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Oleg Deev
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Jan Krajíček

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PREFACE

Dear readers,

It is my pleasure to introduce you a collection of papers from the 11th annual international scientific conference The European Financial Systems 2014 organized annually by Department of Finance of the Faculty of Economics and Administration, Masaryk University in Brno, Czech Republic. This year's conference was focused especially on the current issues related to the impacts of the financial crisis on financial and non-financial institutions, new regulation rules and procedures on financial markets, new accounting and tax challenges and trends and tendencies in banking and insurance industry.

Because the collection of papers presents the latest scientific knowledge in this area, I believe you will get a number of new insights usable both for your scientific, and educational or practical activities. I would also like to express my conviction that we meet each other in occasion of the 12th year of this conference held in 2015.

I wish you pleasant reading!

Petr Valouch

Chairman of the Program Committee

CONTENTS

Sovereign Credit Rating in Ordered Response Model Framework – Case of Visegrad Four Countries

Martin Alexy, Marek Káčer

University of Economics in Bratislava
Faculty of National Economics, Department of Finance
Dolnozemská cesta 1, 852 35 Bratislava, Slovakia
E-mail: martin.alexy@euba.sk, marek.kacer@euba.sk

Abstract: *The aim of this paper is to study the determinants of sovereign credit rating from the four major agencies – Moody's, S&P, Fitch and R&I. The dataset is formed by the Visegrad Four countries in the period 1993-2012. The influence of EU and Eurozone membership is analysed in addition to the macroeconomic and the socio-political explanatory variables. Ordered probit model is used to estimate the parameters and to identify the relevant determinants of sovereign rating. Country heterogeneity not captured by the explanatory variables is modelled using fixed effects. The findings are confronted with our previous research using linear model. Results suggest that the main determinants are inflation, unemployment, import to export ratio, openness of the economy, real effective exchange rate growth, government gross debt and voice and accountability score (of World Bank Governance index). Both EU and EMU membership dummy variables are also significant.*

Keywords: sovereign rating, Visegrad Four countries, panel data, ordered probit

JEL codes: F30, G15, G24

1 Introduction

The sovereign credit rating assigned by credit rating agencies has become a very influential measurement of creditworthiness of governments and significant signal for investors in governmental bonds and debt. Since rating agencies have not been obliged to provide detailed methodology and fully disclose their rating procedures, this area has been an object of interest for researchers. Starting with seminal paper of Cantor and Packer (1996) there were several studies focused on determinants of sovereign rating.

Since credit ratings of developed countries usually do not vary enough, developing countries typically form the main part of dataset for analysis. This paper focuses on a smaller group of countries from the same geographic region with several common features one of them being the level of economic development. We selected four Central European countries from Visegrad Four group. It is an alliance of four states: Czech Republic, Slovakia, Hungary and Poland. In the last 25 years each of them went through large economic and political transformation. Politically the system of one ruling party changed into the democracy. Market economy was introduced instead of centrally planned economy. They used to be members of Council for Mutual Economic Assistance and Warsaw treaty. Following the change they became NATO members and later they all joined European Union (EU) on 1 May 2004; one of them also became member of Economic and Monetary Union (EMU).

There are two main approaches in academic research regarding the econometric modelling of sovereign credit rating. The first approach, starting with Cantor and Packer (1996), uses linear regression methods on a numerical representation of the ratings. Their research utilized ordinary least squares (OLS) regressions to a linear representation of the ratings, on a cross section of 45 countries. Similar methodology was later used by Monfort and Mulder (2000), Afonso (2003), Butler and Fauver (2006) and Mora (2006). Using OLS analysis on a numerical representation of the ratings is simple and allows for a straightforward generalization to panel data by doing fixed or random effects estimation. It has good fit and a good predictive power.

The critique argues that the use of OLS technique assumes the rating (dependent variables in the model) has been categorized into equally spaced discrete intervals rating categories. This suggests that the risk differential between any category is the same (i.e. risk difference between AAA and AA+ rating is the same as between BB- and B+). Using OLS method is argued not to be the most suitable for some multinomial choice variables, which are inherently ordered, such as ratings (Moon and Stotsky, 1993). There is an assumption that sovereign ratings represent an ordinal ranking of creditworthiness.

The second approach in modelling uses ordered response models. These methods should determine themselves the size of the differences between each category. Ordered probit model had been used for example in works of Hu et al. (2002), Bissoondoyal-Bheenick et al. (2006) and Depken et al. (2006).

In this paper we extend our previous research (Alexy et al., 2014) where we used the OLS technique to model the sovereign credit rating of Visegrad Four countries. Our goal is to verify whether using the ordered probit approach significantly changes the results of the analysis and at the same time whether linear approach is warranted. The paper is structured as follows: in the next, second part we briefly describe the ordered response framework along with the data and the explanatory variables, in the third part the results are presented and the last, fourth part summarizes and concludes the paper.

2 Methodology and Data

Ordered Response Models

The ordered response models are suitable for the modelling of the limited dependant variable of the ordinal nature. The sovereign credit rating is in fact the attempt of the respective credit rating agencies to rank the countries in terms of their credit worthiness. The ordered response models assume the existence of the latent variable $R^*_{i,t+f}$ of the linear form:

$$R^*_{i,t+1} = \sum_{j=1}^{k} \beta_j X_{j,i,t} + \gamma_i + e_{it} \tag{1}$$

where $R_{i,t+1}$ – transformation of the rating, β_j - slope coefficients, $X_{j,i,t}$ - explanatory variables, γ_i - country specific unobserved effects. The index *i* denotes the country and the index *t* time period.

The first note to make regarding this model is the transformation of the ratings. The sovereign credit ratings are of ordinal nature and they need to be transformed firstly into cardinal scale for them to be used in regression. Since the credit ratings assess the credit risk, using a simple linear transformation assumes that one notch difference in the rating reflects the same difference in the default probability along the whole rating scale. The ordered probit method relaxes this assumption and allows for the flexible determination of the "sizes" of rating categories.

The second note is about the model being predictive. The credit rating is supposed to be the forward-looking assessment of the default probability and thus it makes sense to explain the future ratings with the set of the contemporary predictors. From the statistical point of view the explanatory variables lagged in the relation to the outcome can be considered as exogenous. That is why the models estimated in this study are forward-looking.

Then the model assumes the existence of the cut-off points forming the lower and upper boundary for each rating category:

$$R_{i,t+1} = \begin{cases} 13\ (Aa3, AA-) & if \quad R^*_{i,t+1} > cut_7 \\ 12(A1, A+) & if\ cut_7 \geq R^*_{i,t+1} > cut_6 \\ 11\ (A2, A) & if\ cut_6 \geq R^*_{i,t+1} > cut_5 \\ & \vdots \\ 6\ (Ba1, BB+) & if\ cut_1 \geq R^*_{i,t+1} \end{cases} \tag{2}$$

There are two approaches possible in the framework of panel data – fixed and random effects. We prefer the fixed effects since the number of cross-section units in our sample does not allow for the meaningful estimation of random effects. At the same time there exists no simple statistical test to reliably discern between the fixed and random effects when using the odered probit approach for panel data. The usual assumption of the normally distributed disturbances leads to the ordered probit model.

Data and Explanatory Variables

We model the sovereign credit ratings from the four credit rating agencies – Moody's, S&P, Fitch and R&I. Ratings used in this paper are: Moody's and S&P Foreign Currency Long Term Debt, Fitch Long Term Foreign Currency Issuer Default, R&I Foreign Currency Issuer Rating. The sample consists of the V4 countries: Czech republic, Hungary, Poland and Slovakia. Our data cover the years from 1993 to 2012 with not all of the data available thus forming an unbalanced panel. We use the time series of the ratings assigned as of the end of the June of the given year (middle of the year). This gives us 4 panels of dependent variables – one for each credit rating agency.

Based on our previous study (Alexy et al., 2014) we select the following variables as potential sovereign credit rating determinants: real GDP growth, inflation (in natural logarithm), unemployment, broad money to GDP ratio, import to export ratio, degree of openness of the economy, real effective exchange rate growth, government consolidated gross debt, primary balance, size of government, voice and accountability and dummy variables capturing the membership in EU and EMU.

3 Results and Discussion

When considering the ordered response framework for modelling the sovereign credit rating, the ordered probit was the preferred option of the majority of academic papers. Following the literature we chose ordered probit, as well. We started with the set of 13 explanatory variables, using the general-to-specific approach. In final models we retained only variables that were statistically significant. The results of preferred models are reported in table 1.

Four variables from the initial set were not significant for any agency. They are GDP growth, broad money to GDP, primary balance and size of the government. The GDP growth did not appear in linear model results either and the other three variables appeared in the results of linear models just for one out of four agencies. On the other hand the variable REER growth is statistically significant predictor of just one agency rating in ordered probit model. There are five variables significant for each agency – inflation, unemployment, government gross debt, voice and accountability score and EU dummy. Import to export ratio and EMU dummy are significant in three out of four agencies. From this point of view the sets of predictors for the individual agencies are overlapping.

The panel data setting allowed us to include the fixed effects as the proxy for the countries' unobservable time-invariant characteristics. However, based on the formal statistical test of their joint significance using the fixed effects was warranted only in the case of R&I. Since we chose Slovakia to be the reference country the results suggest that the actual ratings of Czech republic are somewhat lower than those of Slovakia (everything else equal). On the other hand, Hungary and Poland have the ratings higher.

When modelling the rating, the argument for the ordered response models is that the distances between the respective rating borders are not equal. The results of the formal test reported in table 1 lead us to reject the hypothesis of equal difference between notches for all agencies. This suggests that from this point of view one should prefer ordered probit to linear approach. The question arises whether there are regularities in the sizes of rating categories as reported in Afonso et al. (2011). However, the brief look at the figure 1 showing the explicitly the differences between the cut-off points does not confirm the idea, at all.

Table 1 Ordered probit estimation results (preferred models)

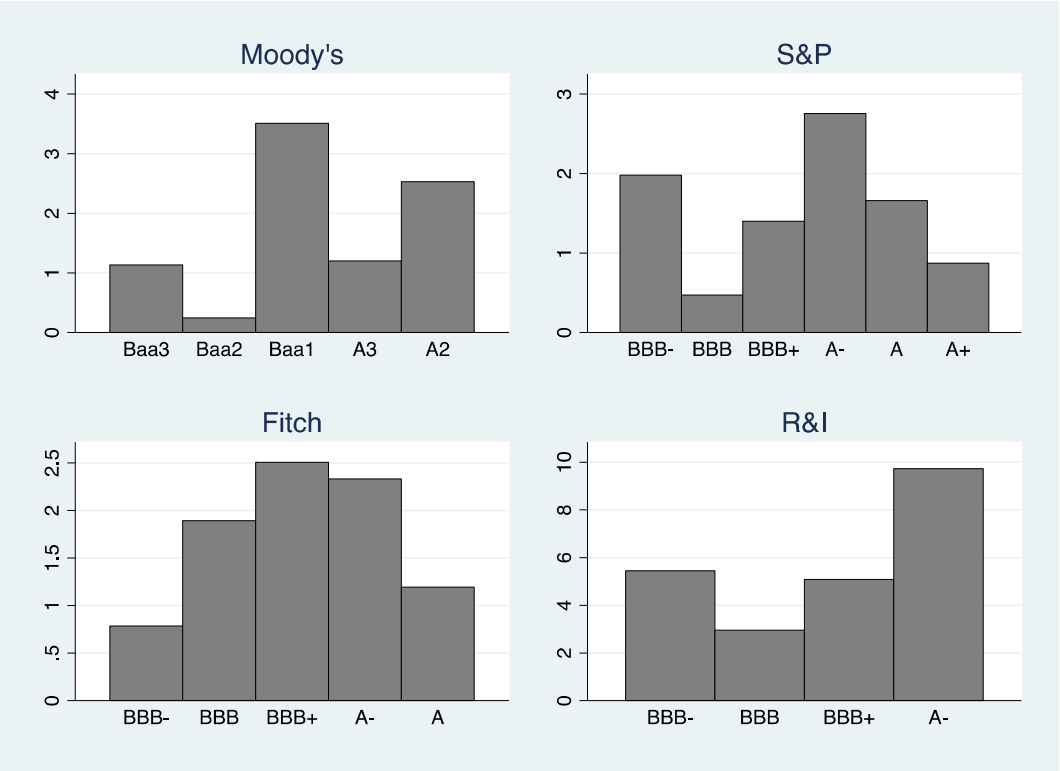
Variable	(1)	(2)	(3)	(4)
	Moody's	**S&P**	**Fitch**	**R&I**
Inflation CPI	-2.950***	-0.517**	-0.506**	-0.942***
	(-6.89)	(-2.28)	(-2.27)	(-2.76)
Unemployment	-0.167***	-0.150***	-0.168***	-0.918***
	(-3.62)	(-4.40)	(-3.86)	(-3.58)
Import to Export	-0.0904**		-0.0791***	-0.322***
	(-2.28)		(-3.08)	(-3.57)
Openness	0.0195***	0.0134***		
	(3.53)	(2.78)		
REER growth	7.380**			
	(2.39)			
Gov. gross debt	0.296***		0.122***	
	(3.76)		(2.66)	
Gov. gross debt squared	-0.00409***	-0.00116***	-0.00248***	-0.00319***
	(-4.45)	(-6.57)	(-4.95)	(-3.91)
Voice & accountability	14.71***	7.683***	9.307***	19.44***
	(6.20)	(4.60)	(5.15)	(3.69)
EMU membership		2.415***	7.065***	12.13***
		(3.99)	(15.20)	(6.58)
EU membership	2.236***	1.840***	2.634***	2.780***
	(3.50)	(4.96)	(4.95)	(3.24)
Fixed effects				
Czech Republic				-2.393
Hungary				1.045
Poland				3.135
Slovakia				0.000
Cut point 1	0.258	0.852	-5.441*	-46.80***
	(0.06)	(0.48)	(-1.91)	(-3.61)
Cut point 2	1.392	2.833	-4.656	-41.35***
	(0.33)	(1.58)	(-1.61)	(-3.41)
Cut point 3	1.639	3.305*	-2.763	-38.40***
	(0.39)	(1.81)	(-0.93)	(-3.25)
Cut point 4	5.148	4.705**	-0.256	-33.31***
	(1.13)	(2.56)	(-0.09)	(-3.04)
Cut point 5	6.350	7.460***	2.077	-23.59**
	(1.42)	(3.82)	(0.68)	(-2.40)
Cut point 6	8.881**	9.120***	3.271	
	(1.98)	(4.49)	(1.07)	
Cut point 7		9.993***		
		(4.67)		
Observations	60	64	64	54
McFadden R^2	0.637	0.455	0.556	0.799
Cut – equal differences [x]	0.0001	0.0013	0.0068	0.0095

z-statistics in parentheses * p<0.1, ** p<0.05, *** p<0.01

[x] p-values of the formal test of equal differences between cut points, the null hypothesis is that all distances between cut points are equal

Source: authors' calculations

Figure 1 Sizes of the respective rating categories



Note: the sizes are calculated as the differences between the adjacent cut-off points

The magnitudes of the effect for each variable are displayed in table 2. Firstly we compare the effect of the given explanatory variable between various agencies and secondly we analyse the relative importance of explanatory variable within the same model. The comparison between the agencies is performed by calculation of the score change if the given explanatory variable changes its value form the 10th to the 90th percentile and dividing by the average rating category size. This way we get the average rating change for the given explanatory variable capturing the variability of in the dataset at the same time. Then we analyse the relative importance of the explanatory variables within each rating agency. We do it looking at the relative weights using the formula:

$$RW_i = \frac{|\beta_i| change_i}{\sum_{j=1}^{m} |\beta_j| change_j} \tag{3}$$

where RW_i is the relative weight of the *i*-th explanatory variable, β_i is its estimated coefficient, $change_i$ is the difference between the 90th and the 10th percentile of its sample distribution and *m* is the number of significant explanatory variables in the model (for dummy variables the *change* is equal to one).

Now let us turn our attention to the magnitudes of the calculated effects of individual variables. Regarding the domestic macro-economic performance two variables are significant and influential – inflation and unemployment. Inflation has clearly negative impact on rating. It is used in the form of natural logarithm to effectively eliminate the outliers. In ordered probit it has by far the greatest weight in Moody's model, nearly 25%; in other agencies its impact is only marginal. Unemployment influence the ratings in an inverse way as well and it is in the R&I model where its weight exceeds 21%, more than double comparing to other agencies. As a sum, these two variables have the greatest relative weight in Moody's model, over 33% and the smallest in Fitch, exactly 14%.

In the external sector three variables proved to be significant rating predictors – import to export ratio, trade openness of the economy and real effective exchange rate growth.

All of them are significant in Moody's model, cumulatively having the relative weight of more than 20%. In S&P it is the openness and in the other two agencies import to export ratio that are the only significant rating predictors from the area of external trade. The weight of these variables is between 7 to 13%, see table 2 for details.

Table 2 Absolute and relative impact of the explanatory variables

	Moody's		S&P		Fitch		R&I	
	notches	**relative**	**notches**	**relative**	**notches**	**relative**	**notches**	**relative**
Inflation CPI	-3.39	24.67%	-0.67	6.63%	-0.58	4.55%	-0.32	3.49%
Unemployment	-1.20	8.74%	-1.22	12.03%	-1.20	9.45%	-1.96	21.27%
Import to Export	-1.12	8.11%			-0.97	7.64%	-1.18	12.80%
Openness	1.15	8.40%	0.90	8.85%				
REER Growth	0.62	4.49%						
Gov. gross debt	-1.90	13.81%	-2.75	27.07%	-2.42	19.13%	-1.98	21.51%
Voice & accountability	3.07	22.34%	1.82	17.89%	1.92	15.21%	1.21	13.08%
EU membership	1.30	9.43%	1.21	11.90%	1.51	11.95%	0.48	5.19%
EMU membership			1.59	15.62%	4.05	32.06%	2.09	22.66%

Source: authors' calculations

In linear model it was the gross government debt that was of greatest importance. Here, in ordered probit it also appears, quite expectedly, in each agency. And at the same time it has non-linear effect on rating since it is its squared term that proved to be significant in all models. But its relative weight differs substantially, reaching about 13% in Moody's model, whereas in Fitch and R&I it is about 20%. Its impact is the highest in S&P model, slightly over 27%.

Voice and accountability is yet another explanatory variable from the initial set that is statistically and economically significant in all models. Again, it is something that is to be expected considering the fact that rating agencies must take into account the general socio-political situation in the country, as well. It is, of course not just voice and accountability that the agencies are looking at, but this variable is the representative of all other proxies for governance because of their high mutual correlation. Regarding the magnitude of its effect, its influence seems to be balanced in all rating agencies, ranging from 13% in R&I to over 22% in Moody's.

Lastly looking at the real impact of the dummy variables capturing the impact of EU and EMU membership on rating, the former one appears in all the agencies while the latter in three them. Their cumulative influence is highly unbalanced across the agencies – while in Moody's it is does not reach 10%, in Fitch it is over 44%. All in all we can say that even though the rating agencies are looking very much at the same set of explanatory variables, they give them different weights.

4 Conclusions

In this paper we used ordered probit approach to identify the sovereign credit rating determinants. The sample covered Visegrad Four countries in the period 1993 to 2012 and the rating from four rating agencies – Moody's, S&P, Fitch and R&I. Concerning the rating determinants, the ordered probit approach does not significantly change the results of the linear model. GDP growth, unlike in the majority of empirical studies on rating determinants, did not prove to be the significant rating determinant. There were five variables important in each model – inflation, unemployment, government debt, voice and accountability score and EU dummy. Regarding the weights of the respective variables, the results differed, sometimes significantly, from the linear model. The inclusion of fixed effects was warranted just in the case of R&I. The signs and values of these effects corresponded to the results of linear model.

The significant difference from the linear model is that the ordered probit approach relaxes the assumption of equal rating categories' size (but does not exclude this possibility either). We tested it using the formal statistical test but this hypothesis was

rejected in all agencies suggesting the ordered probit to be the preferred option to the linear model from this viewpoint. At the same time we did not detect any pattern there. However, there are other important facts to consider when deciding between the two techniques. Technically, the ordered probit model requires the fulfilment of the parallel regressions assumption. This assumption cannot be tested in out dataset because of the insufficient number of observations in some of the rating categories. At the same time the small sample properties of ordered probit is often discussed in the literature. Thus even though from some points of view the ordered probit seems to be more attractive than the linear model approach and at the same time it is an important way to confirm the results of the linear model, in our dataset we consider the linear model to be the generally more appropriate.

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Prediction of Agricultural Enterprises Distress Using Data Envelopment Analysis

Tatiana Bányiová[1], Tatiana Bieliková[2], Andrea Piterková[3]

[1] Slovak University of Agriculture in Nitra
Faculty of Economics and Management, Department of Statistics and Operational Research
Tr. Andreja Hlinku 2, 949 01 Nitra, Slovak Republic
E-mail: xbanyiovat@uniag.sk

[2] Matej Bel University in Banská Bystrica
Faculty of Economics, Department of Quantitative Methods and Information Systems
Tajovského 10, 975 90 Banská Bystrica, Slovak Republic
E-mail: tatiana.bielikova@umb.sk

[3] Slovak University of Agriculture in Nitra
Faculty of Economics and Management, Department of Finance
Tr. Andreja Hlinku 2, 949 01 Nitra, Slovak Republic
E-mail: xpiterkovaa@uniag.sk

Abstract: *The question of predicting the corporate financial distress has critical importance for all stakeholders. It is one of reasons, why the widespread attention in financial disciplines for this topic has been paid. Uncertainty and specificity of the current business environment in agriculture sector, as well as the rising criticism of well-known techniques, caused a tendency to test new approaches in corporate failure prediction. This paper focuses on a relatively new approach Data Envelopment Analysis (DEA), which is typically used to assess the efficiency of decision-making units. The main purpose of this paper is to employ alternative DEA approach for corporate failure prediction. Analysis is applied on financial data for Slovak enterprises from the agriculture sector. The selection of appropriate financial ratios is based on the relevant literature and refers to the key ratios of bankruptcy models specified for agriculture enterprises. Our findings demonstrate aspects of application alternative DEA approach as a corporate prediction tool, and the ways of identification enterprises with high chance of potential bankruptcy. The article also offers several potential areas for the further analysis.*

Keywords: agricultural enterprises, corporate distress, DEA, prediction

JEL codes: C02, C14, G30

1 Introduction

Historically, the oldest company´s objective is the profit maximization. The trend of increasing orientation to individual interest groups of business entity caused a continual transition from profit maximization objective to long-term value creation for the owners, and consequently also for other stakeholders. Regardless the choice of company´s primary objective, its meeting is conditioned by achieving prosperity and financial health of the company. Responses of the global economic crisis, dynamics and uncertainty of the economic environment, globalization of trade and liberalization policies, combined with Common Agriculture Policy implementation resulted into special requirements on the management of agricultural companies in terms of ensuring adequate financial situation. Therefore, the need for quality and permanent evaluation of the financial health of farms has been emphasized, as well as the need to develop models indicating symptoms of financial distress of agricultural entities.

Tool for evaluation and prediction of the financial situation of companies provide quantitative methods that offer a wide range of instruments. Historical background in predicting bankruptcy of company, based on the quantitative methods, represent statistical methods discriminant analysis and logistic regression. With the use of the discriminant analysis were constructed several accepted models such as Altman Z-score model, Taffler model and others. One of the first authors who dealt with the application of logistic regression in evaluation of the company´s financial health was James Ohlson.

