | 0,008 | 10,509 | 0,001 | 1,008 |
| **Revenues – 2013** | 0,000 | 5,329 | 0,021 | 1,000 |

Source: own study.

In the case of six variables the differences in perception of family businesses objectives between companies that were owned and managed solely by generation of the founders and two generations of the family were confirmed statistically. There are: a long-term growth of the company's value; maintaining high pace of the company's growth; maintaining the company's existence; employment of family members in the company; transfer the company to next the generation and dissemination of the value system of the main entrepreneur and his family or maintaining family traditions. A double confirmation of differences, to our point, reflects rough changes that occur with inclusion of members of second generation family members into family business.

## 3 Results

Our research seems, at least in part, to defy the findings presented above. Our study reveal a few statistically significant differences related to the perception level of key goals of companies that are under the influence of solely the first or the first and second generations of the family (Table 1 and 2).

It was observed that the meaning of a long term growth of the company's value dropped in the group of companies, where there were representatives of the second generation in the structure of owners. Simultaneously, in the same group of companies maintaining

high pace of company's growth and maintaining the company's existence gained in significance.

Hence, the conclusion to be drawn is that by presence of the second owners generation, less attention was paid to the company's value as a relatively abstract phenomenon. Instead, more measurable aspects became significant (e.g. pace of growth). The latter one could be measured by, e.g increase of turnover, operational profits, number of employees, property's value (assets), expansion on further markets and the like.

Besides, more attention paid for measurable effect can be also a result of successors attitudes. Having their predecessors in company structure (especially those who fulfil the mobiliser role), they may feel to prove their abilities to steering a company.

In addition, they can finally implement their own ideas and focusing on their own projects performance. In this phase of company's life, second generation, involved in company management may suggest totally new directions of family enterprise development – entering new market niche, internationalization and so on. Those changes are expected to lead a company to the path of growth, hence its pace becomes more important.

Nevertheless, the company's existence as a family business goal also gained in importance. The first generation is still in power, but soon they probably transfer it entirely to the second generation. Approaching business transfer may cause concerns connected with success of succession process and firm long-term existence. Both, predecessors and successors become more aware of long-term perspective, as they have already taken their steps to build multigenerational business. This is compliant with Cadieux (Cadieux, 2007) observation, that during succession process successors and incumbents pursue to achieve the same goal – survival of the business.

Additionally, in firms, where two generations have an impact on it, the importance of succession and the desire to disseminate the value system or maintaining family traditions is significantly higher than in firms when influence of only one generation was identified. These dimensions could perform a supportive role for the aspects presented previously. The successful transfer of a company becomes more important, as successors are already involved in managing or ownership. We can expect that those companies present higher level of preparation for succession – it is more probable that the successor is already known, some necessary legal or organizational steps have been taken etc. So again, both successors and predecessors are more motivated to achieve or only finalize the succession goal.

Having in their mind that the generational change is approaching, family members also become more concerned about dissemination of their values and maintain their traditions. It can be again the result of predecessors' worries about company future, as it can represent significant part of their professional, but also personal and social life (Cadieux, 2007).

Additionally, among the tendencies observed, there is a noticeable difference in importance of hiring family members in the family firm. Companies with the presence of the second family generation, evaluate this goal as much less important. There are two possible reasons for this phenomenon. First, the succession process is already in "joint-reign" phase, so potential successors have been already employed. Second, pending succession process might require hiring specialists. Families and their businesses are in the middle of the road, where taking next steps and making big decisions is necessary. During this journey, they may need a professional support from external managers. From this perspective, employing family members as a company goal becomes less significant.

## 4 Conclusions

To conclude, the first hypothesis it means: the presence of second generation of the family in the owners and managerial staff structure modifies the perception of long term objectives of family business functioning was confirmed in part. The other: the presence of second generation of the family in the owners and managerial staff structure impairs

the perception of objectives directed towards the family and family values, was rejected. The results obtained seem to cast a light that despite of "generational shadow" the existence of the successors' generation, especially in the ownership structure, might lead to particular changes in company's functioning and perception of various processes run by family businesses.

Our results show that family businesses ruled by two generations attribute higher importance to dissemination of company value system and family traditions and to successful succession. They are also more concerned about maintaining high pace of the company's growth and maintaining the company's existence. It is good sign for Polish family businesses, because we can expect that in joint-reign phase, predecessors fulfil their supportive roles and encourage younger generations to implement their ideas, simultaneously sharing with them concept of family business continuity. However, a worrying aspect is that, in joint-managed firms, a long-term growth of the company's value becomes less important. We can assume, that in this phase, succession matters and willingness to prove successors abilities come to the force and unfortunately, less abstract phenomenon lags behind.

## References


Arosa, B., Iturralde, T., Maseda, A. (2010). Outsiders on the board of directors and firm performance: Evidence from Spanish non-listed family firms. *Journal of Family Business Strategy*, vol. 1(4), pp. 236-245.

Bammens, Y., Voordeckers, W., Van Gils, A. (2008). Boards of directors in family firms: a generational perspective. *Small Business Economics*, vol. 31(2), pp. 163-180.

Bertrand, M., Schoar, A. (2006). The role of family in family firms. *Journal of Economic Perspectives*, vol. 20, pp. 73–96.

Cadieux, L. (2007). Succession in Small and Medium-Sized Family Businesses?: Toward a Typology of Predecessor Roles During and After Instantement of the Successor. *Family Business Review*, vol. 20(2), pp. 95-109.

Cater, J. J., Justis, R. T. (2009). The Development of Successors From Followers to Leaders in Small Family Firms: An Exploratory Study. *Family Business Review*, vol. 22(2), pp. 109-24.

Chua, J., Chrisman, J., Sharma, P. (1999). Defining the family business by behaviour. *Entrepreneurship Theory and Practice*, vol. 23(4), pp. 19–39.

Coutu, D. L., Kets de Vries, M. F. R. (2004). Putting Leaders on the Couch. A conversation with Manfred Kets de Vries. *Harvard Business Review*, vol. 82(1), pp. 64-71.

Daspit, J. J., Holt, D. T., Chrisman, J. J., Long, R. G. (2016). Examining family firm succession from a social exchange perspective: A multiphase, multistakeholder review. *Family Business Review*, vol. 29(1), pp. 44-64.

Davis, P., Harveston, P. (1999). In the founder's shadow: Conflict in the family firm. *Family Business Review*, vol. 12(1), pp. 311–323.

Davis, P., Harveston, P. (2001). The phenomenon of substantive conflict in the family firm: A cross- generational study. *Journal of Small Business Management*, vol. 39(1), pp. 14–30.

De Massis, A., Chua, J. H., Chrisman, J. J. (2008). Factors preventing intra-family succession. *Family Business Review*, vol. 21(2), pp. 183-199.