The innovator, in creation the integrated model for agricultural sector, which forecasts the development of financial situation of agriculture company using multivariate discriminant analysis, has become Chrastinová (1998). Model, which allows differentiate the agricultural companies into prosperous and unprosperous was introduced by Gurčík (2002). The G-index construction resulted from the previous works of the Altman Z-score, Bonity Index and CH-index. The discussion about the correctness of the use of classical statistical methods to predict the financial distress of the company can be found in the papers of Kameníková (2005) and Úradníček (2013), which focused mainly on failures in application Altman´s methodology on Slovak business environment. To overcome the shortcomings of traditional methods and develop the predicting ability in models has been trying innovative techniques, which play a key role to this issue. The innovative techniques can include artificial intelligence models that focus on examining the symptoms of financial difficulties and a group of theoretical models, which are primarily focused on their causes. The artificial intelligence models consist of decision trees, support vector machines, different types of neural networks and others.

The presented paper deals with the relatively new approach in the field, the Data Envelopment Analysis (DEA). For predicting bankruptcy of company used non-parametric DEA approach several foreign authors. Methods of application of DEA modelling in predicting company´s distress can be broadly divided into two approaches. The first is the use of DEA in the first step of the process of predicting, the DEA acts as a tool for the creation of predictive variable. The second approach is application of DEA as a separate classification, respectively predicting technique. The predictive variable, efficiency score, used authors Xu and Wang (2009) with objective to predict the financial bankruptcy of enterprises from Shanghai Stock Exchange. The first step of this methodology is to calculate the score of efficiency in its original sense. For this aim was determined CCR model which, according to the assumption of constant returns to scale, can be regarded as a shortcoming of this study. The next step involves the application of classical techniques, as a support vector machines, logistic regression and discriminant analysis, when the efficiency scores, along with other financial indicators is used as a predictor. In the above mentioned study, the inclusion of efficiency score to each model led to the lower misclassification. Another possibility is the application of DEA as a separate prediction method, respectively as part of a combination of different methods. In the paper of Ferus (2010) was applied DEA analysis to create a predicting model of risk of insolvency in building companies. With the objective to simplify the classification process of companies in practice and minimize misclassification of selected DEA approach, the author approximates DEA score using linear regression. The final conclusion of the study is the comparability of the classification accuracy of this methodology with discriminant analysis and logistic regression. Significant proposal for solving this problematic provides Premachandra et al. (2011). The proposed approach combines classical philosophy of the efficiency frontier and philosophy of inverse DEA. The resulting two scores are aggregated, which enables to define discriminant index for classifying bankrupt and healthy companies. In the research of Premachandra et al. (2011) continued Araghi and Makvandi (2013), who according to the mentioned methodology built a discriminant index and subsequently used it as a predictor in the logistic regression. Vavřina et al. (2013) in their study focuses on comparison of Altman Z-score, logistic regression, the production function approach, and the additive DEA model in the classification of companies in bankruptcy for a specific agricultural sector. The selection of input and output was performed by philosophy of negative DEA, which is used in formation of so-called "bankruptcy frontier". The value of the overall correct classification of constructed DEA model exceeds other compared approaches. From the previous available results of foreign studies can be DEA considered as a controversial tool for the prediction of bankruptcy. However, since there is logic relation of inefficiency with existential problems of companies, as well as the many advantages of this technique, it is appropriate to continue in examining this issue. The main objective of the presented paper is applying the DEA method to predict financial distress of Slovak agricultural companies.

2 Methodology and Data

DEA represents a technique included within the group of mathematical methods, which applies linear programming methodology. The objective of the initial proposal of DEA is its use in measuring the efficiency of the decision making units within the analysed group of homogeneous subjects. The basic philosophy of this approach is the calculation of the technical efficiency of decision making units, which is understood as a percentage of successfully transformed inputs to outputs. Historically the first models which formed the basis for the further development of DEA models are CCR and BCC model. The complications when constructing the basic models can be caused by the requirement to select input or output orientation of model. Potential problems with the choice of model orientation are solved by additive model (ADD) that combines both orientations. Commonly used models are supplemented by so-called SBM model, based on the slacks, which is an extension of the ADD model. A complete overview of DEA models can be found in Cooper et al. (2011). With the objective to predict financial failure of Slovak agribusinesses by DEA approach we decided to employ ADD model, which evaluate oth decision making unit as follows:

$$\max \quad \mathbf{es}^{-} + \mathbf{es}^{+} \tag{1}$$

$$\text{subject to} \quad \mathbf{X}\lambda + \mathbf{s}^{-} = \mathbf{x}_{\mathbf{o}} \tag{2}$$

$$\mathbf{Y}\lambda - \mathbf{s}^{+} = \mathbf{y}_{\mathbf{o}} \tag{3}$$

$$\mathbf{e}\boldsymbol{\lambda} = 1 \tag{4}$$

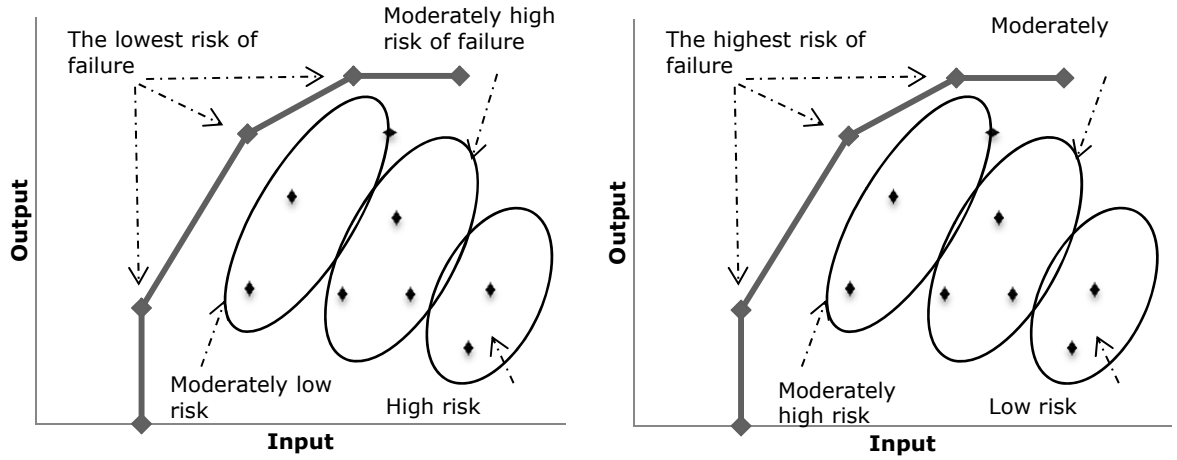
$$\boldsymbol{\lambda} \geq \mathbf{0}, \mathbf{s}^{-} \geq \mathbf{0}, \mathbf{s}^{+} \geq \mathbf{0} \tag{5}$$

where e is a row vector with all elements equal to 1, s^{-} is a vector of input slacks, s^{+} is a vector of output slacks, X is matrix of inputs, Y is matrix of outputs, λ is an intensity variable vector connecting inputs and outputs, x_o is a column vector of inputs of the oth decision making unit, and y_o is a column vector of outputs of the oth decision making unit. Additive model was chosen because it allows negative values of input and output variables. This characteristic is extremely welcome especially in financial failure assessment where we meet with several variables, which reach negative values. Applied additive model assumes variable returns to scale, because of imperfect competition in which agricultural enterprises do not act on the level of the optimum range. Solution of the ADD model is represented by values of excess on side of inputs s^{-} and shortfalls on side of outputs s^{+}. The final classification of firms into groups of failed and healthy is based on whether all the slacks are zero on optimality of the DEA model.

The basic concepts of DEA formulation, in predicting the financial distress, differ mainly in the frontier construction and definition of inputs and outputs. The first concept is based on the traditional approach of frontier, which in the predicting distress models can be called also success frontier. In DEA models the efficiency frontier consists of the units, which have been identified as the most effective. Taking into account the traditional perception of the DEA, in predicting financial distress, the success frontier will be created by business entities with the minimal risk of failure compared to other entities in the sample. Businesses out of the frontier are then considered to have a worse financial situation and a higher risk of problems. Outputs are defined as those variables that contribute to the success of the company and in the mathematical optimization are maximized. The second concept is less used, and its conception of the frontier significantly differs from the first one. The frontier may be called in this case a failure frontier, since it consists of business entities with the highest risk of failure. For the selection of variables to construct the following defined frontier are existing two approaches called negative and inverse DEA. Inverse DEA represents a single swapping of inputs and outputs of any other DEA analysis. The aim of negative DEA is to place enterprises with financial problem on, or near to the empirical frontier of failure. The way to meet the objective is to define outputs as variables, which maximizing leads to

distress of company. The inputs are then defined as those variables, which low level reflects the distress of company. In comparison to the inverse DEA, it is not only the simple replacement of inputs for outputs, and vice versa. The concepts of construction of DEA frontier, used to classify business entities according to their riskiness is shown in Figure 1.

Figure 1 DEA success frontier (left) a failure frontier (right)



Source: Own processing according Kingyens (2012)

In the present paper, we have decided to construct four models that differentiate by frontier concept and choice of inputs and outputs. Table 1 summarizes aspects of created models. Respecting the data availability, the final data set in Model 1 and Model 2 is based on financial ratios used in Premachandra et al. (2009). Model 1 represents negative DEA, where companies with financial problems are placed on the frontier. The success frontier in Model 2 is created by simply swapping input and output variables from the first model. Model 3 incorporates subjectively selected financial indicators in the absolute form. Last model is inversed to previously mentioned model.

Table 1 Summary of models

	Frontier concept	Input variables	Output variables
Model 1	Negative	CFTA=Cash Flow/Total Assets; NITA=Net Income/Total Assets; WCTA=Working Capital/Total Assets; CATA=Current Assets/Total Assets; EBTA=Earnings before taxes/Total Assets;	TDTA=Total debts/Total Assets; CLTA=Current Liabilities/Total Assets
Model 2	Traditional	TDTA=Total debts/Total Assets; CLTA=Current Liabilities/Total Assets	CFTA=Cash Flow/Total Assets; NITA=Net Income/Total Assets; WCTA=Working Capital/Total Assets; CATA=Current Assets/Total Assets; EBTA=Earnings before taxes/Total Assets;
Model 3	Negative	Working Capital; Cash Flow; Retained Earnings; Earnings before taxes	Current Liabilities; Total Debts; Interest Expense
Model 4	Traditional	Current Liabilities; Total Debts; Interest Expense	Working Capital; Cash Flow; Retained Earnings; Earnings before taxes

Source: Own processing

The method was applied to the dataset of Slovak agricultural companies, obtained from the Ministry of Agriculture and Rural Development of the Slovak Republic, processed in the internal dataset of the Department of Finance of the Slovak University of Agriculture in Nitra. The companies with particular unavailable data which were necessary for the calculation of variables had to be excluded from the data sample. For prediction of Slovak agribusinesses distress in a one-year time horizon we identified 43 companies, that in year 2011 had the value of liabilities exceeding the value of assets, it means with negative equity. The failure criterion of negative equity is stated in the legislation of the Slovak Republic (Regulation no. 7/2005 Coll. – Act on Bankruptcy and Restructuring). For a healthy company were considered all the remaining companies, that also achieve best available value in the indicator ROA. In our analysis the balance sample approach was used, in order to select the same number of healthy and failed entities. After the detection the sample of 43 healthy (assigned by number 1) and 43 failed companies (assigned by number 0) was generated. Since the models are used to predict financial failure, all variables are calculated at the end of the fiscal year immediately preceding the year of failure.

3 Results and Discussion

Due to the need for a detailed analysis of the agricultural enterprises included in the group of companies in distress and the group of healthy companies, we chose the additional characteristics that were part of the statements. However, they were on a voluntary basis and therefore were not filled in more enterprises. Despite this fact we can conclude generalized conclusions based on the characteristics of farms to one of the groups. In view of the legal form to a group of farms in distress was classified higher proportion of cooperatives, than in the healthy enterprises, where are dominated the trading companies. A decreasing trend of number of cooperatives can be observed in the Slovak Republic. Contrary, we observe an increase in the number of trading companies that operated the highest part of agricultural land among other subjects. Healthy subjects had lower number of employees as in the farms in financial distress. Healthy companies are thus loaded by lower labor costs than farms in distress. Healthy enterprises are characterized by a smaller number of owners. This follows from a majority of the companies that have a lower number of owners compared to cooperatives. Healthy companies were more indebted, which demonstrates their higher economic credibility to banks in terms of making a profit, and thus especially longer repayment of long-term loans not covered by the supports from the European Union. On the contrary, by the investment support is necessary the own co-financing. In terms of studies on crop and livestock production were demonstrably higher revenues from the crop production per hectare in the group of healthy enterprises, which also operated the higher amount of agricultural land. Financially healthy firms focused their crop production mainly on the production of cereals and oilseeds. Farms focused on crop production receive higher subsidies from the European Union due to the higher utilized agricultural land and growing subsidized crops. This implies a higher profitability of crop enterprises respect to the less attractive and less financially supported livestock sector. Approximately one third of healthy enterprises also deal with livestock production. Farms in financial distress have focused on the livestock production dominated by the pig and sheep-farming.

After identification and detailed analysis of agricultural companies in distress we can compare results of four suggested models. The complex evaluation of created models can be found in Table 2. Evaluation was conducted on the basis of three performance levels of model: total accuracy, correctly predicted healthy companies and correctly predicted failed companies. Model 1 is based on financial ratios and the frontier contains companies in distress, while healthy firms are in failure possibility set. In this model, firm is on the failure frontier if all its slacks from DEA results are zero. If there is at least one slack positive company is considered to be healthy. Percentage of the healthy companies that have been wrongly classified as failed by Model 1 is 4.65 %. On the other hand,

percentage of companies in distress that have been wrongly classified as healthy is more than 55 %.

Table 2 The comparison of models´ prediction ability

	Correctly predicted healthy firms	Correctly predicted failed firms	Total Accuracy
Model 1	95.35 %	44.19 %	69.77 %
Model 2	18.60 %	90.70 %	54.65 %
Model 3	90.70 %	32.56 %	61.63 %
Model 4	18.60 %	90.70 %	54.65 %

Source: Own processing

Model 2, which is inversed to previously mentioned model, puts on frontier healthy companies. The decision whether the firm is healthy or failed is also made on the basis of slacks values. Since this is a traditional concept of frontier, the company is identified as healthy in the case when it reaches zero slacks. Percentage of correctly predicted failed firms by this model is 90.70 %. However, its overall accuracy is lower in comparison with first model, because of only 18.60 % accuracy in prediction of healthy firms. The same prediction ability achieves also Model 4. Percentage of companies in distress that have been wrongly classified as healthy by third model is more than 67 %, which we consider very insufficient prediction ability. An analysis of the prediction accuracy shows that the choice between models is contingent upon user preferences. We consider more important the correct classification of failed companies, in order to eliminate the risk and provide the ability for agriculture companies to undertake the necessary steps in time. In Table 2 we can also notice the connection between the accuracy and the selected frontier concept. In the case of the traditional perception of frontier, DEA models achieve higher prediction accuracy of companies in distress. On the other hand, higher accuracy of healthy companies prediction achieve models, that are based on the negative DEA. Our further investigation also confirmed the dependence of the accuracy on the number of inputs and outputs. The more variables enter into the process of solving the DEA, the prediction accuracy is better.

For the interpretation of the results from the above-described additive DEA model, we chose the Model 4, since the latter has reached better prediction ability and also assuming its better interpretability compared using a Model 2, which have been applied the financial ratios. The outputs from the additive DEA model are slacks, which are the recommendations for the farms to become healthy. On the input side we see most weaknesses in the group of enterprises in financial distress in the heading of the total debt, which should be reduced to become healthy. Lowest deficiencies on the input side in financial distress companies are in interest expenses, when the changes are recommended for around half of the farms. On the output side have farms in financial distress largest slacks in activities in the item of cash flow, which are recommended for the highest increase. Similarly, we could interpret the remaining slacks on the side of outputs. Wrongly classified farms using predictive DEA methods that were incorrectly included in a group of healthy enterprises are characterized by a high amount of working capital and cash flow. Higher percentage of incorrectly classified enterprises was in a group of financially healthy enterprises that DEA method incorrectly classified to a group of unhealthy companies. For these enterprises is recommended for the input side the reduction of the total debt. On the output side, should these enterprises increase the amount of retained earnings and working capital.

4 Conclusions

The results of this study are determined by the criterion of enterprise characteristics in financial distress by the failure criterion of negative equity, which is stated in the legislation of the Slovak Republic. This criterion could be modified to the criterion, when the company in financial distress will be considered to be those, which made on several

consecutive years of negative profit. In the agricultural sector, it is difficult to determine which of the cancelled agricultural subjects were cancelled due to the lack of financial resources and their bankruptcy and which agricultural entities have undergone the transformation from the cooperatives to the trading companies and other changes. For this reason, the cancelled entities are not those, who actually went to bankrupt of the financial situation. The extension of the used method could be a choice of other input and output variables, thereby but we do not expect a better predictive ability of DEA models. This study is a response to the efforts of several authors, whose aim was to compare results of the prediction ability of DEA method with other prediction techniques. The results of this analysis were not run into the satisfactory conclusions.

The present study shows unsatisfactory prediction ability of the DEA models, because by using normal and negative DEA, the businesses achieve one of the percentages correctly classified subjects of less than 50 %. This study follows on our previous study, which dealt with creating the predictive models based on three prediction techniques, namely discriminant analysis, logistic regression and decision trees. Thus we can conclude better prediction power of the financial health of the farms using quantitative methods such as logistic regression, discriminant analysis and decision trees. The extension of the study can be seen in the use of other innovative evaluation methods of the financial such as neural networks and support vector machines. The results of each method will be compared to select the best technique in the evaluation of the financial health of Slovak agricultural sector.

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Zákon 348/2011 Z. z., ktorým sa mení a dopĺňa zákon č. 7/2005 Z. z. o konkurze a reštrukturalizácii a o zmene a doplnení niektorých zákonov v znení neskorších predpisov a o zmene a doplnení niektorých zákonov.

Applications of Grey Models in the Analysis of Financial Time Series. The Forex Market Example.

Stanisław Barczak

University of Economics in Katowice
Faculty of Finance and Insurance, Department of Applied Mathematics
Gen. K. Pułaskiego 25, 40-276 Katowice, Poland
E-mail: stanislaw.barczak@ue.katowice.pl

Abstract: *Gray models represent a class of models that allows forecasting processes using incomplete information. This article will present a gray model GM (1,1) and its modification in the form of a rolling model GM (1,1). For the lower level advantages of the gray models is the possibility of their use for very short time series for which it is impossible to estimate the basic parameters as well as the identification of the probability distribution. In order to improve the goodness of the forecasts presented in the article will be rolling model that can be used for time series with a large number of implementation. Models will be presented to be on the basis of data from the Forex market.*

Keywords: econometrics, grey models, time series, smoothing

JEL codes: C1, C2, C32, C5

1 Introduction to the Class of GM(1,1) Models

The main aim of this article is to compare the classical time series models with grey models in terms of quality of forecasts. In this article author will compare some kind of time series models. The classical adaptive models: Brown and Holt smoothing and grey models: GM(1,1) model and GM(1,1) rolling model. It is assumed that the forecasts will be similar for all presented models. First, consider the assumptions of grey models.

The equation of whitening process (image process) is given as (Sifeng et al., 2010), (Yu et al., 2012):

$$\frac{dx^{(1)}}{dt} + ax^{(1)} = b \tag{1}$$

where:

a - development coefficient. The sign of this coefficient is negative,

b - grey action quantity coefficient.

Let $X^{(0)} = \left(x^{(0)}(1), x^{(0)}(2), \ldots, x^{(0)}(n)\right)$ be a raw vector of observable variable realization. The accumulating generation operator (AGO) is $X^{(1)} = \left(x^{(1)}(1), x^{(1)}(2), \ldots, x^{(1)}(n)\right)$. The original form of GM(1,1) model can be written as:

$$x^{(0)}(k) + ax^{(1)}(k) = b, \quad k = 1, \ldots, n \tag{2}$$

where:

a, b - coefficients of the model,

GM(1,1) – first order grey model with one variable.

By using the formula (2) can be obtained a so-called *basic* form of the GM(1,1) model. Hence the basic form of the GM(1,1) model is given by:

$$x^{(0)}(k) + az^{(1)}(k) = b \tag{3}$$

where:

$Z^{(1)} = \left(z^{(1)}(1), z^{(1)}(2), \ldots, z^{(1)}(n)\right)$ - this is the series of moving averages obtained from variable $X^{(1)}$.

Hence, variable $Z^{(1)}$ is given as:

$$z^{(1)}(k) = \frac{1}{2}\left(x^{(1)}(k) + x^{(1)}(k-1)\right),\ k = 1, \ldots, n \tag{4}$$

Hence, ultimately the basic form of GM(1,1) is given as:

$$x^{(0)}(k) + az^{(1)}(k) = b,\ k = 1, \ldots, n \tag{5}$$

The $X^{(0)}$ variable is non-negative. The coefficients of the model (5) can be estimated using the least squares method. Therefore, we have:

$$\hat{\mathbf{a}} = \left(\mathbf{B}'\mathbf{B}\right)^{-1}\mathbf{B}'\mathbf{Y} \tag{6}$$

where:

$$\mathbf{Y} = \begin{bmatrix} x^{(0)}(2) \\ x^{(0)}(3) \\ \vdots \\ x^{(0)}(n) \end{bmatrix} \quad \mathbf{B} = \begin{bmatrix} -z^{(1)}(2) & 1 \\ -z^{(1)}(3) & 1 \\ \vdots & \vdots \\ -z^{(1)}(n) & 1 \end{bmatrix} \tag{7}$$

The time response is given as a solution of equation (1). What can be written as:

$$\hat{X}^{(1)}(k+1) = \left(X^{(0)}(1) - \frac{b}{a}\right)e^{-ak} + \frac{b}{a},\ k = 1, 2, \ldots, n \tag{8}$$

Thus, the theoretical values are as:

$$\hat{x}^{(0)}(k+1) = \alpha^{(1)}\hat{x}^{(1)}(k+1) = \hat{x}^{(1)}(k+1) - \hat{x}^{(1)}(k) = \left(1 - e^{a}\right)\left(x^{(0)}(1) - \frac{b}{a}\right)e^{-ak} \tag{9}$$

for $k = 1, 2, \ldots, n$.

The applicability of GM(1,1) model (Wen et al., 2005):

- Applied to the short time series. Theoretically time series has a minimum two observations ($k \geq 2$),
- A short-term forecasts,
- The construction of forecasts in condition of incomplete information,
- No need to make assumptions regarding to forecasted variable distribution.

Advantages and disadvantages of GM(1,1) model (Barczak, 2013):

- The possibility of modeling under conditions of incomplete information – the grey information,
- Easy of calculation,
- Model validation process based on the well-know standard assumptions,
- Model can be used only for the specified variable – only positive realizations of forecasted variable,
- Assumptions about the random component of the model cannot be applied,
- Model verification must be carried out very carefully,
- Rating predictions based solely on the *ex post* errors.

In general, the concept of econometric modeling based on grey information systems is assumed that the information about the system can be fully known – white information, there may be limited – grey information or completely unknown – black information. The

idea of grey modeling, which is based on the investigation to the real variable values – whitening process. For example equation (1) in GM(1,1) model. The theory of grey information systems was established in China in 1982. Its creator was Julong Deng. In general, the extended form of GM(1,1) model is a model GM(1,N). Model GM(1,N) uses a number of explanatory variables in the conditions of limited information (short time series). This model is an alternative to multivariate regression model.

2 Modification of GM(1,1) Model – Rolling GM(1,1) Model

Classical time series models assume high number realizations of forecasted variable (Tsay, 2010). In practice, used long time series representing prices which is often expressed as a rate of returns. It is easy, to ask whether the construction of the forecasts, it is necessary to use long time series? The forecast based on short time series is qualitatively the same as in long time series – greater or equal 40 realizations (Greene, 2000)? Obviously, in this case, the structure and distribution of forecasted variable must be omitted – for example: the distribution of the prices or returns.