DiSogra, Ch., Callegaro, M. (2009). Computing Response Rates for Probability-Based Web Panels, Proceedings of the Survey Research Methods Section. Session 273: Estimating and Adjusting for Nonresponse Bia. *American Statistical Association*, pp. 1008-1032.

Dumas, C., Dupuis, J. P., Richer, F., St.-Cyr, L. (1995). Factors that influence the next generation's decision to take over the family farm. *Family Business Review*, vol. 8(2), pp.

99-120.

Gedajlovic, E., Lubatkin, M., Schulze, W. (2004). Crossing the threshold from founder management to professional management. *Journal of Management Studies*, vol. 41(5), pp. 899–912.

García-Ramos, R., García-Olalla, M. (2011). Board characteristics and firm performance in public founder- and nonfounder-led family businesses. *Journal of Family Business Strategy*, vol. 2(4), pp. 220-231.

Gilding, M., Sheree, G., Cosson, B. (2015). Motives and Outcomes in Family Business Succession Planning. *Entrepreneurship Theory and Practice*, vol. 39(2), pp. 299-312.

Handler, W. C. (1991). Key interpersonal relationships of next-generation family members in family firms. *Journal of Small Business Management*, vol. 29(3), pp. 21-32.

Handler, W. C. (1994). Succession in Family Business: A Review of the Research. *Family Business Review*, vol. 7(2), pp. 133-157.

Hoogendoorn, A. W., Daalmans, J. (2009). Nonresponse in the Recruitment of an Internet Panel Based on Probability Sampling. *Survey Research Methods*, vol. 3, No. 2, pp. 69-71.

Keating, N. C., Little, H. M. (1997). Choosing the successor in New Zealand family firms. *Family Business Review*, vol. 10(2), pp. 157-171.

Kelly, L. M., Athanassiou, N., Crittenden, W. F. (2000). Founder centrality and strategic behaviour in the family-owned firm. *Entrepreneurship Theory and Practice*, vol. 25(2), pp. 27-42.

Kets De Vries, M. (2003). The Retirement Syndrome: The Psychology of Letting Go. *European Management Journal*, vol. 21(6), pp. 707-716.

Klein, S. B. (2000). Family Businesses in Germany: Significance and Structure. *Family Business Review,* vol. 13(3), pp. 157-182.

Lansberg, I. (1999). *Succeeding generations: Realizing the dream of families in business*. London, Harvard Business Review Press.

Lederer B. (2008). *Platforms for data quality progress: The client's guide to rapid improvement of online research.* Illinois, RFL Communications, Skokie.

Pontet De, S. B., Wrosch, C., Gagne, M. (2007). An Exploration of the Generational Differences in Levels of Control. *Family Business Review*, vol. 20(4), pp. 337-354.

Poza, E. J., Daugherty M.S. (2013). *Family business,* 4th ed., Cengage Learning, pp. 263-264.

Sonfield, M. C., Lussier, R. N. (2004). First- , Second- , and Third-Generation Family Firms : A Comparison. *Family Business Review*, vol. 17(3), pp. 189-201.

# A Non-asymptotic Automobile Bonus-malus System with Varying Transition Rules

**Silvie Zlatošová**

Masaryk University
Faculty of Economics and Administration, Department of Finance
Lipová 41a, 602 00 Brno, Czech Republic
E-mail: silvie.zlatosova@mail.muni.cz

***Abstract:*** *In this paper, we examine a non-asymptotic criterion for a bonus-malus system in vehicle insurance, and we combine it with varying transition rules. Policies are in effect only during a finite number of insurance periods. If most of the policies are far from a stationary state, it is useful to change the criterion so that to consider the rating error for new policies and policies of medium age too. Therefore we use a bonus-malus system based on minimization weighted average of the expected square rating errors for selected insurance periods. We calculate the relative premium associated with each level of the bonus-malus system. Finally, we compare our proposed bonus-malus system with the system from the Czech Insurance Company. We find that the proposed examples of non-asymptotic bonus-malus system are more effective than the current system used by the Czech Insurance Company.*

*Keywords: bonus-malus system, optimal relativities, non-asymptotic criterion, the efficiency of a bonus-malus system*

*JEL codes: G22, C63*

## 1 Introduction

A very important task of the actuary is to create a fair tariff structure. This structure has to divide the burden of claims among policyholders fairly. *A priori* risk classification segmentizes the drivers into several homogeneous risk classes. Even with a priori segmentation, some heterogeneity remains within the risk classes. Therefore the residual heterogeneity is deal with by the *a posteriori* categorization scheme.

The connected claims experience information such as the amount of the claim, and claims frequency are applied to determine the premium corrections. This problem is solved, e.g., by Pitrebois et al. (2003) or Denuit et al. (2007). The ideal *a posteriori correction* utilizes the techniques from credibility theory. After that, the insurance premium is the product of a base *a priori* premium and of a credibility coefficient which reflects hidden risk factors, as said by Norberg (1976) or Klugman et al. (2012). In reality, nevertheless, insurers prefer another form of corrections called bonus-malus system (BMS) due to the difficulties of introducing credibility premium for each client. A BMS consists of the number of BMS level, and each level is connected with premium correction coefficient (relativity premium) that clarifies what premium amount the client has to pay.

Some authors use asymptotic criterion to determine the relativity premium. The minimization of expected square rating error for a randomly chosen policy in the stationary state is used to this calculation. This approach considers the policy during the infinitely time horizon. See, i.e., Norberg (1976), Pitrebois et al. (2003) or Tan et al. (2015).

Our article was inspired by the idea of Borgan and Hoem (1981). They work with a non-asymptotic criterion because the policies are valid only during a limited time, and most of them are far from the stationary state. We use a BMS based on minimization weighted average of the expected square rating errors for selected insurance periods. We combine this idea with the bonus-malus system with varying transition rules designed by Tan (2016). Tan et al. (2015) pointed out that if the identical level transitions are applied to all drivers without taking into account, the current levels occupied, then the unfairness

could arise. Varying transition rules denote that different transition matrices are used in the optimization procedure for determining the optimal relativities.

Finally, we compare our proposed BM systems with the system from the Czech Insurance Company using a simple measure of efficiency.

The aim of this paper is find the more effective bonus-malus system than the current system of the Czech Insurance Company.

## 2 Methodology

### The Bonus-Malus System

The BMS is a system where claims are penalized by malus points (the driver goes up a certain number of levels each time he files a claim) and each claim-free year is rewarded by bonus point (the driver goes a certain number of levels down). We can denote by *s* the number of levels in our BMS, by *z* the initial level, in which all new clients start, and by *T* transition rules *s x s* matrix, whose entry $t_{ij}$ in row *i* ,and column *j* is the set of claim numbers leading from class *i* to class *j*. The levels $\ell$ are numbered from 1 to *s*.

We assume that the knowledge of the present level and the number of claims of the present year suffices to determine the next level and that the annual claims numbers are independent. Then the trajectory across the BM levels may be represented by a *Markov chain*.

Let $\{L_1(\vartheta), L_2(\vartheta), \dots\}$ denotes the trajectory dependent on the annual expected claim frequency $\boldsymbol{\vartheta}$. Let $\boldsymbol{p}_{\ell 1 \ell 2}(\boldsymbol{\vartheta})$ be the probability of moving from level $\ell_1$to level $\ell_2$ for a policyholder with mean frequency $\boldsymbol{\vartheta}$. Further, $\boldsymbol{P}(\vartheta)$ is the one-step *transition matrix*, thus

$$\boldsymbol{P}(\vartheta) = \{p_{\ell 1 \ell 2}(\vartheta)\}, \quad \ell_1, \ell_2 = 1,2, \dots s.$$

When we want to explore the behavior of BMS during *n* insurance periods, we have to introduce the conditional distribution of the BMS class in period *n* for the individual policy with given risk parameter $\Theta = \theta$. Is the vector

$$p_{\lambda\theta}^{(n)} = \left(p_{\lambda\theta}^{(n)}(1), \dots, p_{\lambda\theta}^{(n)}(s)\right)'.$$

### The residual heterogeneity

Even with a priori segmentation, some heterogeneity remains within the risk classes. This phenomenon is a residual heterogeneity with a random effect $\Theta_i$. We can denote as $N_i$ the number of claims and we assume that it obeys a mixture Poisson distribution

$$\mathrm{P}[N_i = k | \, \Theta_i = \theta \,] = \exp(-\lambda_i \theta) \frac{(\lambda_i \theta)^k}{k!}, \quad k = 0,1,2, \dots, \tag{1}$$

where $\theta$ expresses the residual heterogeneity. We suppose that $\Theta_i$ are independent and that they have a common gamma density function

$$u(\theta) = \frac{1}{\Gamma(a)} a^a \theta^{a-1} \exp(-a\theta), \theta > 0.$$

Then we can say that $N_i$ is negative binomially distributed and $\mathrm{E}[\Theta_i] = 1$, $Var[\Theta_i] = \frac{1}{a}$.

### The Relative premium

The relativity associated with level $\ell$ is denoted as $r_\ell$. Insured occupying the level $\ell$ pays an amount of premium equal to $r_\ell$% of the *a priori* premium determined on the basis of his observable characteristics. The aim is to make $r_\ell$ as close as possible to the risk factor $\Theta$ of a policyholder picked at random from the portfolio. If we want to know the relative premium for the period *n,* the minimization of square rating error

$$\xi(\boldsymbol{T}) = \sum_{n=0}^{\infty} v_n \xi^{(n)}(\boldsymbol{T}) = \sum_{n=0}^{\infty} v_n \, E\left[\left(\Theta - r_L^{(n)}\right)^2\right], \tag{2}$$

where

$$\sum_{n=0}^{\infty} v_n = 1 \quad \text{and} \quad v_n \geq 0,$$

is most commonly used. See Borgan and Hoem (1981).

We assume that we pick at random a policyholder from the portfolio. We denote as $\Lambda$ his *a priori* expected claim frequency and $\Theta$ the residual effect of the hidden risk factors. Then the actual expected claim frequency of the policyholder is $\Lambda\Theta$. The random variable $\Lambda$ and $\Theta$ may reasonably be assumed to be mutually independent. We denote $L$ the level occupied by this randomly picked policyholder in the insurance period *n.*

Now we can estimate $\boldsymbol{r_\ell}$ as the minimum of $\xi(\boldsymbol{T})$. We get

$$r_\ell = \sum_{n=0}^{\infty} r_\ell^{(n)} p_\ell^{(n)} = \frac{\sum_{n=0}^{\infty} v_n \int_0^{\infty} \theta \, p_{\lambda\theta}^{(n)} u(\theta) \mathrm{d}\theta}{\sum_{n=0}^{\infty} v_n \int_0^{\infty} p_{\lambda\theta}^{(n)} u(\theta) \mathrm{d}\theta}, \tag{3}$$

where

$$p_{\lambda\theta}^{(n)} = \boldsymbol{p}_{\lambda\theta}^{(n-1)} \boldsymbol{P}(\lambda\theta) = \boldsymbol{q}_z \boldsymbol{P}^{(n-1)}(\lambda\theta) = \left(0, \ldots, 0, \underbrace{1}_{z}, 0, \ldots, 0\right) \boldsymbol{P}^{(n-1)}(\lambda\theta), \quad n = 2, 3, \ldots$$

**The Efficiency of a bonus-malus system**

Two bonus systems with matrices of transition rules $\boldsymbol{T}_1$ and $\boldsymbol{T}_2$ may be compared by comparing the values of square rating error $\xi(\boldsymbol{T}_1)$ and $\xi(\boldsymbol{T}_2)$. The BMS with $\boldsymbol{T}_1$ is more efficiency than BMS with $\boldsymbol{T}_2$ if

$$\xi(\boldsymbol{T}_1) \leq \xi(\boldsymbol{T}_2).$$

The efficiency of BMS defined by Borgan and Hoem (1981) for the initial class *z* is

$$e_z(\boldsymbol{T}) = \sum_{\ell=1}^{s} r_\ell^2 \mathrm{P}(L = \ell), \qquad P(L = \ell) = \sum_{n=0}^{\infty} v_n \int_0^{\infty} p_{\lambda\Theta}^{(n)}(\ell) u(\theta) d\theta. \tag{4}$$

The BMS with $\boldsymbol{T}_1$ is more efficiency than BMS with $\boldsymbol{T}_2$ if

$$e_z(\boldsymbol{T}_1) > e_z(\boldsymbol{T}_2).$$

**The Varying transition rules**

The fixed transition rules were criticized by Tan et al. (2015) because the bad clients are over-penalized. Therefore the varying transition rules are introduced. These rules should satisfy the following structure:

- bonus transition:

$$t_{\ell,0} \leq 0,$$

$$\left|t_{\ell_1,0}\right| \leq \left|t_{\ell_2,0}\right|, \quad \ell_1 < \ell_2,$$

- malus transition: (5)

$$t_{\ell,k} \geq 0, \ k \in \mathbb{N},$$

$$t_{\ell_1,k} \geq t_{\ell_2,k}, \qquad k \in \mathbb{N}, \ell_1 < \ell_2,$$

where $\ell \in \{1, 2, \ldots, s\}$ and $t_{\ell,k}$ is the effective level transition imposed on the policyholders occupying level $\ell$ in the BMS and making $k$ claims in the current year. Relative premium must satisfy the following condition

$$r_\ell \leq r_{\ell+1}, \quad \text{for} \quad l \in \{1, 2, \ldots, s-1\}. \tag{6}$$