The rolling GM(1,1) model assumes the use of long time series for the construction of the forecast. First about prices, it is assumed that there are positive (the main assumption for the applicability of the model class GM). Secondly, you should take a period of the model GM(1,1). The period of the model is a window to create intermediate and main forecasts.

Model GM(1,1) has the property that increasing the number of observations increases forecast error. Must therefore be very careful when selecting the number of observations in GM(1,1) model. In other words, the number of observation used in the model GM(1,1) is the width of the window under which the forecast is generated.

Generally the rolling model GM(1,1) can be written as:

$$\hat{x}_t^{(0)} = \underset{i=t-k}{GM}^{t-1}(1,1) \tag{10}$$

where:

$\hat{x}^{(0)}$ - predicted value (raw vector) at the moment i,

k - smoothing parameter.

Model calculations include the following steps:

- Determining the main time series (raw vector) with T number of observations,
- Determining the width of window k – the number of observations which are used to estimate the model,

Evaluation of the quality is a result of indirect assessments of forecasts through the prism of arbitrarily chosen *ex post* forecast error. In order to increase the accuracy of forecasts by successive approximations should chose the width of the model GM(1,1).

Advantages of rolling GM(1,1) model:

- The possibility of applying the GM(1,1) model for smoothing long time series,
- Ability to conduct a simple simulation due to the choice of window width,
- There is no need to study the probability distribution of the variable forecasted,
- Short calculation time,

Weaknesses of the rolling GM(1,1) model:

- Limited the possibility of applying classical measures to evaluate the properties of the indirect models,
- It is possible to build only short-term forecasts (horizon of forecast is equal one),
- Lack of application *ex ante* errors to assess quality of forecasts.

GM(1,1) rolling model can in certain circumstances constitute one of the many methods of smoothing time series and determining the short-term forecasts.

3 Selected Alternative Models

Like the GM(1,1) model, an adaptive models are easy to build. From the applicability point of view the adaptive model can be used for:

- Short time series (but longer than GM(1,1) model. Minimum T=8),
- Short-term forecasts.

Characteristics of adaptive models:

- No analytical form,
- This is the group of mechanical models,
- Quality of the model predictions is determined by the smoothing parameter or parameters,
- Assessment of the quality forecasts indicate only the ex post errors.

In the article will be used two adaptive models: a model of exponential smoothing – Brown's model and Holt's model. Main equation of Brown model can be written as (Dittmann, 2003):

$$m_t = \alpha y_t + (1-\alpha) m_{t-1} \tag{11}$$

where:

m_t - assessment of the trend at the moment t,

y_t - realization of the forecasted variable at time t,

α - smoothing parameter: $0 \le \alpha \le 1$.

Prediction equation is given as:

$$y_t^* = m_t + (m_t - m_{t-1})h \tag{12}$$

Where:

h - is the forecast horizon.

Forecasts are obtained by the choice of the smoothing parameter α, which is achieved by minimizing any *ex post* forecast error.

Holt model equations can be written as (Dittmann, 2003):

$$F_{t-1} = \alpha y_{t-1} + (1-\alpha)(F_{t-2} + S_{t-2}) \tag{13}$$

$$S_{t-1} = \beta(F_{t-1} - F_{t-2}) + (1-\beta)S_{t-2} \tag{14}$$

where:

F_t - is the trend at the moment t,

S_t - is the smoothed value of the trend growth at the moment t,

α, β - smoothing parameters: $0 \le \alpha \le 1$, $0 \le \beta \le 1$,

y_t - realization of forecasted variable at time t.

Prediction equation is given as:

$$y_t^* = F_n + (t-n)S_n \tag{15}$$

where:

$t-n$ - forecast horizon: $t > n$.

The rule of forecasting is similar to Brown model. It is necessary to minimize any chosen *ex post* error. In the case of both models is important to choose the initial values for the simulation. In the case of Brown's model (equation 11) the initial value is determined as (Dittmann, 2003):

$$m_1 = y_1 \tag{16}$$

In the case of Holt's model, the initial values are determined as:

$$F_1 = y_1 \text{ and } S_1 = y_2 - y_1 \tag{17}$$

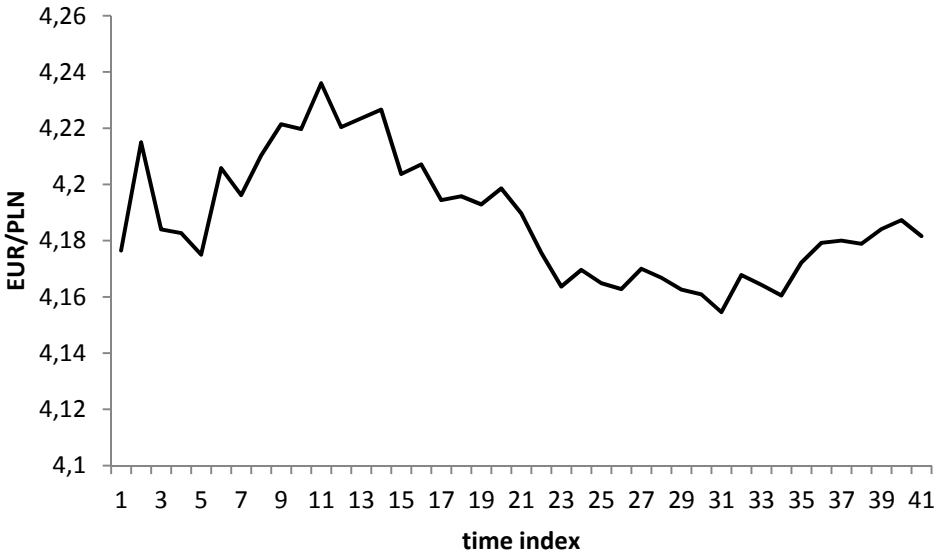
In the literature, the initial value can be determined by other methods.

4 Forex Example

In the analysis used data from the Forex market. The analysis following currency pairs: USD/PLN, EUR/PLN, EUR/USD and EUR/GBP. Data for individual pairs are daily closing quotations. It was assumed that the length of the main time series for each quotation is $T = 41$. An assumption results from the fact that the use of alternative models such as the Brown's model and Holt's model does not require long time series. This assumption stems from the fact that the use of long time series for the considered models does not improve the quality of forecasts. Data are from the period: 2014.03.02 – 2014.04.17.

Daily quotes from the Forex market is characterized by high levels of noise (Figure 1).

Figure 1 Quotes of pair EUR/PLN in the period 2014.03.02 – 2014.04.17



Source: own work

For the rest of time series of currency pairs is the similar as that in Figure 1 – noisy time series. To assess the quality of the forecasts used the Mean Square Error (MSE) and consequently Root Mean Square Error (RMSE). Forecast errors are as follows:

$$MSE = \frac{1}{m}\sum_{t=1}^{m}\varepsilon_t^2 \tag{18}$$

$$RMSE = \sqrt{MSE} \tag{19}$$

where:

m - verification period of forecasts,

$\varepsilon_t^2 = \left(y_t - y_t^*\right)^2$ - where: y_t - real value and y_t^* - theoretical value.

In the case of adaptive models and GM(1,1) model the first ex post forecast value is always perfect. In this case, the counting of ex post forecast error omitted the first difference between real and theoretical value. In this way, the forecast error was not artificially underestimated. The results of the analysis for selected currency pairs are presented in Table 1.

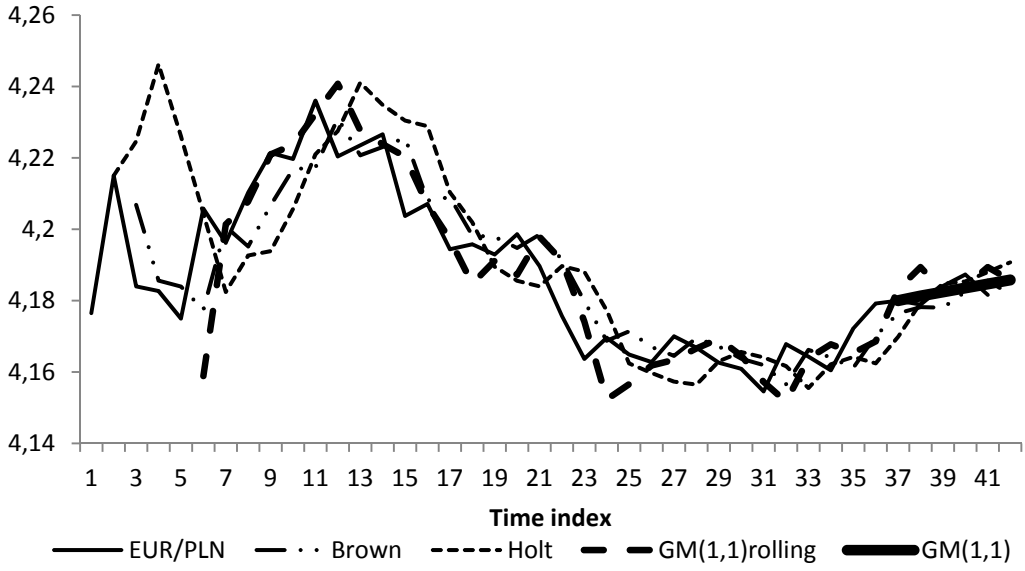
Table 1 The forecast results for future period: 2014.04.18 (T=42)

Currency pair	Characteristics	Brown	Holt	GM(1,1)	Rolling GM(1,1)
EUR/PLN	Forecast	4.1817	4.1907	4.1857	4.1857
	RMSE	0.0105	0.0189	0.0028	0.0115
USD/PLN	Forecast	3.0239	3.0357	3.0300	3.0300
	RMSE	0.0097	0.0217	0.0018	0.0114
EUR/USD	Forecast	1.3812	1.3798	1.3811	1.3811
	RMSE	0.0037	0.0075	0.0001	0.0048
EUR/GBP	Forecast	0.8223	0.8220	0.8205	0.8205
	RMSE	0.0023	0.0033	0.0006	0.0027

Source: own calculations

As is apparent from Table 1, the lowest forecast errors are obtained for GM(1,1) model. This does not mean in practice that the conventional GM(1,1) model is the best. It is easy to see that in the rolling model GM(1,1) forecast error is being built for a longer period of verification of predictions and probably reflects better change quotations for a given currency pair. In other words, the forecast based on rolling GM(1,1) model is loaded with bigger mistake which is conditioned by the long past. It is therefore natural that in conditions of limited information. The forecast error will not fully reflect the facts. It is also important that the models based on a larger number of observations do not achieve dramatically better results. Graphically, the results for the currency pair EUR/USD are presented in Figure 2.

Figure 2 EUR/PLN smoothing results



Source: own work

Obtained forecasts can be verified when they expire. The difference presents Table 2.

Table 2 Comparison of future period forecasts (T=42) and real values

Currency pair	Characteristics	Brown	Holt	GM(1,1)	Rolling GM(1,1)
EUR/PLN	Forecast	4.1817	4.1907	4.1857	4.1857
	Real value	4.1780	4.1780	4.1780	4.1780
	*Difference	-0.0037	0.0127	-0.0077	-0.0077
USD/PLN	Forecast	3.0239	3.0357	3.0300	3.0300
	Real value	3.0235	3.0235	3.0235	3.0235
	*Difference	-0.0004	-0.012	-0.0065	-0.0065
EUR/USD	Forecast	1.3812	1.3798	1.3811	1.3811
	Real value	1.3811	1.3811	1.3811	1.3811
	*Difference	-0.0001	0,0013	**0.0000**	**0.0000**
EUR/GBP	Forecast	0.8224	0.8224	0.8224	0.8224
	Real value	0.0023	0.0033	0.0006	0.0027
	*Difference	0.0001	0.0004	0.0019	0.0019

*Difference: real value – forecast value
Source: own calculation

As shown in Table 2 adaptive Brown's model and GM(1,1) models give the lowest differences between the real values and forecasts. Note, however, that market quotations of Forex significant differences appear in the third and fourth decimal places. Hence, it is difficult to say about the advantages of the grey models over alternative models. In this analysis, the most appropriate in view of the forecast error is a simple Brown model.

5 Conclusions

The analysis leads to the following conclusions:

- Grey models considered in terms of smoothing time series does not stand out significantly against the background of adaptive models,
- Forecasts obtained from grey models and adaptive models are comparable in quality,
- Forecasting results obtained on the basis of short time series are comparable to those obtained on the basis of forecasts of long time series.

In the future, it will be important to further develop:

- Methods of grey models specification,
- Methods of grey model verification,
- Development of grey models GM(1,n) with many explanatory variables,
- Improve the basis of grey mathematics,
- Improve the predictions processes basis on grey models.

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Health System's Financing Inequalities in Selected European Countries

Agnieszka Bem[1], Katarzyna Prędkiewicz[2], Paweł Prędkiewicz[3], Paulina Ucieklak-Jeż[4]

[1] Wroclaw University of Economics, International and Public Finance Department
Komandorska 118/120, 53-345 Wrocław, Poland
E-mail: agnieszka.bem@ue.wroc.pl

[2] Wroclaw University of Economics, Financial Management Department
Komandorska 118/120, 53-345 Wrocław, Poland
E-mail: katarzyna.predkiewicz@ue.wroc.pl

[3] Wroclaw University of Economics, Department of Finance
Komandorska 118/120, 53-345 Wrocław, Poland
E-mail: pawel.predkiewicz@ue.wroc.pl

[4] Jan Dlugosz University in Czestochowa, Faculty of Social Science
Waszyngtona 4/8, 42-200 Częstochowa, Poland
E-mail: p.ucieklak-jez@ajd.czest.pl

Abstract: *The most commonly used indicators of health status (e.g. life expectancy) generally measure only the average values, without taking into account the variability between sub-populations. The aim of the research is to examine the level of inequality in the distribution of the financial burden during the process of funds' collection and in access to benefits and health effects in the population. We have adopted the research hypothesis, that the disparities in the distribution of direct financing and health effects in the population is greater in post-socialist countries than in Western Europe. Several indicators for the analysis have been employed: the expected length of life, the standard deviation of the moment of death, the share of direct expenditure on health care in total consumption and barriers to access to health services. In research we have used data from Eurostat splitting the study group into Western Europe and the former communist countries. We have examined the significance of the differences between groups using Student's T-distribution.*

Keywords: health system, inequality

JEL codes: I10, I12, I31

1 Introduction

The World Health Organization defines the objectives of the health care system as (WHO 2000):

- improving the health status of the population,
- responding to the needs of citizens,
- providing financial protection against the expenses associated with the disease.

Improving the health status of the population can be understood in a literal way - the main objective of the system is to make people live longer and with smaller burden of diseases and disabilities. One should distinguish between two aspects of good health of the population: maximizing the potential to reach the average level of health in the population (goodness) and minimizing the differences between the health status of individuals or social groups (fairness). Responding to the needs of citizens means meeting the non-medical needs of patients, such as treatment with respect and subjectivity, ensuring confidentiality and equal treatment regardless of the socio-economic status (WHO 2000). Financial protection is achieved by minimizing the necessity to bear astronomical - from a patient's point of view - expenses due to illness or accident.

The literature of the subject indicates a significant correlation between the degree of social inequality and the level of health (Beckfield 2009, Kawachi 2002, van Doorslaer

2004, Mackenbach 2008). As far as health care is concerned, inequality can be divided into positive and normative. inequality in positive aspect is the variation in the health status, access to medical care (or other measures of health) among individuals or social groups. The normative aspect (referred to rather as inequity) is inequality, which is socially undesirable (de Looper 2009).

The change in the economic and social system, which occurred in the European countries belonging to the so-called 'Eastern bloc' in the late 80s and 90s of the twentieth century, caused a significant negative change in the protection of the health of citizens (Stuckler 2009, Nolte 2000, Watson 1995). The country, which used to provide a far-reaching package of social benefits for its residents, confined its activities in this field. Instead private healthcare started to bloom. These changes caused a significant variation in the access to health care (Nolte 2002, McKee 2004).

The purpose of this paper is to examine how much post-communist countries differ from the so-called Western European countries in the functioning of health care, particularly in terms of the inequality of financing health care by households.

The research hypothesis assumes, that there is a greater level of inequality in post-communist countries, demonstrated by the health status and a greater diversification of the financial burden imposed on society, resulting in barriers limiting access to health services for the poor. The research hypothesis has been verified by examining the indicators characterizing health care systems.

The subject of the study is financing health care by the private sector in selected countries and the diversification of health consequences in the population, especially among income groups. In research we have used data from Eurostat splitting the study group into Western Europe and the former communist countries. We have examined the significance of the differences between groups using Student's T-distribution.

2 Methodology and Data

The study group are European Union countries, which have been divided into two subgroups: A - countries that underwent political transformation in the last decade of the twentieth century, and B - the so-called Western European countries.

We have used indicators of health consequences (life expectancy for women LE F0 and men at birth LE M0, healthy life years (HLY) respectively for women (HLY F0) and men (HLY M0) and measures characterizing the method of financing health care by households:

- financing current health expenditures by private sector (PRIV_%CHE),
- the share of out-of-pocket payments in the private source of funds (OOP_%PRIV)
- share of out-of-pocket expenditure in the total current expenditure on health (OOP_%CHE),
- the share of health expenditure in total consumption for income quintiles (HE_Q1-5)
- financial barriers limiting access to health care in income groups (EXP_Q1-5).

The significance of differences in the degree of achievement of the health care system's objectives between groups has been tested using the Student's t-test. Authors used also Pearson's correlation coefficient. Data was obtained from Eurostat health databases (2011) and Household Budget Surveys (collection round 2005).

In order to verify the hypotheses we have conducted the correlation analysis, using Pearson correlation coefficient. This is a measure used to test the linear relationship between the measurable characteristics. In the paper we've used formula:

$$r_{xy} = \frac{\frac{1}{n} \cdot \sum_{i=1}^{n} (x_i - \bar{x}) \cdot (y_i - \bar{y})}{s_x \cdot s_y} \quad (1)$$

The Pearson correlation coefficient indicates both the direction and strength of the relationship. We have tested its significance, using the test of correlation's significance, assuming the following construction of research hypothesis:

H0: the correlation coefficient is insignificant statistically (null hypothesis);
H1: the correlation coefficient is statistically significant;

For which the test is statistic:

$$t_e = \frac{r}{\sqrt{1-r^2}}\sqrt{n-2} \quad (2)$$

that, assuming the validity of H0 has the T-Student distribution with n-2 degrees of freedom.

3 Results and Discussion

Our study have given the similar results to previous research outcomes (Bobak 1996). The population of the countries in group A has significantly worse health status than those in group B (Table 1).

Table 1 Health of population in European Union countries

Group A	LE F0	HLY F0	LE M0	HLY M0	Group B	LE F0	HLY F0	LE M0	HLY M0
Bulgaria	77.8	65.9	70.7	62.1	**Belgium**	83.3	63.6	78.0	63.4
Czech Republic	81.1	63.6	74.8	62.2	**Denmark**	81.9	59.4	77.8	63.6
Estonia	81.3	57.9	71.4	54.3	**Germany**	83.2	58.7	78.4	57.9
Croatia	80.4	61.8	73.8	59.9	**Ireland**	83.0	68.3	78.6	66.1
Latvia	78.8	56.6	68.6	53.7	**Greece**	83.6	66.9	78.0	66.2
Lithuania	79.3	62.0	68.1	57.0	**Spain**	85.6	65.8	79.5	65.4
Hungary	78.7	59.1	71.2	57.6	**France**	85.7	63.6	78.7	62.7
Poland	81.1	63.3	72.6	59.1	**Italy**	85.3	62.7	80.1	63.4
Romania	78.2	57.0	71.1	57.4	**Cyprus**	83.1	61.0	79.3	61.6
Slovenia	83.3	53.8	76.8	54.0	**Luxembourg**	83.6	67.1	78.5	65.8
Slovakia	79.8	52.3	72.3	52.1	**Malta**	83.0	70.7	78.6	70.3
					Netherlands	83.1	59.0	79.4	64.0
					Austria	83.8	60.3	78.3	59.8
					Portugal	83.8	58.6	77.3	60.7
					Finland	83.8	58.3	77.3	57.7
					Sweden	83.8	70.2	79.9	71.1
p-value	0.0%	2.0%	0.0%	0.0%	**United Kingdom**	83.0	65.2	79.0	65.2
Mean	80.0	59.4	71.9	57.2	**Mean**	83.7	63.5	78.6	63.8
S. dev.	1.6	4.3	2.5	3.4	**S. dev.**	1.0	4.2	0.8	3.7

Source: Own calculation based on Eurostat health database

The expected length of life in group A is statistically significantly lower than in the group B, in each of the analyzed variants of the indicator ('standard' life expectancy, healthy life years), and regardless of gender, the p-value is very low - less than 0.1% (except HLY F0). This relation can be explained, at least in part, by a lower GDP per capita in the countries from group A. However, our intention was to examine, whether in addition to the differences in the available financial resources measured by GDP, there are differences in the financing of health care from the perspective of natural persons.

Then scale and scope of health system financing by private sector has been separately tested in group A and B (Table 2).

Table 2 Health system financing

Group A	PRIV %CHE	OOP %CHE	OOP %PRIV	Group B	PRIV %CHE	OOP %CHE	OOP %PRIV
Bulgaria	43.8	42.6	97.4	**Belgium**	25.1	20.8	82.8
Czech Republic	17.9	16.1	90.1	**Denmark**	16.0	14.1	88.4
Estonia	21.5	20.5	95.2	**Germany**	23.1	12.6	54.4
Croatia	n.a	n.a	n.a	**Ireland**	n.a.	n.a.	n.a.
Latvia	39.6	37.3	94.3	**Greece**	n.a.	n.a.	n.a.
Lithuania	28.8	28.2	97.9	**Spain**	27.4	21.0	76.8
Hungary	33.4	26.4	79.0	**France**	22.5	7.9	34.8
Poland	28.3	24.4	86.2	**Italy**	n.a.	n.a.	n.a.
Romania	18.5	18.2	98.1	**Cyprus**	57.9	50.2	86.7
Slovenia	26.8	12.8	47.8	**Luxembourg**	17.6	13.7	77.8
Slovakia	29.5	26.1	88.6	**Malta**	n.a.	n.a.	n.a.
				Netherlands	15.0	6.6	44.2
				Austria	22.7	16.9	74.4
				Portugal	33.9	28.5	83.9
				Finland	25.7	20.1	78.2
				Sweden	18.4	17.2	93.3
p-value	43.8%	17.9%	5.7%	**United Kingdom**	n.a.	n.a.	n.a.
Mean	28.8	25.3	87.5	**Mean**	25.4	19.1	73.0
S. dev.	8.5	9.2	15.2	**S. dev.**	11.5	11.5	18.5

Source: Own calculation based on Eurostat health database

There are no significant differences in the scale of private sector in financing current health expenditure (PRIV_%CHE 28.8% versus 25.4% - p-value 22%). However, there is a noticeable difference between the two groups, if we consider only payments made directly by patients for the access to health care. The share of patients' out-of-pocket payments in the financing of current health expenditure (OOP_%CHE) is greater in countries from group A, but this difference is not statistically significant (25.3% versus 19.1%, p-value 17.9%). Even more visible is the analysis of the share of out-of-pocket payments in the private sector health expenditure (OOP_%PRIV 87.5% versus 73.0% p-value 5.7%). In the countries in group A, only 12.5% of private funds is allocated by means other than out-of-pocket payments, compared to 27% in group B. The average value of these two parameters in group A is largely due to Slovenia, which has developed a system of additional complementary private insurance, covering more than 90% of the population (Albreht 2009). If we exclude Slovenia from the analysis, the average value of the group A OOP_%PRIV increases to 91.9%, and OOP_%CHE to 26.7%, and the statistical significance of differences between groups also becomes more clear (p-value of 5.1% and 0.2%).