As an example of the varying transition rules, Tan et al. (2015) showed the following ones

$$t_{\ell,0} = \begin{cases} 0, & \text{for } \ell = 1\,, \\ -1, & \text{for } 1 < \ell \le \left\lceil \frac{s}{2} \right\rceil + 1, \\ -2, & \text{for } \left\lceil \frac{s}{2} \right\rceil + 1 < \ell \le s, \end{cases} \tag{7}$$

$$t_{\ell,k} = \begin{cases} min\left[ s - \ell, \max\left( k, \left\lceil \frac{s-\ell}{p} k \right\rceil \right) \right] & for\ k \in N, 1 \le \ell < s \\ 0 & for\ k \in N, \ell = s, \end{cases}$$

where $p$ is the smallest number of claims required for clients to move from level $\ell$ to level $s$.

## 3 Results and Discussion

In this section, we give numerical examples of the computation of relative premium on the bases of (3) and (7). Let us consider the transition rules from one of the Czech insurance companies.

**The BMS from the Czech Insurance Company (BMS 1)**
The BMS from the Czech Insurance Company consists of a scale with 16 steps having relativities described in Table 1.

**Table 1** The BMS from the Czech Insurance Company

| Level $\ell$ | Relativities | Level $\ell$ | Relativities |
|---|---|---|---|
| **1** | 50% | **9** | 90% |
| **2** | 55% | **10** | 95% |
| **3** | 60% | **11** | 100% |
| **4** | 65% | **12** | 110% |
| **5** | 70% | **13** | 120% |
| **6** | 75% | **14** | 140% |
| **7** | 80% | **15** | 170% |
| **8** | 85% | **16** | 200% |

Source: Česká pojišťovna (2009), adapted by author

The transition rules (fixed rules) are the following:

- Each year a one-class bonus is given.
- Each claim is penalized by going three classes down.

Suppose that

- The maximal bonus is in class 1.
- The maximal malus is in class 16.

**The non-asymptotic BMS with fixed transition rules (BMS 2)**
Now we try to compute relativities $\boldsymbol{r_\ell}$ for fixed rules from Czech Insurance Company according to (3). We assume that

- the number of claims obeys the distribution defined by (1);
- the initial level $z$ is class 11 as the Czech Insurance Company;
- the weights $v_n = \frac{1}{20}, for\ \ n \in \{1,2,\dots,20\}, otherwise\ v_n = 0$;
- the annual expected claim frequency $\lambda = 0.15$;
- the residual heterogeneity $\Theta \sim \Gamma(1.05; 1.05)$.

The resulting relativities are mentioned in Table 2.

**Table 2** The Non-asymptotic BMS with fixed transition rules from the Czech Insurance Company

| Level $\ell$ | Relativities | Level $\ell$ | Relativities |
|---|---|---|---|
| **1** | 41.53% | **9** | 99.43% |
| **2** | 57.42% | **10** | 109.38% |
| **3** | 61.70% | **11** | 145.83% |

| | | | |
|---|---|---|---|
| **4** | 66.48% | **12** | 161.58% |
| **5** | 71.71% | **13** | 181.57% |
| **6** | 77.83% | **14** | 208.56% |
| **7** | 83.97% | **15** | 253.21% |
| **8** | 91.10% | **16** | 297.52% |

Source: Author

Table 2 shows us that the policyholders on the level 1 pay only 41.53% of the *a priori* premium. The result is similar to the BMS from Czech Insurance Company where policyholders on the level 1 pay 50% of the premium. However, the relative premium on level 16 is different. According to our results, the policyholders should pay 297.52%, but they pay only 200%. Our BMS has eight bonus class, and seven malus class but BMS from the Czech Insurance Company has ten bonus class and five maluses. Our proposed system presented in Table 2 is much stricter than the Czech Insurance Company's BMS.

**The non-asymptotic BMS with varying transition rules (BMS 3)**

Now we try to compute relativities $\boldsymbol{r_\ell}$ for varying transition rules (7). We assume that

- the number of claims obeys the distribution defined by (1);
- the initial level $z$ is the class 9 because for $z = 11\ or\ z = 10$ the condition (6) was not met;
- the weights $v_n = \frac{1}{20}, for\ \ n \in \{1,2,\dots,20\}, otherwise\ v_n = 0$;
- the annual expected claim frequency $\lambda = 0.15$;
- the residual heterogeneity $\Theta \sim \Gamma(1.05; 1.05)$;
- the parameter $p = 5$.

The resulting relativities are mentioned in Table 3.

**Table 3** The Non-asymptotic BMS with varying transition rules

| **Level $\ell$** | **Relativities** | **Level $\ell$** | **Relativities** |
|---|---|---|---|
| **1** | 51.28% | **9** | 186.59% |
| **2** | 75.67% | **10** | 214.79% |
| **3** | 82.36% | **11** | 224.29% |
| **4** | 89.85% | **12** | 271.79% |
| **5** | 100.23% | **13** | 315.08% |
| **6** | 110.13% | **14** | 372.79% |
| **7** | 122.01% | **15** | 394.62% |
| **8** | 136.77% | **16** | 476.92% |

Source: Author

The system presented in Table 3 is much stricter than the Czech Insurance Company's BMS or system presented in Table 2. BMS uses only four bonus class and 11 malus class. The policyholders should pay 476.92% on level 16.

Table 4 shows a comparison of efficiency (4) of BMS from Czech Insurance Company (BMS 1) with our BM systems described in Table 2 (BMS 2) and Table 3 (BMS 3).

**Table 4** The Comparison of efficiency

| | **BMS 1** | **BMS 2** | **BMS 3** |
|---|---|---|---|
| **Efficiency** | 0.8411 | 1.4221 | 1.3667 |

Source: Author

It can be seen that the values of efficiency are different. The efficiency is the smallest for BMS from the Czech Insurance Company. The non-asymptotic BMS with fixed rules has the best efficiency, and the non-asymptotic BMS with varying transition rules has the efficiency slightly lower than the best BMS.

## 4 Conclusions

In this paper, we study the idea of using a non-asymptotic bonus-malus system with fixed and varying transition rules. We presented a computation of relativity premium according to fixed transition rules from Czech Insurance premium and according to varying transition rules. In our numerical illustrations, we find that the proposed non-asymptotic bonus-malus systems are more effective than the system used by the Czech Insurance Company. The fixed system gave better results than the variable system. One possible avenue for future research is to investigate more systems with variable transition rules and find a more efficient system than the system created by Tan (2016).

## References


Borgan, Ø., Hoem, J. M. (1981). A nonasymptotic criterion for the evaluation of automobile bonus systems. *Scandinavian Actuarial Journal*, vol. 1981(3), pp. 165-178.

Česká pojišťovna (2009). *Sdružené pojištění vozidla.* Retrieved from: https://www.abcpojisteni.cz/admin/files/file/%C4%8CP%20VPP%20+%20ostatn%C3%AD.pdf.

Denuit, M., Maréchal, X., Pitrebois, S., Walhin, J.-F. (2007). *Actuarial modeling of claim counts: Risk classification, credibility and bonus-malus systems*. John Wiley & Sons, Chichester.

Klugman, S. A., Panjer, H. H., Willmot, G. E. (2012). *Loss models: from data to decisions*. Hoboken: John Wiley & Sons.

Norberg, R. (1976). A credibility theory for automobile bonus systems. *Scandinavian Actuarial Journal,* 1976(2), pp. 92 – 107.

Pitrebois, S., Denuit, M., Walhin, J. F. (2003) Setting a bonus-malus scale in the presence of other rating factors: Taylor's work revisited. *ASTIN Bulletin: The Journal of the IAA*, vol. 33(2), pp. 419-436.

Tan, C. I., Li, J., Li, J. S. H., Balasooriya, U. (2015). Optimal relativities and transition rules of a bonus-malus system. *Insurance: Mathematics and Economics*, vol. *61*, pp. 255-263.

Tan, C. I. (2016). Varying transition rules in bonus-malus systems: From rules specification to determination of optimal relativities. *Insurance: Mathematics and Economics*, vol. 68, pp. 134-140.

# Teaching and Learning with Audiovisual Media: Empirical Analysis of the Effectiveness of Podcasts in Financial Literacy

**Alexander Zureck[1], Eric Frère[2], Gennadij Seel[3], Lars Klingenberger[4]**

[1] FOM University of Applied Sciences/Masaryk University
isf Institute for Strategic Finance/Department of Finance at Faculty of Economics and Administration
Leimkugelstraße 6, 45141 Essen, Germany
E-mail: alexander.zureck@fom.de

[2] FOM University of Applied Sciences
Department of Finance at Faculty of Economics and Administration
Leimkugelstraße 6, 45141 Essen, Germany
E-mail: eric.frere@fom.de

[3] Masaryk University / FOM University of Applied Sciences
Department of Finance at Faculty of Economics and Administration
Leimkugelstraße 6, 45141 Essen, Germany
E-mail: gennadij.seel@fom-net.de

[4] Masaryk University / FOM University of Applied Sciences
Department of Finance at Faculty of Economics and Administration
Leimkugelstraße 6, 45141 Essen, Germany
E-mail: lars.klingenberger@fom-net.de

***Abstract:*** *The more differentiated we explore learning materials in terms of financial literacy, the more diverse are the ways to remember and retain. The reminder rate increases significantly the more senses are involved in the learning process. Audio recordings can be useful in addition to classroom teaching and can be used at any time, any place, and any pace. While other studies considered the implications of digitization, and eventually e-learning, or the knowledge gap regarding to student-generated podcasts in language learning, this paper examines the impact of podcasting in financial literacy. As part of the primary data collection, a questionnaire was conducted with students from both, Bachelor's and Master's degree programs at FOM University of Applied Sciences in Germany. Within the survey, the general handling and attitude to podcasts was examined, as well as the evaluation of defined contributions to the topic of financial literacy. From the questionnaire results (n = 86) the method of logistic regression is used to answer some important hypotheses in this paper. The outcomes present binary insights with respect to the usage of podcasts in the field of financial literacy and education. Firstly, the study derives, that configuration of podcasts affects the transfer of knowledge in financial literacy. With respect to the length of formats, cross connection to recent findings in human psychology are depicted. Furthermore, in terms of learners' perspective, the study reveals limited dependency of the acceptance of podcasts with respect to age, gender and prior education.*

*Keywords: Financial literacy, financial education, e-learning, podcasting, digitization*

*JEL codes: A20, A22*

## 1 Introduction

Over the past few decades, use of podcasts has grown dramatically across educational backgrounds, and especially in financial literacy. Essentially, podcasts find their use in higher education in recording attendance lectures, which are then made available as audio formats. Podcasting is seen as a pioneering medium of technological development and consists of various application series such as Video, Audio, Digital TV, PDF files, and presentations, e.g. Faramarzi and Bagheri (2015). The mentioned podcast services can be downloaded via computer or mobile devices.

In addition, podcasts represent an enormously important extension of both learning methods as well as teaching methods in educational science and especially in financial literacy. Many students utilize podcasts and audiobooks to effectively use their time on the way to or from work or university. Especially for extra occupational study courses podcasts represent a crucial time saving.

Basically, there are three categories of activities and equipment involved in podcasting: File Production, Podcast Publication, Delivery and Playback (Deal, 2007). The main subject of the step of file production is planning, writing, and recording content, as well as audio/video editing and file compression. Podcast publication represents the following step, which includes posting the audio/video file and RSS feed to a Web server. Finally, the listener can add new RSS feeds and the aggregator downloads all episodes referenced in the current RSS feed. Periodically, the aggregator checks the feed for updates and downloads any episodes added since the previous check (Deal, 2007). This point has a huge meaning in financial literacy, because of high volatility in financial and capital markets. The following figure 1 summarized the process of creating, updating, uploading and receiving podcasts.

**Figure 1** Summarized Process of Generating Podcasts

| Step | Description of the process |
|---|---|
| 1 | Podcast creator produces audio/video files. |
| 2 | Podcast creator generates the RSS feed files. |
| 3 | Podcast creator updates the RSS feed files. |
| 4 | Podcast creator uploads audio/video files and RSS feeds to a web server. |
| 5 | Podcast creator notifies audience of the location of RSS feeds. |
| 6 | Listener adds the location of the RSS feed to podcast aggregator software. |
| 7 | Podcast aggregator downloads the most recent episods based on RSS feed. |
| 8 | Listener accesses podcast episodes. |

Source: own representation based on Deal (2007)

## 2 Literature Review and Hypotheses Development

In order to concretize the research hypotheses, it is necessary to give an overview of the current state of research in the subject area.

In the existing literature the adoption is followed that design of the content of podcasts and of the learning activities in which students are involved, as well as the feedback students get on their activities, are key components for successful learning. To provide with a theoretically ground framework for analyzing the educational potential of this new technology, Popova and Edirisingha (2010) refer to Laurillard's Conversation framework. This framework Laurillard (2002) suggests as an important point of reference for identifying the type of media necessary or suitable to achieve one or each of the interactions occurring between teacher, learner, and action within a learning area. Some other authors, e.g. Plaisted and Irvine (2007), use this framework to analyse the design and application of Web 2.0 generation tools. In summary, it should be note that Popova and Edirisingha (2010) shows in their analysis that there are applications of podcasts, which evidence entirely student-centered and student-created learning activities. From the literature, link to the question concerning the design of podcasts for financial literacy is triggered.