The increased financing of health expenditure by out-of-pocket payments can lead to unequal financial impositions in society, because this method of financing creates the greatest burden for people with lower incomes and poor health (Honekamp 2008). The analysis of the structure of household expenditure (Table 3) has revealed no significant differences between the two groups of countries. Households from group B spend more on health care in the first and the last income quintile, while in the middle quintiles the situation is reversed. These differences are not statistically significant (p-value in the range of 40-90%).

Table 3 The share of health expenditure in total household consumption in income quintiles [‰]

	HE_Q1	HE_Q2	HE_Q3	HE_Q4	HE_Q5
Group A	33.8	37.1	35.6	32.8	28.9
Group B	35.7	35.7	33.6	32.3	32.7
p-value	80%	83%	71%	91%	42%

Source: own calculation based on European Household Budget Survey round 2005.

During the next step we have analyzed the reported financial barriers in the access to medical services in income quintiles (Table 4).

Table 4 Self-reported unmet needs of medical examination by income quintile, reason: 'too expensive' EXP(%)

Group A	Q1	Q2	Q3	Q4	Q5	Group B	Q1	Q2	Q3	Q4	Q5
Bulgaria	18.3	8.5	4.4	3.1	1.1	**Belgium**	4.1	1.9	0.8	0.3	0.1
Czech Republic	1.0	0.7	0.2	0.3	0.3	**Denmark**	0.3	0.2	0.1	0.0	0.0
Estonia	2.5	0.8	0.7	0.6	0.3	**Germany**	3.3	0.8	0.3	0.3	0.1
Croatia	5.0	2.8	1.3	0.7	0.2	**Ireland**	1.8	1.8	2.0	1.7	0.4
Latvia	26.1	19.0	13.7	8.8	4.4	**Greece**	10	8.1	5.9	3.6	3.3
Lithuania	1.6	0.8	1.1	0.8	0.1	**Spain**	0.7	0.4	0.4	0.3	0.1
Hungary	5.7	2.0	2.0	0.9	0.4	**France**	4.9	2.3	1.4	0.5	0.5
Poland	6.1	4.4	3.3	2.2	1.0	**Italy**	11	6.5	4.3	2.6	0.8
Romania	14.1	13.8	11.6	9.9	4.8	**Cyprus**	6.3	6.1	4.9	2.7	0.8
Slovenia	0.2	0.0	0.0	0.0	0.0	**Luxembourg**	1.4	0.0	0.2	0.3	0.0
Slovakia	2.0	0.7	0.4	0.4	0.3	**Malta**	1.8	1.0	0.4	0.9	0.2
						Netherlands	0.2	0.3	0.0	0.1	0.0
						Austria	0.9	0.1	0.1	0.1	0.1
						Portugal	2.2	2.4	1.1	0.6	0.1
						Finland	0.1	0.1	0.0	0.0	0.0
						Sweden	1.1	0.4	0.4	0.2	0.0
p-value	9.9%	15%	15%	14%	17%	**United Kingdom**	0.0	0.1	0.1	0.1	0.0
Mean	7.5	4.9	3.5	2.5	1.2	**Mean**	3.0	1.9	1.3	0.8	0.4
S. dev.	8.4	6.3	4.7	3.5	1.7	**S. dev.**	3.4	2.5	1.9	1.1	0.8

Source: Own calculation based on Eurostat health database

Despite the fact, that in group A the average percentage of the population reporting the existence of barriers in the access to medical services is several times higher than in the other countries, this difference - with the exception of individuals with the lowest income (Q1) - cannot be regarded as statistically significant (p-value > 10%). When analyzing the barriers in the access to dental services, the results between groups are even more similar and the difference is not statistically significant either.

Contrary to our expectations, despite the significant differences in the use of out-of-pocket payments, there are no statistically significant difference in the access to health care. However, large absolute difference between the barriers in the countries from both groups, in particular in the first income quintile, suggests that there may be a relationship, which has not been demonstrated by examining the significance of differences in mean values of indicators.

We have also calculated the Pearson coefficients for correlations between the variables depicting the degree of use of private funds, especially out-of-pocket payments, in financing health expenditure, and financial barriers in the access to medical services

among low income earners (Table 5). There is a clear correlation between the financing of health expenditure using out-of-pocket payments and barriers in the access to medical services among the poor.

Table 5 The correlation between financial barriers in the access to medical services in the first income quintile and selected indicators related to the financing of health expenditure

	PRIV_%CHE	OOP_%CHE	OOP_%PRIV
All countries	0.49**	0.56***	0.34
Group A	0.61***	0.71***	0.40**
Group B	0.67***	0.51**	-0.15

* p-value<10% **p-value<5% *** p-value<1%
Source: own calculation based on Eurostat health database.

Next, we have analyzed correlation between financial barriers and life expectancy. The correlation was negative and moderate in group A and contrary to expectation positive but smaller for group B (Table 6).

Table 6 The correlation between financial barriers in the access to medical services in the income quintiles and life expectancy for women LE F0

	Q1	Q2	Q3	Q4	Q5
All countries	-0.50***	-0.46***	-0.46***	-0.49***	-0.43***
Group A	-0.66***	-0.59***	-0.57***	-0.57***	-0.52***
Group B	0.35***	0.21**	0.17**	0.10	0.10

* p-value<10% **p-value<5% *** p-value<1%
Source: own calculation based on Eurostat health database.

The research has given almost the same results for men (LE M0), with weaker correlation coefficient but also significant. Analyze of healthy life years give significant correlation only for whole group but much weaker (-0.3 – -0.1).

Another considered variable is the infant mortality rate, an indicator, that measures the level of health of the population and is often used to measure inequalities in the access to medical services and the health status. Countries in group A are characterized by higher infant mortality rate (5.15) than the rest (3.52) - the difference is statistically significant (p-value 3.1%). A statistically significant correlation is also observed between this indicator and financial barriers in the access to health care among the poor (correlation 0.64, p-value 0.04 %). This ratio is also significantly associated with the share of out-of-pocket payments in the current health expenditure in group A (correlation 0.55, p-value 10%).

4 Conclusions

Conducted studies confirmed, that post-communist countries have significantly lower level of health and life expectancy, whereas infant mortality ratio is higher. Simultaneously, they are also characterized by higher financial barriers and share of out-of-pocket payments, comparing to countries from group B. We have also proved that there is connection between healthcare level in population and financial access barriers to health service, what is particularly evident in the group A.

Countries that have undergone political transformation, should therefore continue reducing barriers in access to health care, but perhaps another decades would pass before the level of health in group A and B will reach a similar level. However, one country from group A - Slovenia – has a chance to catch up developed countries earlier - Slovenia is characterized by similar ratios of health as countries from group B and has one of the lowest financial barriers in the total population of the countries A and B.

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Hospital's Size as the Determinant of Financial Liquidity

Agnieszka Bem[1], Katarzyna Prędkiewicz[2], Paweł Prędkiewicz[3], Paulina Ucieklak-Jeż[4]

[1] Wroclaw University of Economics, International and Public Finance Department
Komandorska 118/120, 53-345 Wrocław, Poland
E-mail: agnieszka.bem@ue.wroc.pl

[2] Wroclaw University of Economics, Financial Management Department
Komandorska 118/120, 53-345 Wrocław, Poland
E-mail: katarzyna.predkiewicz@ue.wroc.pl

[3] Wroclaw University of Economics, Department of Finance
Komandorska 118/120, 53-345 Wrocław, Poland
E-mail: pawel.predkiewicz@ue.wroc.pl

[4] Jan Dlugosz University in Czestochowa, Faculty of Social Science
Waszyngtona 4/8, 42-200 Częstochowa, Poland
E-mail: p.ucieklak-jez@ajd.czest.pl

Abstract: *The purpose of the research is to identify the relationship between the size of the hospital, measured by annual revenue or number of beds, and current liquidity ratio. We've posed two research hypotheses, assuming, that financial liquidity should be lower for smaller hospitals that for larger ones. We have also hypothesized, that for the largest hospital this correlation should be negative. We've found, that there is a positive correlation between annual revenue and current liquidity ratio up to certain level (40.000.000 euro), then the correlation is negative. We couldn't prove the relationship between number of beds and current liquidity ratio. In the study we've use statistical tools - Pearson's correlation coefficient and T-Student's test.*

Keywords: financial liquidity, hospital, financial management

JEL codes: I10, I11, L31, G30

1 Introduction

In the health sector in Poland, strongly dominated by the public sector, the management is still focused on the production of health services. Issues related to financial management, including liquidity and solvency's management, are considered secondary. On the other hand, problems of liquidity or solvency's decline are quite common in polish hospitals. It seems to be, generally, tolerated by the hospital's owners (usually public entities), which support hospitals financially, preserving the inefficient structures.

Hospitals usually consitute the most important group of providers in the health care sector, due to high costs of inpatient treatment. Hospital's treatment in Poland consumes a significant part of the financial resources - in 2014 about 27 billion PLN - 43% of the National Health Fund budget (Narodowy Fundusz Zdrowia, 2013), which is the dominate source of financing. At the same time, the hospitals' debt in 2013 reached to 10 billion zlotys (Ministerstwo Zdrowia, 2013), and almost daily, media reports the financial problems of next medical institutions. That's shows the importance of research on financial management in hospitals.

It is also important to note, that hospitals cannot be seen as any other company, and profits can't be seen as primary purpose of activity. Especially for public hospitals, the objectives can't have only a monetary dimension (Nowicki, 2008, p.4), and its mission must be focused on lifesaving decisions (Kachniarz, 2008, p. 92). This may affect the financial economy of hospitals – that's way financial ratios, in practice, may differ from those recommended for industrial firm (Chu et al., 1991). Notwithstanding, poor financial situation translates into the overall activities - low profitability, liquidity problems, may cause the disruption in supplies, including equipment and drugs. It also prevents the financing of necessary investments, among other things, those, which improve the

quality of services. That's way revenues must not only cover operating cost, but also but also the development (Rój, Sobiech, 2006). In view of the foregoing, the need to maintain financial balance forces a continuous analysis of the financial situation.

Literature indicates a number of concepts, including financial analysis, with a special focus on specifics of the hospital's activities. McKinney (2004, p.89-90) indicates the four classical areas of financial analysis: profitability, giving an information about the ability of creating the profit; activity, which allows to assess the efficiency of the management of enterprises on the market, liquidity – connected with a capability of paying short-term obligations and leverage, characterizing the degree of indebtedness of the company and its ability to repay obligations. Another concept presents indicators that provide a comprehensive picture of the financial situation of the hospital. The analysis focuses in three areas: profitability, liquidity and solvency, defined as the ability to handle long-term commitment (Gunther et al., 2001, p. 29). Penner (2013, p. 327), similarly, indicates areas of the hospital's financial health assessment. These are: profitability, liquidity, debt management and assets management.

Notwithstanding the concept of the financial situation assessment, financial liquidity seems to be a very important area. Liquidity ratios measure the company's ability to repay short-term obligations and determine how quickly hospital can collect cash, to pay off its short-term debts (McLean, 2002). Low level of liquidity often leads to bankruptcy, even if the hospital is generally profitable (Penner, 2013). Low liquidity also enforce an aggressive working capital management (Michalski, 2009), (Michalski, 2010), what, in case of public hospitals, financed generally by one, big, public payer, can be difficult.

The most commonly used financial liquidity indicator is current (CR) ratio (Pink et al., 2007), (McLean, 2002), (Briggs and Briggs, 2004, pp. 164-165), (Gunther et al., 2001). Other liquidity indicator, recommended for the health sector providers, could be: quick ratio, acid test ratio (Briggs and Briggs, 2004, pp. 164-165), days cash on hand (Gunther et al., 2001), days in accounts receivable (Zelman et al., 2009, p. 138).

Generally, for enterprises, liquidity ratio is considered sufficient if it's in the range from 1.5 to 2.0 (Sierpińka, Jachna, 2007). CR value greater than 2.0 testifies to the real hedge of current liabilities (Bednarski, 1994, p. 66). On the other hand, according to Ostaszewski (1991, pp. 54-55), the value higher than 1.9 indicate an excessive freeze of current assets. These values do not take into account, however, the characteristic of the sector. A literature review has allowed to determine the recommended value of CR for hospitals. Current liquidity ratio higher then 2.0, is in the light of literature study, considered as good (the rule of thumb) (McLean, 2002), (Penner, 2013, p. 328). Empirical research on the different groups of hospitals showed, that average of CR were from the range from 1.1 to 2.48 (Penner, 2013),(Zelman et al., 2009, p. 138),(Gunther et al., 2001), (Pink et al., 2007),(Herman, 2012),(Draffin and Tucker LLP, 2011).

Studies also proved the significant diversity of the current ratio between hospitals. Pink et al. (2007) showed, that the group of small hospitals claimed the highest values of CR at the level of 2.0, while community hospitals – 0.9, teaching hospitals – 0.7, comparing to the average level for all hospitals at 1.1. In research carried out in Georgia (USA), the average value of the current liquidity ratio equaled to 1.75 with diversity from 0.4 to 5.5 – at the same time the average CR value for hospitals in the United States was 2.25 (Draffin and Tucker LLP, 2011).

Therefore we have posed the question, how much the size of the hospital affects its financial performance, in particular, liquidity indicators. Literature does not provide a clear evidence in this area. Augurzky and Schmitz analyzed the financial performance of 1,000 hospitals and found that, on average, small hospitals (having less than 200 beds), are more likely subject of financial problems than large institutions (Augurzky, Schmitz, 2010). Souza et al. (2012) found, basing on research of Brazilian hospitals that the most proper number of beds, in terms of financial indicators, should be from 100 to 200. Posnett (1999) showed that the optimal number of beds, in terms of financial stability, should be between 200 and 400. Votápková and Št'astná (2013) in the study of the

hospitals' efficiency in the Czech Republic showed, that large hospitals are characterized by significantly lower financial ratios. On the other hand, Weaver and Deolalikar (2004) claimed, that number of beds or the volume of output is not correlated with higher level of financial indicators.

The purpose of this paper is to study the relationship between the selected quantitative characteristics of hospitals, especially in terms of the size of the hospital (number of beds, the volume of revenues) and the static liquidity ratio. We'd decide to answer the question, **whether the size of the hospital has an impact on the level of financial liquidity**. We have formulated two research hypotheses:

H1: *the size of the hospital, measured by number of beds or income, influences on the level of current liquidity ratio*;

H2: *the correlation between the size of the hospital (measured by number of beds or annual income) is positive up to certain (not known yet) level. Above this level, the correlation is negative*.

H1 hypothesis assumes, that the size of the hospital has an impact on the level of the current liquidity ratio. The literature study, presented above, has shown, that the size of the hospital has an impact on the financial situation, and therefore, also on liquidity ratios. Prędkiewicz (2010) proved, that the size of a company influences financial indicators. We've expected the same relationship in case of hospitals. Basing on that, we've supposed, that hospitals having more beds or higher revenue, should have higher liquidity ratios value than smaller entities. This phenomenon could be associated with the effect of economies of scale, which is related to more efficient use of equipment (e.g. MRI, TK), and, partially, human resources (nurses, doctors).

Due to the existence of natural variation between hospitals, related to the type of hospital or level of specialization, higher number of beds does not automatically means higher revenue. Small hospitals providing short, well paid, surgical procedures, can achieve relatively high income. Therefore, this hypothesis has been verified separately for two measures of hospital's size: the number of beds and the annual revenue.

Hypothesis H2 is a amplification of the hypothesis H1. We've assumed, that the increase in revenue or the number of beds, up to a certain level, which should be empirically estimated, increases financial liquidity. We' have expected, that, if this level is exceeded, further increase in the number of beds or revenue would decline the liquidity ratio. We think, that this could be associated with an increase in the level of specialization of the hospital. Highest level of specialization is related to the providing of high-cost procedures, whose number is strictly limited by the payer agency (National Health Fund). We've also supposed, that in the case of a very large hospitals, the coordination costs could exceed the economies of scale, deteriorating financial ratios.

The analysis has been conducted for 128 polish hospitals in the years 2009-2011. We have used traditional, static current liquidity indicator. In order to prove hypotheses presented above, we've applied statistic methods, including Pearson's correlation coefficient and T-Student test.

The paper is a continuation of the previous research carried out by the authors. At earlier stages we couldn't fully confirm the hypothesis about the relationship between the size of the hospital and the level of liquidity[1]. We have expected, that these study, thanks to a larger sample, would allow us to verify this hypothesis.

2 Methodology and Data

In order to prove the hypotheses, we have created the database, consisting of financial and organizational data from 128 polish hospitals. Hospitals were collected by hand to ensure the homogeneity of the sample. Financial data (annual revenue) were obtained

[1]Result were presented during the conference "Enterprise and the Competitive Environment", 6 - 7 March 2014

from Amadeus Database and supplemented by information, concerning the number of beds, coming from the Registry of Medical Entities (http://rpwdl.csioz.gov.pl/). Data cover years 2009-2011 and the analyzes has been conducted separately for every year. We have qualified to this study hospitals owned by the public body, regardless of the legal form of the activity. Sample takes in both hospitals operating in the form of independent public health care institution (SPZOZ) and commercial law's companies (limited liability company or joint-stock company), on condition, that equity is public.

To measure the level of liquidity, we've decide to use the current ratio (CR), described by formula: current ratio (CR) = (current assets)/(current liabilities). As literature study has shown, current liquidity ratio is the most commonly used measure of financial liquidity in health care sector (Pink et.al., 2007), (McLean, 2002), (Briggs and Briggs, 2004, pp. 164-165), (Gunther et al., 2001).

In order to verify the hypotheses we have conducted the correlation analysis using Pearson correlation coefficient. This is a measure used to test the linear relationship between the measurable characteristics. In the paper we've used formula:

$$r_{xy} = \frac{\frac{1}{n} \cdot \sum_{i=1}^{n} (x_i - \bar{x}) \cdot (y_i - \bar{y})}{s_x \cdot s_y} \tag{1}$$

The Pearson correlation coefficient indicates both the direction and strength of the relationship. We have tested its significance, using the test of correlation's significance, assuming the following construction of research hypothesis:

H0: the correlation coefficient is insignificant statistically (null hypothesis);
H1: the correlation coefficient is statistically significant;

For which the test is statistic: $t_e = \frac{r}{\sqrt{1 - r^2}} \sqrt{n - 2}$ (2)

that, assuming the validity of H0 has the T-Student distribution with n-2 degrees of freedom.

In order to verify the hypotheses, we have split the research sample into 3 groups in terms of annual revenue. We have distinguished small hospitals, with annual income below the 63,000 thousands of PLN, medium, with revenues from 63,000-160,000 thousands of PLN and large hospitals, with revenues excessing the level of 160,000 thousands of PLN.

Based on the criterion of number of beds, hospitals have been divided into two groups - small and large hospitals, assuming different boundaries for every analyzed years. In the sample, in case of the number of beds, we have observed the outliers, that have prevented the use of arithmetic mean, and, as a result, the Pearson correlation coefficient. Observations from the beginning and end of the statistical series, that differ clearly from all the rest, have been removed (up to 15% of the observations from the beginning of the series and 1.5% from the end).

3 Results and Discussion

Preliminary analysis has showed, that the current liquidity ratio for the research sample, has significantly lowered (33%) in the following years, and it was relevantly lower, than values recommended in the literature (2.0). That indicates, that hospitals are potentially at high risk of insolvency. The decline was accompanied by an increasing diversification, shown by standard deviation (Table 1).

Table 1 Descriptive statistics for current ratio, whole sample, years 2009-2011

	Mean	Minimum	Maximum	Standard deviation
2009	1.327	0.240	4.816	0.731
2010	1.186	0.177	4.793	0.854
2011	0.890	0.165	5.537	0.897

Source: own study

Hypothesis H1:

In order to prove the hypotheses concerning the relationship between the size of the hospital (measured by annual revenue) and the current liquidity ratio, we have calculated the linear correlation coefficient and tested the null hypothesis of correlation coefficient's insignificance. The rejection of a null hypothesis was a basis of adoption the hypothesis concerning an existence of analyzed relationship.

During first stage, we have analyzed the relationship between financial liquidity and size of hospital measured by annual revenue. On the significance level $\alpha < 0.1$ (in case of year 2009, $\alpha < 0.05$) we have rejected the null hypothesis of insignificance of correlation coefficients between hospital size measured by income and liquidity (Table 2). As a result, we have adopted the hypothesis of existence of linear relationship between values in every analyzed year. That has showed, that increase in revenue should improve the current liquidity ratio, but the force of this relationship is rather of moderate strength.

Table2 Correlation coefficients between hospital size measured by annual revenue and liquidity ratio, in years 2009-2011

Year	CR	
	R_{XY} Pearson's	p
2009	0.1853	0.0274**
2010	0.1231	0.0930*
2011	0.1380	0.0855*

* significance level $\alpha = 0.1$, ** significance level $\alpha = 0.05$ *** significance level $\alpha = 0.01$.Source: Source: own study

A similar procedure has been applied in the case of the relationship between the number of beds and the current liquidity ratio (Table 3). We've found weak linear relationship, statistically insignificant. That's way we couldn't reject the null hypothesis of the lack of significance of Pearson's coefficient). In the light of that, the number of beds can't be consider as the determinant of financial liquidity.

Table 3 Correlation coefficients between hospital size measured by number of beds and liquidity ratio, in years 2009-2011

Year	CR	
	R_{XY} Pearson's	p
2009	-0.0253	0.3908
2010	-0.1280	0.0791**
2011	-0.0954	0.1541

* significance level $\alpha = 0.1$, ** significance level $\alpha = 0.05$ *** significance level $\alpha = 0.01$. Source: Source: own study

Hypothesis H2:

The second hypothesis is an amplification of first one. We have assumed, that with the increase in the size of the hospital, initially, liquidity ratio grows. Above a certain, empirically estimated, size, we have expected, that, along with a further increase in the size of the hospital, the value of current liquidity ratio would decrease. Similarly to the first hypothesis (H1), during the analysis of hypothesis H2, the size of the hospital has been measured firstly in terms of revenue, and then - the number of beds.

As a result, on the significance level α <0.05 we have rejected the null hypothesis of insignificance of correlation coefficients between hospital size measured by annual income and liquidity ratio, and we have adopted the hypothesis H2. (Table 4). However, the relationships disclosed for year 2010 remain, partly, at odds with the results for other years, what has shown the need of further research.

Table 4 Correlation coefficients between hospital size measured by revenue and liquidity ratio in years 2009-2011, hospitals split into groups

Year	Annual revenue (thousands of PLN)	CR	
		R_{XY} Pearson's	p
2009	63,000-125,000	0.2279	0.0387**
	125,000-160,000	0.3930	0.0107**
	160,000-226,000	-0.4882	0.0453**
2010	32,000-67,500	-0.1947	0.1558
	67,500-149,000	0.2110	0.0356**
	149.000-205.000	-0.4330	0.0610*
2011	63,000-125,000	0.2016	0.0459**
	125,000-160,000	0.4434	0.0427**
	160,000-226,000	-0.5148	0.0359**

* significance level α = 0.1, ** significance level α = 0.05 *** significance level α = 0.01.Source: Source: own study

For this hypothesis (H2) not only the existence of the moderate correlation is important, but above all, the direction of the relationship. The design of the hypothesis assumed, that for smaller hospitals, increase in revenue results in higher values of current liquidity ratio, and for the largest hospitals (the largest revenue) the revenue growth results in a diminishment of CR values.

Such expected relationship we have observed in the test sample. For hospitals with annual income less than 160,000 thousands of PLN, revenue growth is related to an increase in the liquidity ratio. What is important, for larger hospitals in this group (with revenue higher than 125,000 thousands of PLN), the strength of relationship is higher (especially for year 2011) than in the case of smaller hospitals (Table 4).