Furthermore, podcasting has a range of several dynamics and ongoing educational functions. Podcasting systems can be used as a method to facilitate the teaching-learning delivery in many institutions and delivers providing RSS (Really Simple Syndication) feeds which are automatically updated by subscribes (McCombs and Liu, 2007). Another

big advantage of podcasts is the ease of application, in which users can get access to the downloaded or saved Information on their device. A lot of institutions (e.g. The University of Huston) confirm the quality of educational podcasting service and its content delivery through a participated group of experts. The report by Duke University (2005) shows, that Students welcomed the use of podcasts in classrooms. Nevertheless, the system of podcasting of educational delivery and especially in financial literacy is not popular in many institutions because of a fallacy which restricts the use of this innovated technology to possessing iPods and Mp3 devices. Since its birth, the use of podcasting method has been significantly increased. The growth is due to a variety of different factors. Campbell (2005) carries this growth of the factors such as the popularity of the amount of internet activities, the improvement in the broadband technology, and the fast progression of devices like Mp3 players, iPods and Smartphones.

Gamböck and Pichler (2006) refer to a major survey on podcasting in Germany. The results of the Survey (n=2.344) have shown that already one third of respondents use podcasts for their personal education. According to the survey the German-speaking Podcast listener is on average 29.6 years old, has a university degree, is working (64 %) or in education (33 %), earns on average 2,100 euros net, has subscribed to eight podcasts and listens to them 3.61 hours a week, often on the way to work. In addition, it is stated that the ideal length of a podcast is between 10 and 20 minutes, and that the optimal update rate is weekly. Nonetheless, the literature lacks further analysis concerning gender differences, which will be problematized as part of this study. Furthermore, the age is introduced in various research, but could not be largely identified as a researched factor, which likewise raises problematization as part of the conducted research.

Rostami et al. (2017) found in their study that the application of podcasts as a motivational teaching strategy significantly benefited the experimental group to show a higher mean on classroom motivation. It also revealed that the application of podcast changes the Iranian EFL learners' motivation positively.

For developing speaking skills in language acquisition settings, particularly within the context of the emerging Mobile Assisted Language Learning (MALL), podcasts present a useful tool. In her study Phillips (2017) seeks to address the gap in knowledge within student-generated podcasts in language learning. On the purpose of highlighting some of the main pedagogical considerations of using podcasts in language learning, the paper of Phillips (2017) explores students' perceptions of podcasts as a learning tool. Furthermore, the study describes the results of two surveys which were conducted with two different student cohorts over the course of two years. The aim of conducted survey was to explore the students' levels of acceptance and enjoyment of activities in which they had to produce their own podcasts, as well as the perceived learning benefits. The results section describes a range of positive learning outcomes and highlights the pedagogical implications of using podcasts in class.

Faramarzi and Bagheri (2015) highlighted, that podcasting has been regarded as an innovative method in language learning and instructional technology which offers more flexibility and portability of language materials. In their study, the authors sought to investigate the role of podcasting technology in different domains of language learning and teaching by reviewing the previous research projects and offer new directions for future research activities. In conclusion, the study shows that some future potential trends and recommendations are proposed for those researchers interested in podcasting research.

Thiyagu (2014) tried to find out in his study the effectiveness of Video Podcast in learning psychology among Bachelor of Education Trainees. For this study two equivalent group experimental designs are employed (24 students were chosen as control group and 24 were chosen as experimental group). The results show that 37.5% of the control group students have low level, 58,3% of them have moderate level and 4,2% of them have high level of the gain scores. The results in the other group show that 8,3% of them have low level, 58,3% of them have moderate level and, 33,3% of them have high level

of the gain scores. Furthermore, Thiyagu shows that there is a significant difference between control and experimental group students in their gain scores and a significant difference between control and experimental group, referring to their gain scores for attainment of the knowledge and understanding objectives. In addition to similar test set-up, also the differentiation of various levels of education, apart from peers, must be considered, will be introduced as part of this study and is going to extent the lack of research in this field.

Summing up the empirical results, Podcasts are key components for successful innovative learning. Empirical studies have shown that the use of podcasts has many advantages. Some studies could demonstrate an increase in student motivation when using podcasts, whereby other Studies have shown that the use of podcasts is an appropriate supplement, especially when learning languages, and ultimately contributes to the effectiveness of learning.

While other studies have investigated the impact of digitization and finally e-learning or addressing the gap in knowledge through student-generated podcasts in language learning, this paper is going to assess the suitability of the format of podcasts in teaching and learning financial literacy. Based on the literature review, the study focuses on four hypotheses, presented in Table 1:

**Table 1** Research Hypotheses

| No. | Hypothesis |
|---|---|
| H1 | The capacity of Financial Literacy via podcasts depends on the extent of the contributions |
| H2 | Gender has no significant impact on the use of podcasts |
| H3 | Use of podcasts is negatively depending on the age of students |
| H4 | The prior education has a positive impact on the acceptance of podcasts |

Source: Own representation

## 3 Methodology and Data

### *Data and Variables*

In order to test the hypothesis and underlying research questions, suitable data concerning the evaluation of the use of podcasts in financial literacy must be analyzed. Driven by the novelty of the research topic and the connection to social science, the collection of primary data has been chosen from pool of methods. With the aim to increase the scope of the study and to back up an explorative approach, a questionnaire has been introduced, which was conducted with suitable target group. For the purpose of flexible availability, the questionnaire has been captured and stored on an online platform which has been published only for the participant group and could be accessed with own internet-enabled devices.

The subject is a 73-Item questionnaire approaching the perception and evaluation of podcasts in context of financial literacy. It contains out of two parts, which splits into one section of 13 Items and a second section of ten times six repeated items. The first section contains out of four items which refer to personal information of the participant including age, gender, professional & educational degree, three items referring to the perception of digital media & podcasts, three items concerning the use of podcasts and finally again three items for evaluation of the application of podcasts in various contexts of studies. The second section contains out of ten sub-sections, each comprising six items with five-point Likert scale ranging from fully agree to fully disagree. These items of the questionnaire asked the participants to rate the comprehensibility and the use of technical terms, speed and length of podcasts as well as the content and relevance for studies, after playing various podcasts in front of the participants.

Within the present study, extra-occupational students from private university in Germany were consulted to participate in the survey. Thereby, both Bachelor and Master students were included in the group of participants. The age of the students from initial responses

is between 20-38 years. The groups were selected randomly from a list of different courses and were asked to attend in the context of a lecture. In total, 92 students executed the survey. Following a conservative approach and to ensure data quality, only fully competed surveys were taken into account. Furthermore, patterned entries, e.g. showing exclusively highest or lowest possible values for Likert scale over all responses have been validated with no findings.

Ultimately, six responses have been removed from dataset, as their status reflect incomplete number of items responded or invalid due to out of date range. Thus, a total sample of 86 cases remained after clean-up of the record. Women comprised 51.2% of the data sample, whereby there was overall 17.4% of participants without vocational qualification. The mean age of the cleaned data sample was 25.4 (SD 3.86) years and 73.3% were undergraduates.

***Main Procedure & Analysis***

The data was collected in four waves during the winter semester of 2018/2019. To ensure comparability, the same procedure was used in each of the four rounds of surveys. After a consistent introduction to the topic covering explanations of the planned course of the survey, students were given time to answer the first section of the questionnaire. From the beginning, motivation for the study and a link to the subject of financial literacy has been made clear. Questions about individual items were clarified in advance. After completing the first section, detailed instruction about the course of the second part of the questionnaire was introduced. Subsequently, a total of ten audio contributions on financial topics (Shares, Stock Exchange, Cash Flow, Derivates, Equity, Debt Capital, Income Statement, Hedge fond, Investments, Financial Statements) were presented to the participants one after the other. After each podcast, the participants were asked to rate them. The survey was completed after audition of the last podcast and filling of all items in section two.

In order to tackle the research hypotheses, the data analysis has been divided into two parts. With the aim of testing the capacity of podcasts dependency on the extent of the contributions, comparative approach of concrete podcast evaluation has been taken. Additionally, a regression model has been introduced on the research of the other hypotheses. Data has been analyzed primarily with the use of statistic tool GRETL. With regard to the capacity of podcasts in financial literacy, finding of appropriate measures is necessary to enable data analysis. Testing the evaluation of varying criteria on podcasts rather than the experimental and control group, enables the assessment of variances between various audios on financial literacy. Therefore, results of the evaluation of ten podcasts from the study has been divided into two groups -classified by their length- and were compared with respect to the means of groups. The first group ranges from 53-88 seconds with a mean value of 67 seconds, whereby the second group ranges from 90-143 seconds with a mean value of 117 seconds. Based on Likert scale (1= Does not apply, 5= Conditions fully met) mean of the two groups were compared.

**Table 2** Descriptive Statistics of independent Variables

| Variable | Mean | Median | SD | Min | Max |
|---|---|---|---|---|---|
| **GENDER_transform** | 0,488 | 0,000 | 0,503 | 0,000 | 1,00 |
| **AGE** | 25,4 | 24,5 | 3,86 | 20,0 | 38,0 |
| **EDUCATION_transform** | 0,733 | 1,00 | 0,445 | 0,000 | 1,00 |

Source: Own calculations

Supportively, the influence on the use of podcasts has been examined to derive implications for applicability for financial literacy. Derived from the results of questionnaires, respond in terms of the use of podcasts had to be conducted. Therefore, the dependent variable on the use of podcasts (Item eight) has been used for this purpose. Due to the text format (Yes; No), a transformation of the variable has been implemented from a text into binary number format (Variable: POD_UTIL_LEISURE_transform – yes=1, no=0). In terms of the independent variable of

age (Variable: AGE) data has been used for the model in original string format. Furthermore, the independent variable of the gender also exists in text format. Since the data sample only contains male and females, the data again could be transformed into binary number format (male=1, female=0).

Lastly, the prior education has been derived from item four of the results. With respect to the data set grouping into undergraduates and students with degree, responses have been formed and translated into binary number format (1= Undergraduate, 0= Student with degree). An overview of the basic statistics has been summarized in Table 2. Driven by the binary data format of the dependent variable, requirements of Ordinary Least Squares methods are not satisfied and would deliver invalid values. Thus, testing is performed by logistic regression (logit). The full regression model is presented in the following equation:

$$POD_{UTIL_{LEISURE_{transform}}} = \beta_0 + \beta_1 * GENDER_{transform} + \beta_2 * AGE + \beta_3 * EDUCATION\_transform$$

## 4 Results and Discussion

The results of the study of the two groups of podcasts are presented in Table 3, which shows the mean values from the responses regarding the individual evaluation criteria of the respective contributions as well as group average. The variances in cumulative averages per group are presented in bold below the table, whereby Group 2 values are subtracted from Group 1. The results point out, that most criteria in Group 1 outperform Group 2, whereby only the criterion of pace underperforms. In total, results present an outperforming difference in cumulative means of 0.33 on Likert Scale of Group 1.

With regard to the first hypothesis, the extent of the contributions has been declared for testing. The results confirm, that there is an overall positive difference for shorter formats, which underpins hypothesis H1. Since having embedded the criterium of length of podcast as criterion, proof can be directly shown from the data.

**Table 3** Comparison of Mean Values

| | Comparison of Mean Values of Podcasts I-X | Length (in sec) | Wording | Terminology | Pace | Length | Content | Support |
|---|---|---|---|---|---|---|---|---|
| Group 1 | Debt (VI) | 53 | 4.17 | 4.16 | 3.49 | 3.91 | 3.67 | 3.92 |
| | Shares (I) | 61 | 4.63 | 4.23 | 4.06 | 4.08 | 3.80 | 3.80 |
| | Stock Exchange (II) | 65 | 4.21 | 4.15 | 3.27 | 3.97 | 3.71 | 3.65 |
| | Derivatives (IV) | 69 | 4.13 | 3.77 | 3.69 | 3.99 | 3.62 | 3.71 |
| | Cashflow (III) | 88 | 4.49 | 4.23 | 4.42 | 3.93 | 3.93 | 3.99 |
| | **Average SUM** | **67** | **4.33** | **4.11** | **3.78** | **3.97** | **3.75** | **3.81** |
| Group 2 | Income Statement (VII) | 90 | 4.41 | 4.20 | 4.41 | 3.87 | 3.78 | 3.98 |
| | Equity (V) | 104 | 4.40 | 4.16 | 4.34 | 3.65 | 3.78 | 4.00 |
| | Financial Statement (X) | 105 | 4.10 | 4.10 | 3.60 | 3.69 | 3.71 | 3.81 |
| | Investment (IX) | 142 | 4.26 | 4.20 | 4.30 | 3.53 | 3.62 | 3.83 |
| | Hedgefond (VIII) | 143 | 3.92 | 3.77 | 3.48 | 3.20 | 3.56 | 3.45 |
| | **Average SUM** | **117** | **4.22** | **4.09** | **4.03** | **3.59** | **3.69** | **3.81** |
| | **Dif Group I vs. II** | **-50** | **0.11** | **0.02** | **-0.24** | **0.39** | **0.06** | **0.00** |

Source: Own calculations

In terms of the other hypotheses however, the results of logistic (logit) regression present a differentiated picture (see Table 4). Since the model of logistic regression is applied, the interpretation of coefficients is based on probabilities. For coefficients, which correspond to log of odds ratios, the increase of an independent variable with values

greater null refer to increased, whereby values below null are accompanied by a reduced probability of occurrence of the dependent variable.