For hospitals with annual revenue over 160,000 thousands of PLN, the correlation coefficient changes the direction – the negative correlation coefficient occurs. Along with an increase in revenue, financial liquidity decreases. In the light of above, we have, therefore, assumed, that the boundary income level for analyzed sample is 160,000 thousands of PLN (Table 4).

Table 5 Correlation coefficients between hospital size measured by number of beds and liquidity ratio in years 2009-2011, hospitals split into groups

Year	Number of beds	CR	
		R_{XY} Pearson's	p
2009	135-595	0.0565	0.3176
	595-1090	0.2422	0.0468*
2010	126-633	0.0225	0.4196
	634-983	0.2937	0.0348*
2011	166-606	0.1547	0.0475**
	607-1090	0.2520	0.1541*

* significance level α = 0.1, ** significance level α = 0.05 *** significance level α = 0.01.Source: Source: own study

Analysis of the correlation between the size of the hospital, measured by the number of beds hasn't indicated statistically significant correlations between size and liquidity ratio (CR). The correlation coefficients are weak and, generally insignificant (Table 5). Basing

on the created database, we couldn't select specific groups of hospitals (especially the large ones), which has closed the door on verification of this part of H2 hypothesis.

4 Conclusions

Liquidity indicators for hospitals in Poland are significantly lower than levels recommended in the literature, that's way the analysis of the factors affecting the liquidity seems to be especially important for health care managers.

In this paper we have analyzed the relationship between the size of the hospital and the level of financial liquidity. The size of the hospital should be, in the light of empirical research presented in the literature, one of important factors affecting the financial situation of the medical institution, including liquidity ratios. In this paper, we have examined two aspects of the hospital's size - the annual revenue and the number of beds.

The results obtained has confirmed the existence of a linear relationship between the income and liquidity – generally, the higher the hospital is, the better liquidity it has. As particularly important achievement, we recognize the empirical estimation of the level of revenue, above which financial liquidity starts to drop. This seems to confirm the initial assumption, that for very large hospitals the cost of coordination may exceed the economies of scale. In this research we have determined this level as about 160,000 thousand of PLN (about 38,000 thousands of EUR). This information is important for policymakers, especially taking on consideration the increasing consolidation of hospital's sector in Poland.

Contrary to our expectations we haven't confirmed the relationship between the number of beds and the level of liquidity. This may suggest that the use of the beds and, as result, the revenue generated by one bed, might be more important factor of liquidity.

Obviously, the size of the hospital is not the only variable that may affects the level of financial indicators, including indicators of liquidity. Such factors may be the type of hospital (surgical or general), ownership (private or public), goals (not-for-profit, for-profit) or the location of the hospital (e.g. rural of urban area), which haven't been analyzed in this study. This introduce certain limitation of the analysis and create the field for further research.

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The Classical and Stochastic Approach to Option Pricing

Luděk Benada, Martin Cupal

Masaryk University
Faculty of Economics and Administration, Department of Finance
Lipova 41a, 602 00 Brno, Czech Republic
E-mail: 75970@mail.muni.cz, martass@mail.muni.cz

Abstract: *Black-Scholes model (BS) and lattices are well-known methodologies applied to option pricing, with their own specific features and properties. Briefly, lattices are discrete in the inner computing process and stochastically based, while BS is represented by a continuous functional form without single steps, but deterministic only. The strong assumption of constant volatility and the inability of application in valuing "American" options represent major disadvantages of the BS model. Its main advantage is its simplicity and ease of application. The use of Monte Carlo simulations constitutes an alternative to this model. Its main advantages include a relatively easy procedure of calculation and efficiency. Problems can arise when applied to the "American" option. Likewise, this method does not belong among highly sophisticated ones due to the requirements of prerequisites. If we were to consider a model that can work with the "American" option, i.e. an option that may be exercised at any time before maturity, then calculation using the lattice approach is conceivable. In contrast, the disadvantage of this method lies in the lack of ability to apply continuous consistency with price development history as well as inability to work with a model that would require more underlying assets. Finally, the two approaches, Black-Scholes model and the lattice approach, considered for pricing options, derived their value from IBM stocks as an underlying asset. On individual valuations, accuracy of these valuation models will be observed in accordance with the real option price.*

Keywords: option pricing, lattices, Black-Scholes model, volatility, Geometric Brownian motion

JEL codes: G12, G13, G17

1 Introduction

Option pricing is dealt with by a large number of financial professionals. On one hand, there is the interest of active traders; on the other, the options serve as a grateful topic of academic debate. The breaking point came with the paper of Black and Scholes (1973), which provides a tool to theoretical price estimation of the European option. In their paper, (Black and Scholes, 1973) they provide instructions under the assumption of arbitration mechanism to ensure long and short positions of market operator.

Specifically, the paper further focuses on valuation of American options. The first guidance for pricing of American options was introduced by Rox, Ross and Rubistien (1979). The advantages of their methodology were the ability to achieve a more accurate result in comparison to BS, customized calculation and the effect of dividend payment. The flexibility of the model led to the development of various modifications.

The lattice method was used for instance for two underlying assets (Liu and Zhao, 2013) in the regime-switching model; here the efficiency of lattice approach is fully evident, with the discrete lattice being approximated to the continuous-time regime-switching diffusion process.

Muzzioli and Torricelli (2004) deal with European options (DAX index) in the multi-period binominal model. Their approach is based on the assumption of risk-neutral valuation approach and they combine the stock price and risk-neutral probabilities in weighted intervals. Risk-neutral assumption is also used in this paper.

Aluigi et al. (2014) applied the Chapman-Kolmogorov lattice (CKL) method on a wide range of derivatives. The paper confirmed a convergence of standard lattice method,

revealed and compared CKL, binomial and trinomial lattices with respect to the number of steps, for both American and European call options. All charts show the CKL method as extremely efficient and able to price a wide range of derivative securities.

In this respect the sector of industry or services with the underlying asset of options is also significant. Murphy and Oliveira (2013) study the impact of oil prices and stocks on prices of call and put options. They analyze the interaction between the call and put option contracts and consider how such instruments can be used by the government and by refiners as well.

Leisen deals with testing errors in Binominal models for American put option (1998). The convergence between BSM and lattice was investigated by Leisen (1999). Another approach in option pricing is provided by Storkbridge (2008), who uses a multi-period binominal model. An improved model based on nonlinear differential equation generalizing the BMS with stochastic volatility was introduced by Amster (2002). Amster et al uses also the adjusted BMS for transaction costs. An interesting benefit of option theory is the testing of accuracy of pricing models during the financial crisis.

Bates provides a comprehensive overview of the development in empirical option pricing in his paper (Bates, D. S., 2003). He emphasizes especially comparing and testing of consistency of objective distribution and risk-neutral distribution and the methods of determining volatility.

2 Methodology

Black-Scholes Model

The Black-Scholes formula is able to calculate the price of European put and call-option; the value of a call option for a non-dividend paying stock is determined as:

$$C(S,t) = N(d_1)S - N(d_2)Ke^{-r(T-t)} \tag{1}$$

$$d_1 = \frac{1}{\sigma(T-t)}\left[\ln\left(\frac{S}{K}\right) + \left(r + \frac{\sigma^2}{2}\right)(T-t)\right] \tag{2}$$

$$d_2 = \frac{1}{\sigma(T-t)}\left[\ln\left(\frac{S}{K}\right) + \left(r - \frac{\sigma^2}{2}\right)(T-t)\right] \tag{3}$$

The notation of individual symbols is as follows: $N(\cdot)$ represents the cumulative distribution function of the standard normal distribution $N\sim(0,1)$; T-t is the time to maturity, S is the spot price of the underlying asset and K the strike price; r means risk-free rate as annual rate, expressed in terms of continuous compounding and σ is the volatility of underlying asset returns (Black and Scholes, 1973).

Due to the processing of valuation only for call-options, there is no reason to derive valuation model for a put-option.

Binomial Lattice Simulations

A lattice method can certainly be considered as a powerful way to value options that allow early exercise before maturity. That represents a big advantage over MC simulation. This method covers the valuation of both American and European style derivatives. The simplest version is binomial lattice method.

Binomial tree or lattice uses the construction of different possible paths of a stock price over time to price a derivative. Only two possible moves of the stock price, up or down (intensities u and d) within the time period of length Δt are assumed.

One-step binomial tree fits the best on vanilla call option on non-dividend–paying stock and with only two possible outcomes for the stock price over time interval Δt. Thus the stock prices just in Δt are either S_0u or S_0d, where S_0 is an initial stock price, $u > 1$ and $d < 1$. The corresponding payoff of the call option while stock price moves up to S_0u is

denoted by C_u = max(S_0u – K,0) and a move down in the stock price means C_d = max(S_0d – K,0), where K denotes a strike price (International Actuarial Association, 2010). Topological consequences of the issue can be seen in Figure 1 and Figure 2.

All the assets are assumed to earn a risk-free rate of interest under the risk-neutral valuation, and the current stock price is assumed to equal the expected value of the stock price discounted at the risk-free rate. According to these assumptions (binomial tree world and risk-neutral) the approach to option valuation depends on probabilities of up and down stock price movement that sets the discounted expected value of the stock equal to the current stock price. The probability of an upward movement of the stock price denotes p and risk-free rate r; stock price at time 0 (risk neutral world) is given by

$$S_0 = e^{-r\Delta t}\left[pS_0u + (1-p)S_0d\right] \tag{4}$$

Solving that expression gives condition for p:

$$p = \frac{e^{r\Delta t} - d}{u - d} \tag{5}$$

And corresponding u and d given by

$$u = e^{\sigma\sqrt{\Delta t}}, d = u^{-1} \tag{6}$$

where σ is a volatility of the stock price. The payoff of the call-option (at time 0) is

$$C_0 = e^{-r\Delta t}\left[pC_u + (1-p)C_d\right] \tag{7}$$

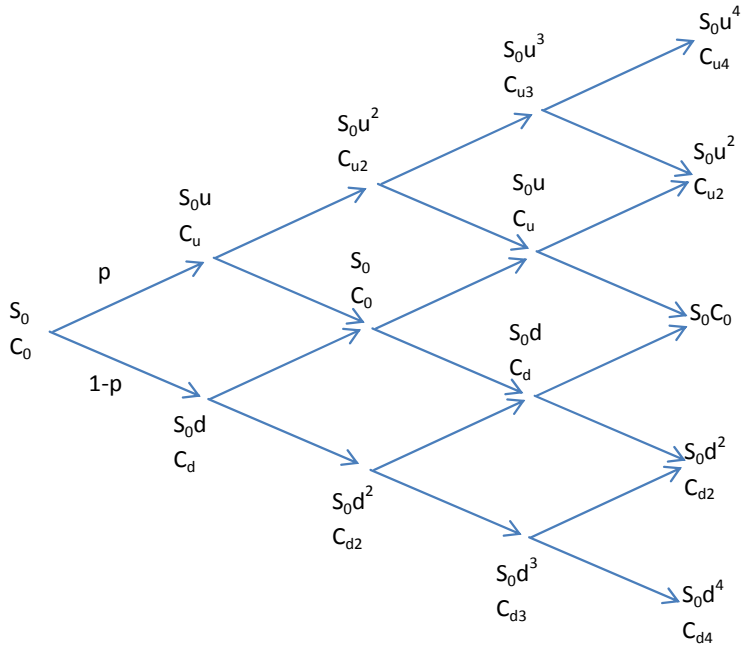
It logically follows multi-step binomial tree with large number of time steps. Then a stock price at time $m\Delta t$ is given by

$$S_m = S_0u^n d^{m-n}, m = 0,1,\ldots,n \tag{8}$$

where u and d see above.

The call-option price is evaluated from the end of the tree (backward movement from time T, where price is known). The whole tree process can be seen in Figure 1.

Figure 1 Call-option price with a non-dividend-paying stock price movement in the time interval under a multi-step binomial lattice model



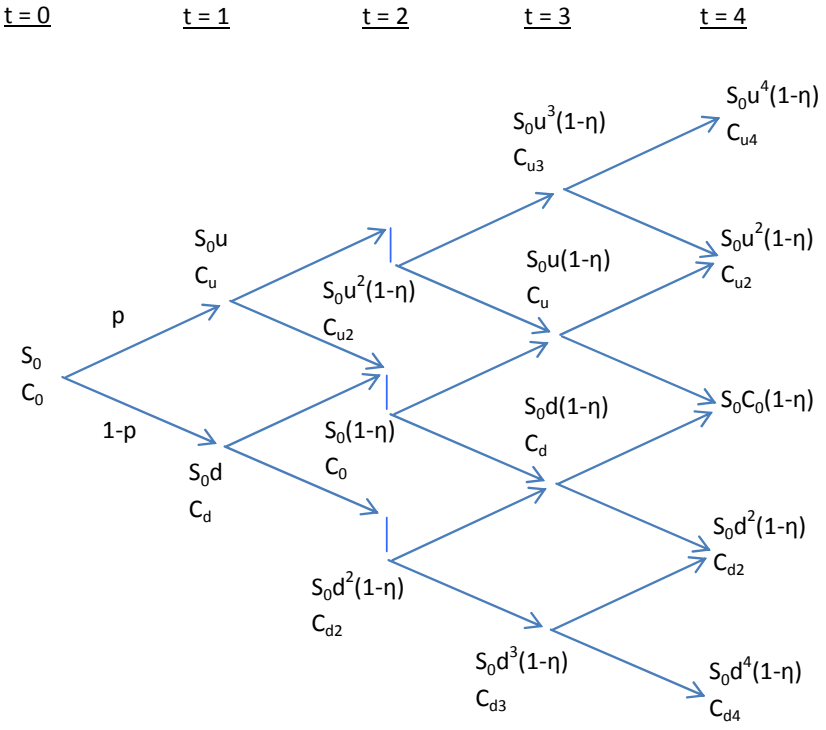
Source: International Actuarial Association, 2010

If dividend paying stock is to be considered, it is necessary to establish the dividend yield η as a percentage of the stock price, where the ex-dividend stock price at each time step is

$$S_m = S_0(1-\eta)u^n d^{m-n}, m = 0,1,\ldots,n \tag{9}$$

The following figure shows a binomial tree of a stock paying dividend at a dividend yield (International Actuarial Association, 2010).

Figure 2 Call option price with a dividend-paying stock price movement in the time interval under a multi-step binomial lattice model



Source: International Actuarial Association, 2010

In the paper the standard Black-Scholes model and the Cox, Ross and Rubinstein models were used for the lattice calculation. That represents a simple discrete-time model for valuing options that use binomial option pricing formula, see (Cox, Ross, Rubinstein, 1979).

Since risk neutrality had been assumed, the current price of options has been calculated on estimated future cash flow.

3 Data

The interest rate of the U.S Treasury Bill ISIN-US912796CF47 issued on 10/17/2013 with expiry on 10/16/2014 was used as a discount factor.

A rate of daily profit was applied for the calculation of a yield of market value to maturity and for the daily rate a number of trading days were considered.

The research was built upon the options of IBM Corporation. It is a stable company belonging to the Blue chips in the DJIA index and a stable dividend-paying company from the perspective of stock development; the dividends are paid quarterly. The twelve-month dividend yield is 2,01 %. The analyzed options have a different time to maturity

(64, 192, 217, 278, 530 days). The research was focused only on call options; all of them are American options.

By the exploration of fundamental properties of the underlying asset, the estimation of daily return has been made. The input data are the closing prices of the stock. Taking into account the dynamic development of the return variance, the risk has been calculated on the 50 days return period using the rollover methodology, i.e. for every day the volatility has been recalculated from 50 observations.

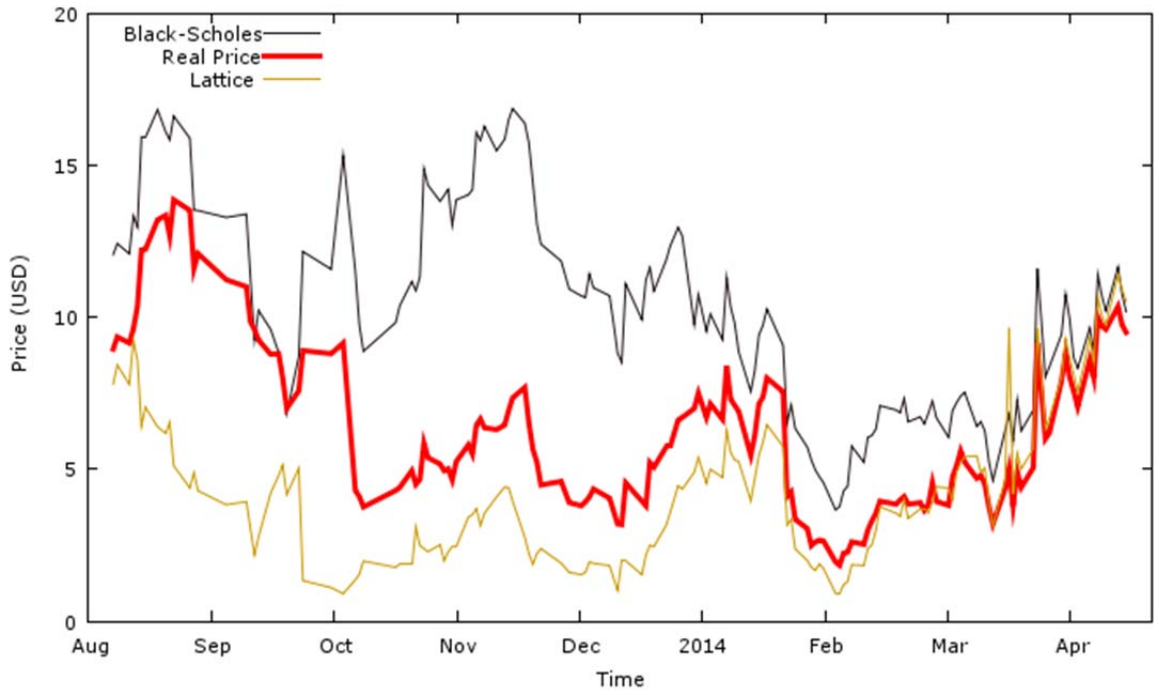
In the calculation of lattice method 15 forward and backward steps were used. All the input data were received from Bloomberg terminal.

4 Results and Findings

According to the obtained results, it is possible to conclude that in both cases of the computation (BS and lattice) of the theoretical option price, the input parameters are rather significant; especially the strong determination by the volatility and interest rate of t - bills. The appropriate volatility (which is an important parameter of price option) can be obtained from optimal return period of the underlying asset.

The following figures represent partial results of the research. They show all three price developments (BS price estimation, lattice estimation and real option price) in time; figure 3 illustrates this for strike price K = 190 USD and figure 4 for K = 200 USD.

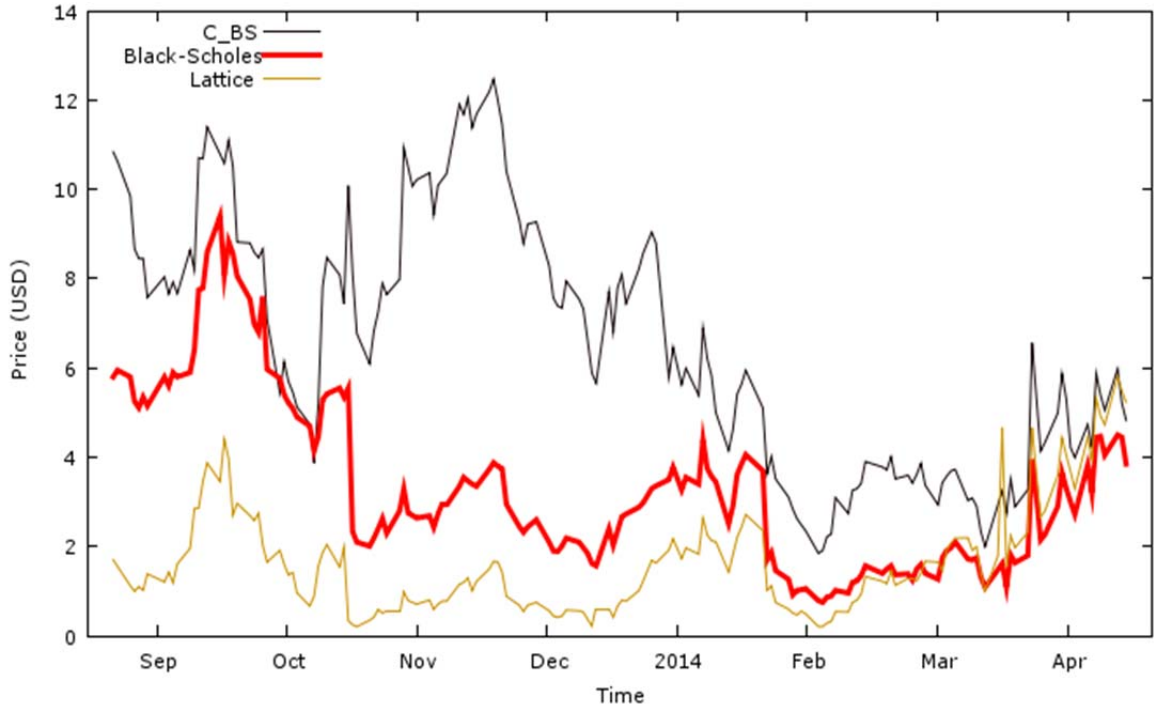
Figure 3 190 Strike Price



Source: Own figure

In general, based on the findings, it can be concluded that the theoretical price of option provided by the lattice methodology is lower than the real option price. In contrast, according to the Black-Scholes (BS) model, the theoretical price of the option is overrated. Decreasing the number of days to maturity clearly showed the convergence of all monitored options observed in all three prices (the actual option price, BS, lattice).

Figure 4 200 Strike price



Source: Own figure

5 Conclusions

The paper explored two most frequently applied methods of option pricing (BS, lattice). We examined the explanatory power of both and compared the results with the real market price of options. We chose the IBM Corporation as input data for the analysis. The daily closing price of its stock was used as an underlying asset on which other call and put options with diverse maturity and strike price are issued. The results of the analysis confirmed that the BS-methodology, especially immediately after the issue of options, gives overestimated prices. Contrary to that, the prices computed by lattice over the given time period were underestimated. With the approaching date of maturity, however, the theoretical prices given by both models converge to the real option price.

It would be useful to confirm our findings using a broader portfolio of similar financial instruments. Furthermore, there are other possibilities of comparing the methodology used with other models or modified models that use a simulation approach.

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Combination of Multifactor APT Model and CAPM: An Empirical Analysis of the Prague Stock Exchange

Luděk Benada, Juraj Hruška

Masaryk University
Faculty of Economics and Administration, Department of Finance
Lipová 41a, 602 00 Brno, Czech Republic
E-mail: benada.esf@gmail.com, 206887@econ.muni.cz

Abstract: *The goal of the paper is to investigate possibilities of utilizing multi factor APT models in constructing portfolios of securities under circumstances of Czech capital market. Authors are focusing on using several econometrical models like multifactor regression, regression including lags of explaining variables, Cochran Orcutts procedure with and without lags of explanatory variables, ARDL models and sequential F-tests for identifying factors that are crucial for explaining development of Czech market represented by index of Prague Stock Exchange. These factors are tested, evaluated and consequently applied to explain the variability of selected shares listed on the PSE. These models are created in three versions depending on different market indices. For these analysis have been chosen indices DAX, DJSTXE and WIX. Using sensitivities of companies' shares on the selected factors, their betas are investigated. Multifactor model is transformed into one factor CAPM model. Weights of shares in optimal portfolio are calculated using cut-off method. However Czech market is not old enough to perfectly perform such analysis, many helpful findings can be found in this paper, which may lead to better understanding of behavior of prices in PSE. Validity of models is confirmed by rather accurate predictions of portfolio value development.*

Keywords: capital markets, portfolio, CAPM, APT, PSE

JEL codes: G11, G12, C12

1 Introduction

Optimal portfolio creation is one of the crucial disciplines in the world of financial investments. Certainly, generating as big profit as possible is the leading motivation of every investor. However, avoiding diversifiable risk is even more important for each subject operating on the financial market.