**Table 4** Results from Logistic Regression Model

| Variable | Coefficient | Std. Errors | z | p-value | Slope |
|---|---|---|---|---|---|
| **Intercept** | 1,87415 | 1,77839 | 1,054 | 0,292 | |
| **GENDER_transform** | 0,0204566 | 0,46897 | 0,04362 | 0,9652 | 0,00492512 |
| **AGE** | −0,059506 | 0,0650391 | −0,9149 | 0,3602 | −0,0143261 |
| **EDUCATION_transform** | −1,04185 | 0,531116 | −1,962 | 0,0498 | −0,253440 |
| **Dependent Variable: POD_UTIL_LEISURE_transform** | | | | | |

Source: Own calculations

Driven by the results, the direction of gender is positive. Since the variable is built on dummy for men (1) and women (0), the probability of utilization of podcasts is more likely with men. With regard to the hypothesis H2, the results are not corresponding with the predicted relationships. Nevertheless, since there was no significant impact predicted, hypothesis testing will basically look for impact of the independent variable. Solely from coefficient interpretation, age has a positive impact on the likelihood of using podcasts. The higher the age, the lower the likelihood that podcasts will be used. Still, in terms of the third hypothesis H3, this could not be confirmed, since there is accordingly low significance. Again, limiting the analysis to interpretation of coefficients, direction would be negative. In terms of the last Hypothesis (H4), this could be confirmed. Based on the transformation of binary variable, undergraduate students have lower probability of using podcasts. Vice versa, students with degree are more likely to utilize podcasts.

## 5 Conclusions

The study reveals that there are several components affecting the potential of podcasts in financial literacy. One of the major findings could be retrieved from the comparison of different length of audio formats. Effectively, shorter formats are perceived on average more positively than podcasts with longer duration. Considering the assessed criteria in this study, also anomalies could be presented. When it came to the pace of podcast in both groups, students rated the aforenamed divergent on Likert scale. With respect to recent findings concerning the attention span for different formats, implications might be seen on that regard.

Beside the extent of podcasts in financial literacy, the study also presents implications on the usage as well as user groups of podcasts. Based on logistic regression, independence from gender about utilization of podcasts is implied. Furthermore, increased acceptance potential of podcasts could be identified for non-undergraduate students. Usage of podcast implies a potential acceptance for the usability in teaching and learning, also in financial literacy. Taking these aspects into account, insights regarding effective usage and target group specific application of podcasting in teaching and learning of financial literacy can be assessed.

Nevertheless, consecutive research is necessary to explore the potential of podcasts in financial literacy further. Effectively, there are two areas of interest appearing from that study, which can be explored. First, following studies can add and examine further variables -beside the length of podcasts- such as aspects and properties of the speaker in relation to perception and acceptance of audio formats in financial literacy. The selection of different speakers might offer conclusions about differences from established, measurable criteria. Different genders of the narrator might be of interest and can be tested in terms of the perception of gender variances.

Secondly, broader field of visual components can be added. Since the study casually reveals, that for people who are familiar with podcasts, the use of digital media is associated with e.g. the use of video platforms, the importance of visual support might be explored. Thereby the novelty is not about the topic of visual support in general, but on the assessment of formats.

## References


Cambell, G. (2005). *Podcasting in Education*. EDUCAUSE. Retrieved from: http://www.educause.edu/ir/library/pdf/ERM0561.pdf.

Deal, A. (2007). *Podcasting: Carnegie Mellon University Teaching with technology white papers*. June 2007, pp. 1-15. Retrieved from: https://www.cmu.edu/teaching/technology /whitepapers/Podcasting_Jun07.pdf.

Duke University (2005). *Duke sees growth in classroom iPod use. News and Communications.* Retrieved from: http://www.dukenews.duke.edu/2005/12/ipodupdate. html.

Faramarzi, S., Bagheri, A. (2015). Podcasting: Past Issues and Future Directions in Instructional Technology and Language Learning. *Journal of Applied Linguistics and Language Research,* vol. 2(4), pp. 207-221.

Gamböck, B., Pichler, M. (2006). E-Learning-Trend 2006, Besser lernen mit Weblogs, Wikis, Podcasts. *Wirtschaft + Weiterbildung*, vol. 2, pp. 54-63.

Laurillard, D. (2002). *Rethinking university teaching: A framework for the effective use of learning technologies,* 2nd ed. Oxon: RoutledgeFalmer.

McCombs, S., Liu, Y. (2007). The Efficacy of Podcasting Technology in Instructional Delivery. *International Journal of Technology in Teaching and Learning,* vol. 3 (2), pp. 123-134.

Phillips, B. (2017). Student-Produced Podcasts in Language Learning-Exploring Student Perceptions of Podcast Activities. *Journal of Education*, vol. 5 (3), pp. 157-171.

Plaisted, T., Irvine, S. (2006). Learning from Web 2.0 practices: A tool to support real-time student collaboration. *Proceedings of the 23rd annual ascilite conference: Who's learning? Who's technology?* 3-6 December, Sydney, Australia.

Popova, A., Edinrisingha, P. (2010). How can podcasts support engaging students in learning activities. *Procedio Social and Behavioral Sciences,* vol. 2(2010), pp. 5034-5038.

Rostami, M. A., Azaznoosh, M., Abdolmanafi-Rokni, S. J. (2017). The Effect of Podcasting on Iranian EFL Learners`Motivation and Attitude. *Theory and Practice in Language Studies*, vol. 7 (1), pp. 70-78.

Thiyagu, K. (2014). Effectiveness of video podcast in learning psychology among Bachelor of education students. *i-manager's Journal on School Educational Technology*, vol. 10 (1), pp. 36-43.

Masaryk University
Faculty of Economics and Administration
Department of Finance
and
Institute for Financial Market

# European Financial Systems 2019

**Proceedings of the 16th International Scientific Conference**

Edited by Josef Nešleha, Lukáš Marek, Miroslav Svoboda, Zuzana Rakovská

Published by Masaryk University Press, Žerotínovo nám. 617/9, 601 77 Brno, CZ

1st edition, 2019, number of copies 100

Printed by: **Tiskárna KNOPP s.r.o.**
**U Lípy 926, 549 01 Nové Město nad Metují**

ISBN 978-80-210-9337-9

ISBN 978-80-210-9338-6 (online : pdf)