Leaving aside investment activities based on an access to insider information, diversification is crucial for the creation of an efficient portfolio. A combination of risk assets such as stocks or basket of stocks and risk-free asset can be an example of a simple form of diversification. These are the basis of the well-known capital asset pricing model. The efficiency of an investment from the perspective of the undertaken risk is determined by the selection of suitable assets and their weights in the portfolio. The investor´s decision may also be influenced by market conditions and regulations - typically sell short. An investor can choose assets for his portfolio by simple comparison of market prices of a stock with its fair value. He can also track the mutual linear or non-linear relation between assets. Alternatively he can examine factors which determine the price of an asset. In the case of the simple CAPM it will be the market development represented by its index. For a more precise analysis of an asset more factors should be included. Most commonly macro-economic factors, the price of commodities, geopolitical situation. One of the most commonly used multifactor model is APT model.

The efficiency of APT and CAPM in Scandinavian Stock Exchange was examined by Ostermark (1989). Empirical testing nonrisk-based sources in the CAPM provided MaxKinlay (1995). He concluded that multifactor models cannot sufficiently explain deviations in CAPM. Fletcher and Hillier examined the explanatory power of the conditional CAPM in the situation when an investor decision is restricted (2002). They concluded that restrictions play a crucial role in investment decision making. The results of the conditional models gave significantly better results in the situation without any

restrictions. Kim proved that conditional information can improve the results of empirical testing in comparison to classical consumption CAPM (2012). His model is significantly better than the Fama-French model. Lozano and Rubio compared the estimations of beta conducted by OLS and GLS with stochastic discount factor (2010).

The authors in this paper are focusing on the optimization of portfolio of shares listed on the main market Prague Stock Exchange. They have chosen not to follow the basic Markowitz methodology, but to implement combination of Capital Asset Pricing Model and Arbitrage pricing theory model (Ross 1976). Based on these methods they have identified optimal weights of portfolio.

2 Methodology and Data

Analysis were implemented on the time series of the index of Prague Stock Exchange PX and Polish and German stock exchange indices, macroeconomic data of Czech economy such as GDP, industrial production, inflation, unemployment, exchange rates with American dollar and euro, interest rates and money supply of Czech central bank, data from balance of payments and prices of some commodities, that are widely used in Czech industry especially by the companies that were supposed to be listed in the potential portfolio (King 1966). For the further calculations authors were operating with quarterly differences in all examined variables from the beginning of year 1997 until beginning of year 2011. Differences were used to avoid problems with unstationarity and autocorrelation. Unstationarity was proven by unit root test and autocorrelation by Dicky-Fuler test (Carter et al., 2011). The authors were considering only selected companies for the optimal portfolio. Some were excluded, because they had been traded on regulated market only for the short time, so there was lack of observations for proper analysis.

Methodology was based mainly on the principles of Capital Asset Pricing Model as it was introduced by Sharpe with influence of Arbitrage pricing theory (1963). The First step was to identify main factors that have significant influence on Czech market. Over 15 variables and their lags up to delay of one year were used for analysis (Fletcher and Hillier,2002). Authors used several econometrical methods for identification of the most appropriate ones. Firstly Ordinary Least Square model were created, then its variation with reduced amount of variables (only main macroeconomic factors were allowed). Then length of the lags was reduced. All these variation were taken into account because only a limited number of observations were available. This was done to avoid biasness and spurious regression caused by such a vast amount of variables. To deal with present autocorrelation Cochrane-Orcutts procedure was used (Greene 2007). This procedure requires larger number of observation compering to OLS, so authors omitted all the lags in this case. Cochrane-Orcutt procedure was used for another model, which used at least first lags. Last model was the ARDL model of second level using Box-Jenkinson's methodology. Heteroscedasticity was tested by White and Breusch-Pagan test (Heij 2004). In all cases occurred problems heteroscedasticity, which were solved by using robust errors. Based on these calculations variables with higher significance were chosen. Also variables like impact of political situation were excluded, because their coefficients were too low (however their p-values were low) comparing to other variables. Certainly, possible absolute changes of variables were taken into account in these cases. To verify choice of variables authors performed sequential F-tests (MacKinlay 1995). Firstly simple regression was calculated for every variable and each lag. Then they were ordered by the value of coefficient of determination and sequentially added into the model, until the marginal increase in the coefficient of determination was not noticeable or until the null hypothesis of F-test was denied. These tests were done in three versions because there were three factors with highest impact on coefficient of determination, but also with strong multicolinearity. Their combination in single model would have no meaning. These three factors were indices of DAX (german market index), WIX (polish market index) and DJSTXE (Dow Jones index of European market). All indices were strongly correlated which proves significant relationship among the European markets. F-tests confirmed choice of variables made by previous econometric models. After comparing results of both methods authors chose most significant variables, which had relevant impact on

development of index of Prague stock exchange. Chosen factors were: past changes of indices DJSTXE and WIX, exchange course of American dollar and Czech crown, exchange course of Euro and Czech crown, prices of Oil on world markets, financial account of Czech balance of payments, inflation measured by Consumer Prices Index, victory of left wing or right wing parties in the election to the lower house of Czech parliament and index of riskiness of Czech bank sector; and the present changes of factors: indices of European, German and Polish market, exchange rate of dollar and Czech crown, prices of silver, coal and oil, level of industrial production, interest rates of Czech National Bank, amount of public debt and Gross Domestic Product of Czech economy.

Next step was to implement all selected variables into the multifactor model, which would explain returns of chosen shares listed in the SPAD. As was mentioned before, only shares with sufficient history of trading were analyzed, because quarter data have been used for calculations and large number of explaining variables could have brought spurious results. After all adjustments 11 shares were considered as suitable for optimal factor portfolio. For creating portfolio using cut-off method based on CAPM multifactor model had to be transformed into one factor model to identify market beta. In mathematical notation multifactor APT model can be determined through covariance between security and market portfolio as a sum of covariances of selected factors with development of market portfolio, which was in that case index of Czech stock market PX multiplied with coefficient of sensitivity of the share on the factor plus residual error:

$$\operatorname{cov}(r_i, r_m) = [\operatorname{cov}(F_1, r_m) \cdot b_{i1}] + [\operatorname{cov}(F_2, r_m) \cdot b_{i2}] + \ldots + [\operatorname{cov}(F_n, r_m) \cdot b_{in}] + \operatorname{cov}(\varepsilon, r_M) \quad (1)$$

Beta coefficient is calculated as:

$$\beta_i = \frac{\operatorname{cov}(r_i, r_m)}{\sigma_m^2} \quad (2)$$

This can be calculated by dividing previous formula with variance of market portfolio

$$\beta_i = \frac{[\operatorname{cov}(F_1, r_m) \cdot b_{i1}]}{\sigma_m^2} + \frac{[\operatorname{cov}(F_2, r_m) \cdot b_{i2}]}{\sigma_m^2} + \ldots + \frac{[\operatorname{cov}(F_n, r_m) \cdot b_{in}]}{\sigma_m^2} + \frac{\operatorname{cov}(\varepsilon, r_M)}{\sigma_m^2} \quad (3)$$

where

$$\frac{\operatorname{cov}(\varepsilon, r_m)}{\sigma_M^2} \quad (4)$$

would not have impact on the value of final beta and can be asymptotically considered as 0.

Rest of the fractions in the formula represent beta of the factors:

$$\frac{[\operatorname{cov}(F_j, r_m) \cdot b_{ij}]}{\sigma_M^2} = \beta_{Fj} \quad (5)$$

Hence, beta coefficient of security which represents its relationship between development of its return and return of the market is calculated as linear product of beta coefficients of analyzed factors and sensitivities calculated by the multifactor APT model.

$$\beta_i = \sum_{j=1}^{n} \beta_{Fj} \cdot b_{ij} \quad (6)$$

Ordinary least square model was used for identifying sensitivities of chosen factors and lags. There can be observed sensitivities of shares to the change of factors in Table 1. In

the last column are noted betas of all factors and in the bottom line can be found betas for each security.

With identified betas for each security, it can be approached to the last step of calculations, where the weights of optimal portfolio are set. One – index CAPM model can be used, because all the influences had been cumulated into one factor – market development represented by Index PX. For optimizing weights of portfolio first have to be decided which shares are the most desirable for investor (Elton, 1973). Potential of share being included in the portfolio is measured by ratio of risk premium and beta of share. All the shares are ranked by the ratio mentioned before decreasingly. Then cut-off rate is set to identify to select last share that is included in the portfolio. Ratio of risk premium of the share to beta of the share is compared with C_i, which can be obtained from the formula:

$$C_i = \frac{\sigma_m^2 \sum_{j=1}^{i} \frac{\left(\overline{r_j} - r_f\right)\beta_j}{\sigma_{ej}^2}}{1 + \sigma_m^2 . \sum_{j=1}^{i} \left(\frac{\beta_j^2}{\sigma_{ej}^2} \right)} \tag{7}$$

Where σ_m^2 is market risk and is $\sigma_{\epsilon i}^2$ non-systematic risk of security. All shares with greater risk premium to beta ratio to C_i are included in portfolio in long position. Cut-off rate C* is the last C_i whose security has greater risk premium to beta ratio than its C_i. Weights of shares in optimal portfolio are determined are set like:

$$x_i = \frac{z_i}{\sum_{i=1}^{n} z_i} \tag{8}$$

where

$$z_i = \frac{\beta_i}{\sigma_{ei}^2} \left(\frac{\overline{r_i} - r_f}{\beta_i} - C^* \right) \tag{9}$$

This is of course only for the cases when short sale is forbidden. In case it is allowed cut of rate is the C_i of the last security i.e. security with the lowest risk premium to beta ratio (Elton and Gruber, 2011).

3 Results and Discussion

While analyzing variables that are crucial for explaining development of changes on Czech stock market authors found out that most of the basic macroeconomic factors like GDP, inflation, level of public debt, unemployment rate, interest rates and accounts of balance of payments can significantly participate in the creation of exact model. Prices of many commodities were significant as well. Surprisingly gold had to be excluded from all models because it caused biasness in the most estimation. That happened mostly due to its multicolinearity and autocorrelation. Hence, it was replaced by silver and coal, which seemed more suitable for the model creation process. A bit uncertain was influence of the election results. It had hardly any significance for the market as whole, but in further analysis of the company shares themselves, authors came to conclusion that the effect of election is present at some of them. Especially large companies in strategic industries like ČEZ could be influenced by the change in political situation. Nevertheless, this hypothesis was not confirmed, but other companies like Philipe Morris and Unipetrol were affected, which was probably caused by fear and hopes of changes in consumption tax. As there are two banks and one insurance group in the market portfolio index of riskiness of Czech bank sector played an important role not only for these three companies but

nearly for every one of them including index PX. Authors chose four indices to the models; German market index DAX, index of Warsaw stock exchange WIX, index of Budapest stock exchange BUX and Dow Jones index for European market DJSTXE. These indices are strongly correlated and they were causing problems with multicolinearity in the models. BUX was classified as non-significant in every model. Other ones were accepted, especially DAX and WIX but could not be used together. This phenomenon was most visible in sequential F-tests. DAX was chosen, because model, which included this variable, had the greatest explanatory power (measured by adjusted coefficient of determination and information criteria).

Considering values and directions of coefficients, most of them had sign as would be theoretically assumed. However, inflation, which mostly do not have any major effect on return of shares, have significant effect in many models. That might be caused by the fact that unexpected changes in inflation rate could negatively affect earnings of companies and consequently alter preferences of potential investors. Interest rates of central bank have direct impact on the interest rates of commercial banks. Other type of companies is affected indirectly through the loan policy of commercial banks that could delay new investments of companies. Public debt changes can motivate investors in positive way if they believe that larger debt will enhance future growth or in negative way if they believe that the whole country are getting in debt trap. Money supply stimulates business activity of banks and trading intentions towards their shares. All these factors have reasonable explanation to be part of the sources that are causing variability of index PX.

Sequential F-test confirmed most of the variables selected by econometrical models. In addition they strongly empowered position of commodity prices. The only difference with the previous models was mostly in the length of lags. Main improvement was that these tests strictly excluded current account of balance of payments as important factor. In fact, it was causing strong biasness in all F-tests. This left only financial account of balance of payments in the models. This variable is great measure of desire of foreign investors to invest in Czech market and Czech investors to prefer foreign markets. All the tests were based on three different indices (DAX, WIX, DJSTXE) as the leading factor with the highest coefficient of determination in the simple regression model and strong multicolinearity among each other.

Models for shares themselves kept the selection of the variables. The authors wanted to avoid using more market indices in one model. Therefore, for each index and each share a unique model was created. In this case models were created for indices DAX, DJSTXE and WIX was replaced by PX which seemed to be more suitable. After comparing results for each index, DAX was chosen as its models had the best outcomes. Model for returns of middle European media company CETV had coefficient of determination around 95,21% with all significant variables. Strongest positive influence had rate of inflation, which absolutely verifies economic theory that television is the cheaper alternative of entertainment during periods of growing inflation. On the other hand changes of inflation were rather small during observed periods; therefore coefficient could only reflect compensation of that fact. České energetické závody were influenced by the changes of American dollar. Their model was one of the weakest with coefficient of determination 41.39%. Variability in change of returns of share of Erste Bank Group was explained by significant variables by 76.67%. Again the key factors were inflation and exchange course of American dollar and Czech crown. Interesting is the negative effect of GDP growth. Model of Komerční banka was weak with only 33.88% explanatory power. Surprisingly interest rates had no effect on this share. Again main influence was caused by American dollar. Coal miners NWR were explained by 79.05%. Changes of coal prices had no effect on this share. This result has probably the weakest significance, because it is listed in SPAD only for a short time, so that it offered only small number of observation, which might have led to inaccurate results. Shares of developer ORCO were positively influenced by growth of GDP and indebtedness. Economic growth can enhance

demand for real-estates and growth of debt goes hand in hand with profits for developers. Inflation had delayed negative effect. Model had very satisfying coefficient determination 92.14%. Returns of shares of Pegas NONWOVENS were completely immune to market movement. On the other hand not so immune to changes of inflation rate and exchange rates of dollar and euro. Coefficient of determination was 99.77%. Most expensive share in SPAD was explained only by 32.55%. Probably including different variables (in this case especially tobacco prices) would help to explain changes in movements of Philip Morris. Telefónica O2 had coefficient of determination 54.18%. This share was positively influenced by the market movements and negatively by growth of GDP and inflation. Despite many variables were significant in the model for Unipetrol, its coefficient of determination was only 57.22%. As before, major influence on this share had factors like inflation, exchange courses and GDP growth. Oil prices would be appropriate in models for this company shares. Oil prices had no explanatory power for other shares except of Pegas. Most of significant factors had negative influence on return of shares of Vienna Insurance Group. Especially strong position was observed with Euro and growth of GDP. Explanatory power of this model was 96.99%.

Table 1 Sensitivities of Shares on selected factors and their betas

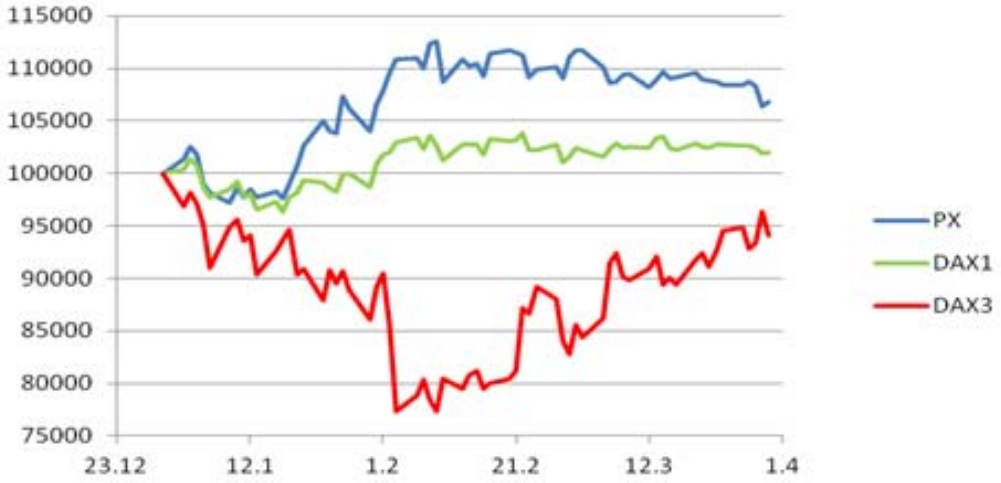
	VIG	Uni	TELE	PM	PEGAS	ORCO	NWR	KB	Erste	ČEZ	CETV	Betas
constant	0.32	0.00	0.00	0.07	0.07	-0.31	-1.02	-0.02	-0.14	0.05	0.03	
HDP	-2.97	2.03	-1.00	0.00	-1.03	0.00	0.00	0.00	-3.27	0.00	0.00	**-0.03**
HDP(-1)	0.00	2.23	-0.71	0.00	0.00	4.45	0.00	0.00	0.00	0.00	6.08	**0.01**
CPI	0.00	0.00	0.00	0.00	13.62	0.00	-12.79	0.00	0.00	0.00	15.78	**-0.01**
CPI(-1)	0.00	0.00	-4.73	0.00	6.99	0.00	0.00	0.00	5.93	0.00	0.00	**-0.02**
CPI(-2)	0.00	-6.78	0.00	0.00	2.38	-17.28	0.00	0.00	0.00	0.00	5.00	**-0.03**
USD/CZK	0.00	-3.88	0.00	0.00	-2.07	-1.95	-14.18	-3.51	-2.01	-3.29	0.00	**-0.07**
USD/CZK(-1)	0.00	3.71	0.00	2.48	9.47	0.00	-43.81	2.82	3.14	3.03	4.12	**0.03**
USD/CZK(-2)	0.00	0.00	0.00	0.00	-1.49	0.00	31.00	0.00	0.00	0.00	0.00	**0.03**
EUR/CZK	0.00	1.01	0.40	-0.95	0.68	0.00	0.00	0.00	1.14	0.00	-1.59	**-0.06**
EUR/CZK(-1)	-2.59	-1.28	-0.37	0.00	-3.56	0.00	0.00	-1.08	-2.58	-1.50	-4.70	**-0.10**
Public debt	1.91	0.00	1.26	0.00	0.00	4.36	19.74	0.00	1.73	0.00	0.00	**0.09**
Public debt (-1)	0.00	0.00	-0.47	0.00	0.00	3.05	0.00	1.52	0.00	0.00	-3.81	**0.05**
Victory of right wing	0.00	0.00	0.00	-0.19	0.00	0.00	0.00	0.00	0.17	0.00	0.39	**-0.20**
Victory of left wing	0.00	0.66	-0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**-0.15**
Riskiness of banks	0.00	0.00	0.00	0.00	-1.22	0.00	11.90	0.00	1.33	0.00	3.00	**-0.04**
Riskiness of banks(-1)	1.46	1.41	0.00	0.00	1.24	0.00	-11.68	0.00	0.00	0.00	2.02	**0.00**
Silver	0.00	0.00	0.00	0.00	0.31	0.00	0.00	0.00	0.00	0.00	0.00	**0.34**
Silver(-1)	0.00	-0.42	0.00	0.00	0.00	0.84	0.00	0.00	0.60	-0.30	0.00	**0.17**
Coal	0.00	0.00	0.00	-1.69	-5.50	0.00	46.96	-1.27	-1.73	0.00	-2.49	**-0.03**
DAX	0.91	0.45	0.31	0.00	0.00	0.89	0.00	0.00	1.41	0.38	2.72	**0.59**
DAX(-1)	-1.06	0.54	0.00	0.00	0.00	0.00	0.00	0.40	0.00	0.46	0.00	**0.09**
Betas of shares	**0.96**	**0.73**	**0.44**	**0.21**	**0.71**	**1.87**	**1.37**	**0.58**	**1.41**	**0.67**	**1.77**	

Source: Authors' calculations

Portfolios were created with respect to the matrix of sensitivities and coeficients for market betas for the particular shares (shown in Table 1). In that step interest rates of Czech central bank had to be omitted, because this factor was overvaluing betas. This

factor was significant only in 3 out of 11 shares. This had hardly any effect on the weights of shares in portfolio with permitted short sale. In case of forbidden short sale it reflects only on the shares of VIG, which was not included in portfolio anyway. Based on the calculated betas can be assumed that shares of CETV, Erste Bank Group, NWR and ORCO are aggressive comparing to market. Rest is defensive, except of VIG which could be considered as market following share with beta 0.9587. The optimal portfolio with forbidden short sale had following weights: 45,21% for ČEZ, 21,15% for KB, 17,85% for PM, 0,14% for Telefónica O2 and 15,65% for Unipetrol. All the shares from the pool of selected titles with positive average returns were placed in the optimal portfolio. Largest part was invested into ČEZ which has the most stable performance. Weight of Telefónica O2 is rather small and can be theoretically ignored, if investment is realized in small amounts. Expected return of portfolio for quarter period is 5.2% and risk 24.94%. Risk seems to be high, but is still lower comparing to risk of single shares. Beta of portfolio is 0.58, which means that portfolio is defensive. In Figure 1 is shown development of portfolio in next quarter (DAX1), development of portfolio with allowed short sale (DAX3) and index PX for comparison.

Figure 1 Development of portfolios and index PX in 1st quarter of 2012



Source: Authors' processing

4 Conclusions

In this paper authors focused on the creation of a portfolio of stocks traded on the PSE. We examined data from 1997 - 2011. Due to lack of historical data, only 11 stocks were convenient for the intended portfolio. Quarterly data were analyzed. For the reason of stationarity we used differences of selected time series. For all econometric models it was necessary to test the data for autocorrelation, heteroscedasticity and multicolinearity. The significance of explanatory power for asset price development of all factors was statistically tested. Statistically insignificant factors were excluded. Afterwards, we set down the weights of assets for an optimal portfolio in the case of ban short sell. The resulting portfolio was represented by five companies. The estimated beta of portfolio was 0,58 which is defensive in comparison to the market. The expected return of the portfolio was 5,2% and the risk was 24,94%. Given the limitations of the time series some inaccuracies in the models may occur.

We investigated the multi-factor models to create an optimal stock portfolio. Authors used data from the PSE for the econometric models. In order to determine the beta of the market, the multifactor model was transformed into a single-factor model. Fifteen explanatory variables including delays of up to one year were used. On the basis of sequential F-test the most price-setting factors were chosen. In line with this approach we used a cut-off methodology to ascertain the optimal weight of selected stocks. The created portfolio was modeled assuming sell short ban. The factor portfolio is a very suitable tool for identifying the price-setting factors of selected stocks. Subsequently,

through these factors the relationship between securities can be determined, which is crucial for risk diversification.

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Change in Technical Efficiency of Slovak Banks over Time under the Intermediation Approach

Martin Boďa[1], Vlastimil Farkašovský[2], Emília Zimková[3]

[1] Matej Bel University in Banská Bystrica
Faculty of Economics, Department of Quantitative Methods and Information Systems
Tajovského 10, 975 90 Banská Bystrica, Slovak Republic
E-mail: martin.boda@umb.sk

[2] Matej Bel University in Banská Bystrica
Faculty of Economics, Department of Finance and Accounting
Tajovského 10, 975 90 Banská Bystrica, Slovak Republic
E-mail: vlastimil.farkasovsky@umb.sk

[3] Matej Bel University in Banská Bystrica
Faculty of Economics, Department of Finance and Accounting
Tajovského 10, 975 90 Banská Bystrica, Slovak Republic
E-mail: emilia.zimkova@umb.sk

Abstract: *The goal of the paper is to investigate into technical efficiency exhibited by Slovak commercial banks and its changes over the period from 2000 to 2012. Under the premise of the intermediation approach to evaluating technical efficiency in banking and by dint of the decomposition based the Malmquist index, both efficiency changes and productivity changes are analysed and commented in order to draw conclusions relevant for managerial purposes and to macro-regulation of commercial banks.*

Keywords: technical efficiency, Slovak banking industry, non-radial SBM model, Malmquist index, intermediation approach

JEL codes: G21, C44

1 Introduction

In the span of the years 2000 - 2012, three sub-periods in the development of the Slovak banking sector may be singled out on economic and analytical grounds (cf. Boďa and Zimková, 2014). In the first sub-period, from 2000 to 2003, the process of privatization was typical of the Slovak banking sector; in the second sub-period, from 2004 to 2008, the Slovak Republic entered the European union and commercial banks were pressed to make their active and passive operations of higher quality and implement principles of corporate governance; and, finally, in the third sub-period following the entry of the Slovak Republic to the monetary union, from 2009 – 2012, the financial crisis emerged and was of impact, which strengthen in consequence resilience of the Slovak banking sector. This periodization is recognized and respected in the paper and gives an impetus for investigations of efficiency changes that must have inevitably taken place in the development of the Slovak banking sector. This task is approached from the standpoint of Malmquist index analysis.

The Malmquist index is a standard tool that is employed in productivity analysis to evaluate efficiency changes of two sorts over time. It may be used in a parametric framework, yet most often is its employment tied with the non-parametric approach of data envelopment analysis, which is also the stance adopted in the paper. By its very definition, the Malqmuist index measures these two sorts of efficiency changes, viz. technological change and technical efficiency changes, which comes from the deliberation that over time the production possibility set changes (i.e. it notionally shifts upwards or downwards) and/or movements in the position of individual production units. Introduced for each production unit

- a technological change represents a shift of the production possibility frontier or, synonymously, the technology frontier (as an effect of innovations and technological enhancements) in the vicinity of the respective production unit, and

- a technical efficiency changes signifies an alteration (improvement or deterioration) of the relative performance of the respective production unit over time.

Speaking formally and clearly, it is the ambition of the paper to investigate the changes of technical efficiency in the Slovak banking sector and decompose them into those that are attributable to technological shifts and those that stem from boosts or decreases in efficiency performance for the period from 2000 to 2012. To this end, the intermediation approach to banking efficiency is adopted and this decomposition is based on the Malmquist index methodology. One need be aware that the intermediation approach provides needful guidance for theoretical considerations concerning the production process that runs in commercial banking. Under this concept of banking production, commercial banks transform total deposits to total loans acting thus as financial intermediaries.

Save the introductory and concluding sections, the body of the paper is organized into 3 other sections. The next section gives an overview of the literature and is complemented by a methodological section. The fourth section reports the results and includes their interpretation.

2 An Overview of the Literature

There have been several studies on the topic and the exposition of this section is restricted only those centred upon European banking. Prior studies (e.g. Casu et al, 2004, Angelidis et al., 2005, Řepková, 2012, Guarda and Rouabah, 2009) devoted to application of the Malmquist index in the sphere of the European banking industry usually utilized the CCR and BCC models of data envelopment analysis (abbreviated commonly as DEA). Still, their results concerning the efficiency of the banking sector in Europe are heterogeneous. The study undertook by Casu et al. (2004) aimed at measuring the dynamics of productivity in the five largest countries of Europe in the epoch of economic integration over the years 1994 – 2000 and finding the sources of their productivity. For some countries, their findings suggest that the main source of productivity increase was technological change (i.e. frontier shift upward), but for other countries, their conclusions are mixed and point to a fluctuating role of both technological change and technical efficiency change in productivity increase. The only study that acknowledged an increase in productivity due to technical efficiency change was the one conducted by Gurada and Rouabah (2009) for the banking sector of Luxembourg over the years 1994 – 2007. They found that most of the productivity growth followed from technical efficiency change rather than from technological change. Another study by Primorac and Troskot (2005) focused on productivity investigations of the Croatian banking sector over the liberalization years 2000 – 2003 and confirmed productivity decline and technological retrogression. The other two studies inquired into the efficiency changes present in the Czech banking sector. Angelidis et al. (2005) examined how the liberalization of the financial environment had influenced the productivity in the Czech banking sector in the course of the years 1996 – 2002, and they found that the cause of productivity stagnation was technological decline. Eventually, Řepková (2012) followed upon this research and found that for the years 2001 – 2010 the identified productivity decrease had been caused by a technological shift of the production frontier downward.

To the best knowledge of the authors, this paper is the only empirical (and theoretical) inquiry into the productivity of the Slovak banking sector and its changes through the optics of Malmquist index analysis.

3 Methodology

In order to determine the technical efficiency changes of organizational units of the Slovak banking sector under the intermediation approach, a Malmquist index analysis based on the non-radial SBM model was conducted for ten organizational units of the Slovak banking sector using the panel data for the period from 2000 to 2012. This data span is chosen with utmost care in regard to currency for the needs of this analysis and

in reference to another study by the authors (Boďa and Zimková, 2014). Though the paper arises in reference to the previous research of the authors, it is an original continuation and not an update. The methodological procedure stands on several characteristic points or assumptions that underlie and shape the line of research and they may be summarized into three points:

- the assumption of the production frontier time invariance during three identified phases of the Slovak banking sector development,
- the selection of organizational units of the Slovak banking sector and the selection of a particular set of inputs and outputs,
- the employment of non-radial SBM-based Malmquist index analysis.

These points are addressed and explained in brief in the following text.

First and foremost, it is assumed that the production function is time invariant during the three identified phases of the Slovak banking sector development (2000 – 2003, 2004 – 2008, 2009 – 2012). It frequently happens that production function changes over time. However, in some consecutive periods production function due to inertia of the economic environment may remain invariant in regard to a time shift. This view is applied in the paper and it is believed that there are some phases in the evolution of the Slovak banking sector during which its production function remained intact and shiftless. In the previous research the authors (Boďa and Zimková, 2014) classified and justified three such phases, or sub-periods, valid for the Slovak banking sector: 2000 – 2003, 2004 – 2008, 2009 – 2011. The current study extends the third phase into another year and treats the third period as stretching from 2009 to 2012. It is clear that adding 2012 to the third phase is a legitimate step since the economic crisis was fading away through the entire year of 2012.

The dataset comprises the data on 10 organizational units (commercial banks) operating in the Slovak Republic and it covers the great majority of Slovak banking structures (as the total of included banks exceeds 90 percent of the Slovak banking assets). The organizational units considered in the paper are listed in Table 1. In order to assure consistency of the analysis, building societies and special financial institutions are subject to exclusion. The source of the data is TREND Holding, s.r.o., Bratislava. The data used in the empirical analysis are the annual data disclosed by the ten organizational units of the Slovak banking sector during the period 2000 – 2012. During the period some of the organizational units underwent a merger or a takeover, it was therefore necessary to operate with aggregated values for the banks which changed its legal and economic status. The data on this banks are aggregated as a total and only the new organizational unit (through a merger or an acquisition) is considered.

Table 1 Organizational units of the Slovak banking sector subjected to the analysis

Organizational unit	
Československá obchodná banka, a. s. (in 2009 merged with Istrobanka, a. s.)	
Prima banka Slovensko, a. s. (before 2011: Dexia banka Slovensko, a. s.)	
Privatbanka, a.s. (before 2005 Banka Slovakia, a. s.)	
OTP Banka Slovensko, a. s.	Poštová banka, a.s.
Slovenská sporiteľňa, a. s.	Tatra banka, a.s.
VOLKSBANK Slovensko, a. s. (since 2013 Sberbank Slovensko, a. s.)	
Všeobecná úverová banka, a. s.	
UniCredit Bank Slovakia, a. s. (a 2007 merger of UniBanka, a. s. & HVB Bank Slovakia, a. s.)	

Source: the authors

Two inputs and one output are recognized in the study. The inputs are fixed assets per employee (in thousand euro per employee) and total deposits per employee (in thousand euro per employee) and the output is represented by total loans plus securities per employee (again in thousand euro per employee). The aggregate of total loans and securities serves as a proxy for earning assets. The act of dividing three production variables, viz. fixed assets, total deposits and total loans plus securities, by the average

number of employees in full time equivalents makes allowance for an additional production variable, which is labour force. This transformation is effected in the attempt to reduce the number of production variables entering the study. All the production variables used in this study are reported in compliance with International Accounting Standards / International Financial Reporting Standards (IAS/IFRS). Usage of the data from different years necessitated their deflation for a proper analysis. Individual data are deflated to the prices of 2000 by the GDP deflator provided by Eurostat.

Investigations of technical efficiency changes between the three sub-periods (the first sub-period --> the second sub-period, the second sub-period --> the third sub-period, and eventually the first sub-period --> the third sub-period) were somewhat restricted by the fact that invariance of production technology in individual sub-periods is assumed. In order to cope with this restriction, average values of the two inputs and of the output are taken to represent organizational units in each sub-period. The panel for the analysis is thus represented by three averages across the sub-periods calculated for the ten organizational units of the Slovak banking sector, representing thus a total of $3 \times 10 = 30$ observations.

Two quantities are set-up for each production unit in the Malmquist index: an index that measures technological change (contracted here for convenience as TECH), and an index that quantifies technical efficiency change (denoted here for simplicity as TCH). Since the Malmquist index is defined as a multiplication of these two indices, MI = TECH × TCH, in consequence of which for each production unit a different value is obtained, this fact is indicated in the right subscript appended to individual symbols later on.

In this paper, the assumption of variable returns to scale (abbreviated as VRTS) is accepted as general and non-restrictive (as it, of course includes a specific case of constant returns to scale) and combined with a non-oriented SBM model that is employed in estimating the non-radial Malmquist index. This effort is accomplished with the intention measuring and decomposing the technical efficiency changes present in the Slovak banking sector between the three periods earmarked and defended in the study. Note that it is common practice to use the rudimentary CCR or BCC model for the purpose of measuring technical efficiency. This study thus goes farther and is a natural prolongation of the previous work done by the authors (Boďa and Zimková, 2014). In the following, the methodology in its generality is exposited.

In the technical presentation of a DEA scheme for the Malmquist index methodology, two time instances must be distinguished s and t (with $s < t$) and they are denoted generally by a common time index τ. It is assumed that the data on n production units are available for each time instance $\tau \in \{s, t\}$, whereas any production unit o, $o \in \{1, ..., n\}$, produces s desirable outputs out of m inputs. The observed activities of production unit o at any time τ are represented by the m-dimensional input vector $\mathbf{x}_o^{\tau} = (x_{o1}^{\tau}, ..., x_{om}^{\tau})'$ and by the s-dimensional output vector $\mathbf{y}_o^{\tau} = (y_{o1}^{\tau}, ..., y_{os}^{\tau})'$. The elements of both vectors are positive. An observed activity is frequently understood as an ordered pair $(\mathbf{x}, \mathbf{y})$, in which the first element is an input vector and the second element is an associated output vectors. All the observed activities at any time τ are cast into a set P^{τ} and defined in the following way as $P^{\tau} := \{(\mathbf{x}_1^{\tau}, \mathbf{y}_1^{\tau}), ..., (\mathbf{x}_n^{\tau}, \mathbf{y}_n^{\tau})\}$. Individual inputs and outputs have corresponding vectors of potential slacks $\mathbf{s}^-_o = (s^-_{o1}, ..., s^-_{om})'$ and $\mathbf{s}^+_o = (s^+_{o1}, ..., s^+_{os})'$, which state how individual inputs and outputs must be improved in order that production unit o become efficient (whereas vector of inputs $\mathbf{x}_o$ need be reduced by $\mathbf{s}^-_o$ and vector of outputs $\mathbf{y}_o$ need be increased by $\mathbf{s}^+_o$). Nota bene, it will not be necessary to distinguish time indices in the case of slacks, and therein is the reason that a time index is not displayed. These slacks are to be identified within the DEA and serve as an exclusive basis of efficiency calculation for respective production unit o.

Of central importance is the production possibility set (hereinafter shortened as PPS) for technical efficiencies of production units are evaluated in respect to the frontier induced by this PPS and the shift of this frontier about individual production units is carefully quantified. In DEA applications (as well as in applications of other sorts), it is rigorously assumed that the PPS satisfies certain regularity conditions (that are in detail

summarized e. g. by Debreu (1959, pp. 37-42)). In DEA, the PPS is estimated from the observed set of activities as a set of convex linear combinations of observed inputs and observed outputs given that inputs produced in such a manner are not "better" than those actually observed and generated outputs are not "better" than those really observed. (Observe that convexity is induced by the assumption of VRTS for the production process in Slovak banking.) The verbal statement of the DEA-like PPS estimation is clarified by the exact definition that ensues. Having observed the set of activities P^{τ} at time τ, the PPS in the DEA fashion is denoted $PPS(P^{\tau})$ and is constructed as

$$PPS(P^{\tau}) = \left\{ (\mathbf{x},\mathbf{y}) \in \Re^{m} \times \Re^{s} : \ \mathbf{x} \geq \sum_{i=1}^{i=n} \{\boldsymbol{\lambda}\}_i \mathbf{x}_i^{\tau}, \ \mathbf{0} \leq \mathbf{y} \leq \sum_{i=1}^{i=n} \{\boldsymbol{\lambda}\}_i \mathbf{y}_i^{\tau}, \ \sum_{i=1}^{i=n} \{\boldsymbol{\lambda}\}_i = 1, \ \boldsymbol{\lambda} \geq \mathbf{0} \right\}. \qquad (1)$$

The symbol „≥" denotes at a vector that respective elements of this vector are non-negative and at least one element is non-zero.

Consider the following task of mathematical programming of the non-oriented SBM model under the assumption of VRTS which is solved separately for each production unit o, $o \in \{1, \ldots, n\}$, and in which τ and τ' are two time indices (such that $\tau, \tau' \in \{s, t\}$):

$$\rho_o\left((\mathbf{x}_o^{\tau}, \mathbf{y}_o^{\tau}), \tau'\right) = \frac{1 - \frac{1}{m}\sum_{i=1}^{i=m} s_{oi}^{-} / x_{oi}^{\tau}}{1 + \frac{1}{s}\sum_{j=1}^{j=s} s_{oj}^{+} / y_{oj}^{\tau}} = ! \min_{\boldsymbol{\lambda}, \mathbf{s}^{-}, \mathbf{s}^{+}} \quad \text{with respect to} \quad \begin{aligned} \mathbf{s}^{-} &= \mathbf{x}_o^{\tau} - \sum_{i=1}^{i=n} \{\boldsymbol{\lambda}\}_i \mathbf{x}_i^{\tau'} \geq \mathbf{0}, \\ \mathbf{s}^{+} &= \mathbf{y}_o^{\tau} - \sum_{i=1}^{i=n} \{\boldsymbol{\lambda}\}_i \mathbf{y}_i^{\tau'} \geq \mathbf{0}, \\ &\sum_{i=1}^{i=n} \{\boldsymbol{\lambda}\}_i = 1, \ \boldsymbol{\lambda} \geq \mathbf{0}. \end{aligned} \qquad (2)$$

The restrictions of the optimization task construct the PPS with respect to the set of activities $P^{\tau'}$ observed at time τ', and the optimization task then evaluated the technical efficiency of the activity $(\mathbf{x}_o^{\tau}, \mathbf{y}_o^{\tau})$ under the constructed $PPS(P^{\tau'})$. In this process, the information on technical efficiency is encoded in the value of a non-radial measure of efficiency ρ. The coefficient ρ taking values at interval $[0, 1]$ and it is the SBM score of technical efficiency (in this case of production unit o whose task (2) is subject to optimization). If for some production unit $\rho = 1$ happens to be the case, this production unit is called SBM-efficient, which means that it is technically efficient in the sample of n production units to be evaluated.

However, complications arise with such an interpretation due to the fact that two time indices τ and τ' are distinguished (whilst $\tau, \tau' \in \{s, t\}$) and task (2) encompasses in point of fact four non-linear programs. If $\tau = \tau' = s$ or $\tau = \tau' = t$, then the mathematical program in (2) leads to a conventional evaluation of technical efficiency and its result is a standard SBM score. In such a case, the technical efficiency of each production unit is evaluated with respect the PPS of the same period are within-period SBM technical efficiency scores are obtained. On the other hand, if $\tau = s, \tau' = t$ or $\tau = t, \tau' = s$, then the technical efficiency of each production unit is evaluated with respect the PPS of a different period, which produces intertemporal technical efficiency scores. A caveat must be placed here because intertemporal technical efficiency scores may easily have values greater than unity. This, of course, indicates a shift in the production frontier between periods.

Skipping the justification that technical efficiency scores produced by (2) can be thought of as estimates of the distance functions, one may define the Malmquist index step by step in the following way. The technical efficiency change $TECH_o$ of production unit o from time s to time t (retaining, of course, that $s < t$) is measured by the efficiency ratio

$$TECH_o = \frac{\rho_o\left((\mathbf{x}_o^{t}, \mathbf{y}_o^{t}), t\right)}{\rho_o\left((\mathbf{x}_o^{s}, \mathbf{y}_o^{s}), s\right)}, \qquad (3)$$

and the technological change TCH_o of production unit o over this period is quantified by the index

$$TCH_o = \sqrt{\frac{\rho_o\left((\mathbf{x}_o^{\,s},\mathbf{y}_o^{\,s}),s\right)}{\rho_o\left((\mathbf{x}_o^{\,s},\mathbf{y}_o^{\,s}),t\right)} \cdot \frac{\rho_o\left((\mathbf{x}_o^{\,t},\mathbf{y}_o^{\,t}),s\right)}{\rho_o\left((\mathbf{x}_o^{\,t},\mathbf{y}_o^{\,t}),t\right)}}. \tag{4}$$

Efficiency ratio (3) measures how relative technical efficiency of production unit o improved (if greater than 1) or worsened (if lesser than 1) from time s to time t. The expression in (4) is constructed as a geometric mean of two efficiency ratios. The first of them measures the local shift of the technological frontier in the vicinity of production unit o for its activity observed in time s and the second factor does this for the activity of production unit o observed in time t. The product of these two indices is called the Malmquist index and it may be shown by a simple re-arrangement that

$$TECH_o \cdot TCH_o = MI_o = \sqrt{\frac{\rho_o\left((\mathbf{x}_o^{\,t},\mathbf{y}_o^{\,t}),s\right)}{\rho_o\left((\mathbf{x}_o^{\,s},\mathbf{y}_o^{\,s}),s\right)} \cdot \frac{\rho_o\left((\mathbf{x}_o^{\,t},\mathbf{y}_o^{\,t}),t\right)}{\rho_o\left((\mathbf{x}_o^{\,s},\mathbf{y}_o^{\,s}),t\right)}}, \tag{5}$$

in other words, that it is a mere geometric mean of two efficiency rations: the one being the efficiency change measured with respect to $PPS(P^s)$ and the other the efficiency change measured with respect to $PPS(P^t)$. The MI is usually interpreted in terms of productivity. The case when the MI takes value greater than 1 is interpreted as a productivity increase, which contrasts with the situation when the MI has value lower than 1 and which suggest a fall in productivity.

The version of the Malmquist index entertained here is called the adjacent Malmquist index, which should act as a contrast to the base period Malmquist index (cf. Asmild et al., 2004). Yet, the authors opine that this form of emphasis and distinction is not necessary here as it is this version of the Malmquist index that is most frequent in analyses (see e.g. Angelidis et al., 2005; Casu et al., 2004, Cooper et al., 2007, pp. 328-344).

In the paper, the role of production units is undertook by the considered organizational units in the Slovak banking sector in the three phases of its development. The quantities now are thus $m = 2$ (the number of inputs), $s = 1$ (the number of outputs), and $n = 10$ (the number of organizational units). In the paper, there are three sub-periods recognized in the development of the Slovak banking sector. The Malmquist index analysis was therefore conducted to map changes from the first sub-period to the second one, from the second sub-period to the third one, and, lastly, over the entire period from the first sub-period to the third sub-period.

4 Results

All computations were performed by means of the commercial application DEA-Solver Professional version 11 distributed by SAITECH, Inc., and some figures were obtained by sub-sequent processing of the results in the program Microsoft ® Excel 2013. The results are displayed compactly in Table 2. The former table shows the results of the analysis and the decomposition of the Malmquist index (MI) into the technical efficiency change (TECH) and the technological change (TCH) for each of the 10 organizational units of the Slovak banking sector.

The Malmquist index over the entire investigated period 2000 – 2012 showed an increase of productivity in the Slovak banking sector on average 6.4 % and this increase was chiefly triggered by a positive upward shift of the production frontier of average 16.5 %, whereas the technical efficiency of organizational units decreased on average by 9.3 %. The rise of productivity was not straightforward as productivity fluctuated between the sub-periods. Between the first phase (the period of privatization and economic standardization of 2000 – 2003) and the second phase (the period of corporate governance implementation and introduction of a wide spectrum of new financial services in 2004 – 2008) the productivity of Slovak banking fell on average by 16.4 % and it rose up to the third phase (the epoch of banking consolidation and resilience against the financial crisis in 2009 – 2012) by 23.60 % on average.

The decrease of productivity of banking intermediation in the second phase of standard banking business adoption (relative to the first phase of privatization) was predominantly caused by a decrease of technical efficiency of individual banks on average by 16.0 %, which points to incompetence of managerial decisions in banking production process of the majority of the analysed Slovak banks. The most substantial fall of technical efficiency status was recorded by UniCredit Bank Slovakia, a. s., VOLKSBANK Slovensko, a. s., Prima banka Slovensko, a. s. Note that between the first and the second phase, also a positive upward shift of the production frontier by about 6.6 % on average was found (and exhibited by 7 out of the 10 analysed banks). This is reflected by the fact that privatized banks implemented new innovations and gained technological progress through foreign parent companies, though the managerial decision-making in this period did not give rise to technical efficiency of inefficient banks in comparison to technically efficient banks.

Table 2 Results of the Malmquist index analysis between the sub-periods

Sub-periods evaluated	FIRST PHASE --> SECOND PHASE			SECOND PHASE --> THIRD PHASE			FIRST PHASE --> THIRD PHASE		
Bank	**TECH**	**TCH**	**MI**	**TECH**	**TCH**	**MI**	**TECH**	**TCH**	**MI**
Československá obchodná banka, a.s.	1.3498	1.3137	**1.7731**	0.6553	0.9830	**0.6442**	0.8845	1.2279	**1.0861**
OTP Banka Slovensko, a.s.	0.9240	0.4918	**0.4544**	1.0019	0.5620	**0.5630**	0.9258	0.5549	**0.5137**
Poštová banka, a.s.	1.6890	0.6491	**1.0963**	0.3971	1.8833	**0.7478**	0.6706	1.5608	**1.0467**
Prima banka Slovensko, a.s.	0.4835	1.1027	**0.5332**	0.9279	1.0640	**0.9872**	0.4487	1.2158	**0.5455**
Privatbanka, a.s.	1.0355	0.9878	**1.0228**	2.9702	1.7623	**5.2343**	3.0755	1.2825	**3.9442**
VOLKSBANK Slovensko, a.s.	0.4709	1.3459	**0.6337**	1.0134	0.5145	**0.5214**	0.4772	1.0892	**0.5197**
Slovenská sporiteľňa, a.s.	0.6041	1.1246	**0.6793**	1.0627	0.8309	**0.8830**	0.6420	1.2040	**0.7729**
Tatra banka, a.s.	1.0333	1.0937	**1.1302**	0.9390	0.9986	**0.9378**	0.9704	1.1097	**1.0768**
UniCredit Bank Slovakia, a.s.	0.1922	1.2549	**0.2412**	1.4109	0.6968	**0.9831**	0.2712	1.2818	**0.3476**
Všeobecná úverová banka, a.s.	0.6142	1.2984	**0.7975**	1.1482	0.7490	**0.8600**	0.7052	1.1201	**0.7899**
Summary indicator									
Average value	0.8396	1.0662	0.8362	1.1526	1.0044	1.2362	0.9071	1.1647	1.0643
Max	1.6890	1.3459	1.7731	2.9702	1.8833	5.2343	3.0755	1.5608	3.9442
Min	0.1922	0.4918	0.2412	0.3971	0.5145	0.5214	0.2712	0.5549	0.3476
Standard deviation	0.4537	0.2876	0.4378	0.6940	0.4686	1.4150	0.7939	0.2528	1.0455

Source: the authors

On the contrary, the rapid increase of productivity in the third phase of banking consolidation in defiance to the financial crisis (2009 – 2012) as compared to the second phase was for the most part incurred by an increase in technical efficiency of banks by as much as 15.3 % on average. In the meantime, the production frontier remained almost in the identical position as in the previous phase because only a slight (0.4 %) improvement of technological status was established. To this positive change a total of six out of the 10 analysed banks made their contribution.

During the entire analysed period of 12 years, the most dynamic rise of productivity was manifested by Privatbanka, a. s., which displayed a positive change of productivity in both inter-periods. Whilst in the first inter-period (from the first phase to the second one), the increase of productivity was influenced by an increase of technical efficiency whose benefits were intermediated by austerity measures of its management in the area of fixed assets, in the second inter-period (and in the second phase to the third one), this bank markedly had the production frontier in its vicinity shifted upwards by means of innovations of its intermediation technology.

5 Conclusions

This paper represents a case study, in which organizational units of the Slovak banking sector over the years 2000 – 2012 are evaluated in terms of technical efficiency changes that they underwent in their operations from the standpoint of the intermediation approach. In the evaluation, a Malmquist index analysis was utilized based on the non-

radial non-oriented SBM model through which technical efficiency scores were calculated which approximated distance functions originally used in the definition of the Malmquist index. The analysis was conducted under the assumption of variable returns to scale and under the belief that the production frontier remains constant in three identified sub-periods. The original contribution of the paper rests in directing the focus of academic research to investigating efficiency changes for the Slovak banking sector by means of the Malmquist index methodology and in using the non-radial SBM model to such an end.

The study included in the paper has proven that over the entire investigated period of 13 years the productivity in the Slovak banking sector improved and this increase can be quantified as 6.4. % on average. This positive development is exclusively attributable to implementation of new innovations and was accompanied by an overall decrease of technical efficiency. The first factor is most important to regulatory bodies as it informs of production technology shifts in financial intermediation and gives promises of a higher quality of banking intermediation. The National Bank of Slovakia is free to expect a smother functioning of the financial intermediation carried out by the Slovak banking sector in a near future. The second factor is relevant from a managerial aspect and instructs the executive boards of individual commercial banks how they might interpret their managerial skills and changes in the positions of relative technical efficiency. Additionally, it also places some banks with a worse development of productivity (as measured by the Malmquist index itself) in the spotlight of the National Bank of Slovakia

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Factors behind the Pricing of Eastern and Western European Oil and Gas Companies

Gábor Bóta, Mihály Ormos, Dániel Tunkli

Budapest University of Technology and Economics, Department of Finance
Magyar tudósok krt. 2., 1117 Budapest, Hungary
E-mail: bota@finance.bme.hu, ormos@finance.bme.hu, tunkli@finance.bme.hu

Abstract: *We investigate the factors influencing returns of European oil and gas companies. Our dataset consist of 60 European oil and gas firms: 39 representing developed Western European countries and 21 from Central and Eastern Europe. We run regressions for the following market equilibrium models: standard CAPM, Fama-French three-factor model, Carhart four-factor model and Pastor-Stambaugh five-factor model using different variables as a market proxy, furthermore we extend all the models with the oil price as well. We also distinct different situations regarding the movement of general market prices, and oil price as well to examine regime dependency of the applied model. Our results show that including oil price factor increase the explanatory power of all the models, although we can detect significant differences for companies from developed and emerging Europe. It is an interesting finding that even models using an emerging European index as a market proxy result higher determination coefficient for companies from developed countries than for emerging ones. We find that by involving firm size, book-to-market ratio, momentum and liquidity factors the explanatory power of the model is gradually increasing both for western and eastern European companies. The increasing and decreasing market dummies are proved to be insignificant for most of the companies regardless of their region contrary to the oil price regimes which proved to be significant in most of the cases. The explanatory power of the models include oil price dummy is increased.*

Keywords: asset pricing, oil price, time varying beta

JEL codes: G12, G15

1 Introduction

We examine the factors influencing the pricing of European oil and gas companies. We divide our dataset of 60 European oil and gas companies into two sub-categories: Western and Eastern European countries, the former group consists of 39, while the latter of 21 companies. We incorporate the regional distinction in order to detect differences in the price developments of companies from the two regions. We test different equilibrium models such as standard CAPM, Fama-French (1996) 3 factor model, Carhart (1997) four-factor model and Pastor-Stambaugh (2003) five-factor model to capture the significant parameters influencing the oil and gas companies pricing by applying different variables as a market proxy; furthermore we extend all the models with the oil price.

Oil price is an important factor influencing economic activity as Hamilton (1983) and Mork (1989) show oil price shocks are the reason behind most US recessions. Jones et al. (2004) provide a detailed review of literature about developments in theoretical and empirical understanding of the macroeconomic consequences of oil price shocks.

The results of papers focusing on the relationship between oil prices and stock market returns strongly depend on the countries, industries and even periods examined. Chen, Roll and Ross (1986) find no overall effect of oil prices on asset pricing, Huang et al. (1996) also find that oil futures returns are not correlated with stock market returns, except for oil companies. Basher and Sadorsky (2006) conclude that oil price risk impact stock price returns in emerging markets. Aloui et al. (2013) also show positive, however varying among countries, dependence between oil price changes and returns of Central and Eastern European stock market indices. Asteriou and Bashmakova (2013) estimate negative and statistically significant coefficient for oil price risk for Central and Eastern

European stock market indices, adding that the reaction of the stock returns to oil price changes is more significant when oil prices are low. On the contrary Nandha and Hammoudeh (2007) find that stock returns in the Asia-Pacific markets show no sensitivity to oil price. Fang and You (2014) detect mixed effects of oil price changes on the stock returns of China, India and Russia.

Several articles examine the effects of oil price changes on sector level. For example Faff and Brailsford (1999) find that Australian, Sadorsky (2001) or Boyer and Filion (2007) that Canadian, El Sharif et al (2005) that British while Arouri and Nguyen (2010) that European oil and gas industry has significant sensitivity to the oil price. Nandha and Faff (2008) find that oil price rises had a negative impact on equity returns for all of the examined 35 global sectors except mining, and oil and gas industries. Ramos and Veiga (2011) also show that oil price has a positive impact on global oil and gas industry returns, however they document that oil price risk is a more important factor in developed country industries than in emerging markets. Nandha and Brooks (2009) also document substantial differences in the role of oil price changes in determining transport sector returns between developed and emerging countries. Moya-Martinez et al. (2014) demonstrate limited but varying exposure of stock returns to oil price changes across different Spanish industries.

On the firm level Oberndorfer (2009) shows that oil price changes positively related to returns of oil and gas stock returns in the Eurozone. Mohanty et al. (2010) find no significant relation between oil prices and returns of Central and Eastern European oil and gas companies. Narayan and Sharma (2011) not only find positive relation between oil price changes and returns of NYSE-listed energy and transportation companies but they report adverse effects for stock returns of companies representing other sectors.

2 Data and Methodology

Our dataset includes monthly returns of 60 European (39 from developed and 21 from emerging European countries) oil and gas companies for the period January 2002 – December 2012. After similar difficulties of data collection as described by Tóth and Jónás (2014) we choose Reuters Datastream as the main source of data. The companies are those constituents of the Europe-Datastream Oil and Gas index that have data for the whole investigated period. As oil price factor we use the monthly returns of Brent Crude oil, expressed in U.S dollar/barrel. We use two different market proxies in our models: the MSCI European Emerging Market Index (source: Thomson Reuters Datastream) and the market factor for (developed) European companies of Center for Research in Securities Prices from Kenneth R. French's website. This latter webpage is the source of the (developed) European Fama-French factors (1996) and the Carhart (1997) momentum factors. Pastor-Stambaugh (2003) liquidity factors are downloaded from the website of The University of Chicago Booth School of Business.

First we run regressions for the following market equilibrium models: standard CAPM, Fama-French three-factor model, Carhart four-factor model and Pastor-Stambaugh five-factor model using the standard parameters (for European companies), than we add the oil price factor as well. In the equilibrium models as a market factor we use both the CRSP European market factor (including developed Western European countries) and the MSCI European Emerging Market index. Table 1 presents the average adjusted determination coefficients (R^2) for the whole dataset and the Western and Eastern European sub-sets as well.

Our results (in Table 1) show that incorporating the oil price factor into the equilibrium models the average R^2 increases in all cases. Based on the average adjusted R^2-s we can also state that increasing the number of factors in the model increases the explanatory power. Comparing the explanatory powers of the equilibrium models using different market proxies the models applying the emerging European market index have higher explanatory power not only for the Eastern European companies, but for the Western European companies as well. This latter result seems a bit surprising at a first glance as it shows that in the case of these Western European oil and gas companies an

equilibrium model using an Eastern European market index seems to be superior to a Western European index in explaining their returns.

Table 1 Average adjusted R^2-s of different equilibrium models

	1-factor	+oil	3-factor	+oil	4-factor	+oil	5-factor	+oil
Eastern Eur	0.111	0.164	0.155	0.185	0.158	0.188	0.166	0.197
Western Eur	0.210	0.268	0.303	0.328	0.304	0.330	0.314	0.339
all companies	0.175	0.232	0.251	0.278	0.253	0.280	0.263	0.290
market proxy: Developed EU								
	1-factor	+oil	3-factor	+oil	4-factor	+oil	5-factor	+oil
Eastern Eur	0.229	0.246	0.244	0.256	0.247	0.259	0.255	0.267
Western Eur	0.309	0.317	0.341	0.344	0.349	0.353	0.363	0.367
all companies	0.281	0.292	0.307	0.313	0.313	0.320	0.325	0.332
market proxy: Emerging EU								

Notes: this table presents the average adjusted R^2 values of the estimations for the whole sample and the regional breakdown of the oil and gas companies.

Table 1 also shows that the average explaining power of the five-factor model extended with the oil price is higher for the whole sample and both for Western and Eastern European companies when using the emerging European index instead of the CRSP developed Europe market proxy. We present the detailed company-level results of the extended five factor model only using the emerging European index as a market proxy and only refer to some of the results of the model using the CRSP developed European market factor, however the detailed results of the latter model are available upon request.

3 Results

Turning to the results of individual companies by the five-factor model extended with the oil price (Table 2 and Table 3) we can measure significant excess returns only for 2 (at 5% significance) out of the 21 Eastern European companies and 2 (at 10% significance) out of the 39 Western European companies using both the CRSP developed Europe and the emerging European index as a market proxy.

The market factor is significant for all the 38 Western European companies with no respect of the market proxy used (however in case of CRSP developed Europe proxy it is significant in 35 cases at 1% and in 3 cases at 5%, while using the emerging European index there are 37 cases at 1% significance and 1 at 10%). For Eastern European companies the CRSP developed Europe and the emerging European market factors are significant in 9, 3, 3 and 13, 0, 2 cases at 1%, 5% and 10% significance respectively.

Oil price is a significant factor for more companies when using the CRSP developed European market factor than in the case of using the emerging European index: for Western European companies oil price is significant for 27 companies (11, 11 and 5 at 1%, 5% and 10% respectively) when using the model with the CRSP market proxy, for the model using the emerging European index the number of companies when oil is a significant factor is only 9 (2, 6 and 1 at 1%, 5% and 10% respectively). For the Eastern European companies oil price is significant in the model using CRSP developed Europe factor in 12 cases (7, 3, and 2 at 1%, 5% and 10% respectively) and in 7 cases (4, 1 and 2 at 1%, 5% and 10% respectively) when applying the emerging European index.

Our results show that market capitalization is not a significant factor for most of the Eastern European companies when we use emerging European index as a market proxy (not significant in 16 cases and significant at 1% in 3 cases and at 5% in 2 cases); however, the results of the model using the CRSP developed European index the SMB factor is significant for 14 Eastern European companies (6, 3 and 5 at 1%, 5% and 10% respectively). In the case of Western European companies the SMB factor is significant for 23 companies (13, 6 and 4 at 1%, 5% and 10% respectively) in the model using the

emerging market proxy while for 30 companies (24 at 1% and 6 at 5%) in the model using the CRSP developed European index.

Table 2 Five-factor model extended with the oil price factor using emerging European index as a market proxy for Western European companies

Company	Country	Alpha	market	SMB	HML	WML	LIQ	oil	Adj.R^2
Total	France	0.003	0.437***	-0.318	0.082	-0.021	0.311***	-0.016	0.472
BP	UK	-0.003	0.305***	-0.453	0.518**	0.013	0.300***	0.103	0.312
RD.Shell	UK	0.004	0.399***	-0.468**	-0.303	0.037	0.337***	0.000	0.422
ENI	Italy	0.004	0.401***	-0.080	0.328	0.036	0.313***	-0.002	0.399
Bg.group	UK	0.005	0.536***	0.330	-0.138	0.023	0.221**	0.032	0.489
Repsol	Spain	-0.001	0.366***	-0.220	0.851***	-0.137	0.109	0.101	0.361
Tullow	UK	0.009	0.675***	0.301	-0.037	0.202	-0.128	0.199**	0.414
Technip	France	0.005	0.781***	0.612**	-0.377	-0.387**	0.115	0.065	0.557
Saipem	Italy	0.009	0.603***	0.282	0.165	-0.310**	0.318***	0.164**	0.572
Amec	UK	0.006	0.549***	1.260***	-0.206	-0.369**	0.160	-0.085	0.391
Subsea.7	Norway	-0.001	0.582***	2.590***	0.075	-0.374	0.536**	0.190	0.366
Fugro	Netherl.	0.006	0.598***	0.763**	0.215	-0.224	0.307***	0.111	0.554
Vestas	Denmark	-0.017	0.583***	1.920***	0.482	-0.956***	-0.077	0.140	0.299
Cairn	UK	0.008	0.638***	0.732	0.101	-0.111	0.099	0.060	0.323
Comp Gen.	France	0.000	0.756***	1.317***	0.801**	-0.214	0.480***	0.015	0.526
Premier.oil	UK	0.006	0.556***	0.574	0.775**	-0.197	-0.092	0.124	0.408
Sbm.offsh	Netherl.	-0.006	0.552***	0.841**	0.461	-0.141	0.324**	0.035	0.341
Dragon.oil	Ireland	0.015	0.533***	1.444**	-0.164	-0.498**	0.052	0.277**	0.298
Hellenic	Greece	-0.001	0.490***	0.070	0.408	-0.055	0.086	0.044	0.300
Soco.int	UK	0.013	0.351***	-0.124	0.247	-0.206	-0.003	0.084	0.122
Dno.int	Norway	0.015	0.637***	0.504	0.252	-0.075	0.440**	0.098	0.272
Fred.olsen	Norway	0.018	0.754***	1.175**	-1.046**	-0.614**	0.221	0.025	0.347
Petroleum	Norway	-0.011	0.981***	3.461***	-1.357	-0.693	0.317	0.177	0.219
Tgs.nopec	Norway	0.010	0.516***	2.478***	-0.001	-0.315	0.547***	0.056	0.442
Total.g	France	0.008	0.359***	0.752**	0.134	0.126	-0.040	0.209**	0.297
Hunting	UK	0.009	0.634***	-0.117	-0.059	-0.524**	-0.014	0.146	0.356
Erg	Italy	0.004	0.196**	0.351	1.150***	-0.182	0.364***	0.112	0.236
Maurel	France	0.013	0.387***	0.588	1.235***	-0.307	0.065	0.161	0.333
Prosafe	Norway	0.009	0.780***	0.741**	-0.824**	-0.167	0.305**	0.048	0.511
Abengoa	Spain	-0.006	0.602***	1.464***	1.057**	-0.149	0.126	-0.051	0.372
Bonheur	Norway	0.012	0.562***	1.959***	-0.456	-0.563***	0.148	0.115	0.441
Cape	UK	0.009	0.619***	2.856***	1.133	-1.608***	-0.177	0.493**	0.392
Esso	France	-0.001	0.331***	0.949***	0.507**	-0.343**	0.159	0.158**	0.451
Farstad	Norway	0.012**	0.233***	1.173***	-0.086	-0.610***	0.093	0.221***	0.364
Ganger.rolf	Norway	0.012	0.517***	1.723***	-0.119	-0.401**	0.229**	0.066	0.418
Porvair	UK	-0.007	0.038	2.410***	-0.281	-0.073	0.068	0.280**	0.214
Aminex	Ireland	-0.024	0.544***	1.791**	-0.073	-0.226	0.036	0.252	0.145
Fluxys	Belgium	0.012**	0.243***	0.534**	0.443	0.005	-0.152	-0.028	0.133
OMV	Austria	0.002	0.488***	0.188	0.458	-0.019	0.134	0.301***	0.462

Notes: This table shows the results of the extended five-factor model, using emerging European index as a market for Western European oil and gas companies for the full sample period of January 2002 and December 2012. *, **, *** denote significance levels of 10%, 5% and 1% respectively.

There are no differences between the two models using different market proxies in the case of the book-to-market, momentum and liquidity factors. HML is significant for 4 Eastern European and 10 Western European companies in the model using the emerging European, while the number of significant cases is 2 and 8 using the CRSP developed European factor. Momentum is a significant factor 3 Eastern European and 12 Western European companies in the former and for 4 and 6 companies in the latter model. The number of significant cases for liquidity factor are 4 Eastern European and 15 Western European companies in the former and 6 and 15 companies in the latter case.

Table 3 Five-factor model extended with the oil price factor using emerging European index as a market proxy for Eastern European companies

Company	Country	alpha	market	SMB	HML	WML	LIQ	oil	Adj.R^2
Omv.petrol	Turkey	-0.008	0.603***	1.680***	0.132	-0.697***	0.088	0.071	0.326
Tupras	Turkey	0.012	0.982***	-0.141	-0.268	-0.446**	0.043	-0.166	0.442
Dogan.	Turkey	-0.002	0.858***	0.480	0.344	-0.395	0.438**	-0.176	0.341
Mol	Hungary	-0.002	0.739***	0.166	1.218***	0.009	0.122	0.012	0.519
Unipetrol	Czech R.	0.002	0.567***	0.589	0.850**	0.103	-0.220	0.030	0.286
Lukoil	Russia	0.003	0.920***	0.360	-0.089	-0.120	-0.001	0.083	0.671
Surgutneft.	Russia	0.002	0.697***	-0.540	0.131	0.059	0.365**	-0.071	0.257
Oil.terminal	Romania	-0.006	0.520***	1.430**	0.969	-0.097	-0.242	0.463***	0.299
Surgut.pref	Russia	0.005	0.635***	0.355	0.287	-0.017	0.248	0.029	0.272
Rompetrol	Romania	0.006	0.737***	0.936	0.826	0.189	-0.179	-0.055	0.221
Gazprom.neft	Russia	0.004	1.153***	0.297	-0.656	0.120	0.069	0.150	0.502
Plk.orlen	Poland	-0.001	0.726***	-0.155	0.912**	-0.066	-0.055	0.015	0.487
Slovnaft	Slovakia	0.004	0.012	0.111	0.808**	0.229	-0.061	0.207**	0.030
Petrol	Slovenia	0.024	0.075	2.893***	1.283	-0.361	-0.263	-0.051	0.070
Petrol	Bulgaria	0.001	0.089	0.000	0.449	0.272	-0.172	0.247**	0.088
Turcas.petrol	Turkey	0.002	0.304	1.563**	0.046	0.063	-0.529**	0.322**	0.113
Omv.petrom	Romania	0.007	0.233	0.862	0.480	-0.262	-0.348	0.502***	0.168
Istrabenz	Slovenia	-0.042**	0.407**	0.428	1.115	1.070**	0.089	-0.149	0.035
Petrolina	Cyprus	0.007	0.209**	0.370	-0.527	-0.019	-0.217	0.115	0.027
Bashneft	Russia	0.030**	0.153	1.766***	-0.376	-0.378	-0.381**	0.443***	0.158
Tatneft	Russia	0.011	0.406***	0.703	-0.597	-0.342	-0.785***	0.608***	0.305

Notes: This table shows the results of the extended five-factor model, using emerging European index as a market for Eastern European oil and gas companies for the full sample period of January 2002 and December 2012. *, **, *** denote significance levels of 10%, 5% and 1% respectively.

4 The Effect of Different Market Circumstances

We have incorporated additional variables into our model to distinct different market situations: by using dummy variables we have separated bullish and bearish markets and to capture the effect of oil price changes on the examined oil and gas companies we have also separated periods of increasing ad decreasing oil prices.

The general market condition is captured by a market dummy equals zero in the months when the market return is above the average return of the previous 36 months (and equals 1 when it is below the average). Oil price dummy is constructed in the same way: when monthly oil price change is above the average of the changes of the previous 36 months it is zero (and equals one when it is above the average).

Incorporating the dummy variable reflecting to the monthly oil price change in the models increase the explaining power of all the equilibrium models. Table 4 show the changes in explaining power resulted by adding the oil price change dummy to the model compared to the adjusted R^2-s presented in Table 1.

Table 4 Change in average adjusted R^2-s of different equilibrium models caused by adding oil price change dummy

	1-factor	+oil	3-factor	+oil	4-factor	+oil	5-factor	+oil
Eastern Eur	0.024	0.009	0.009	0.010	0.010	0.010	0.010	0.010
Western Eur	0.045	0.001	0.019	0.001	0.019	0.001	0.019	0.001
all companies	0.037	0.004	0.015	0.004	0.016	0.004	0.016	0.004
market proxy: Developed-EU								
	1-factor	+oil	3-factor	+oil	4-factor	+oil	5-factor	+oil
Eastern Eur	0.002	0.009	0.000	0.011	0.001	0.011	0.001	0.011
Western Eur	0.006	0.000	0.003	0.001	0.004	0.001	0.004	0.001
all companies	0.005	0.003	0.002	0.004	0.003	0.004	0.003	0.004
market proxy: Emerging-EU								

Notes: this table presents the change after incorporating oil price change dummy into the model in average adjusted R^2 values of the estimations for the whole sample and the regional breakdown of the oil and gas companies.

If we consider the company level results oil price dummy is a significant factor (in the extended five-factor model) for 10 (2, 3 and 5 at 1%, 5% and 10% respectively) Eastern European companies and for 4 Western European companies (3 at 5% and 1 at 10%) in the model using emerging European market index. (The number of significant cases are 8 and 4 for Eastern and Western European companies when using the CRSP developed Europe index.) So these results suggests that the oil price movement has a larger impact on Eastern European oil and gas companies than on Western Europeans. This result may suggest that Eastern European companies are more exposed to the effect of the oil price changes, which can be the result of different level of hedging used by the companies of the two regions.

Table 5 Change in average adjusted R^2-s of different equilibrium models caused by adding market dummy

	1-factor	+oil	3-factor	+oil	4-factor	+oil	5-factor	+oil
Eastern Eur	0.000	-0.001	0.003	0.000	0.003	0.000	0.004	0.002
Western Eur	-0.003	-0.002	-0.001	-0.002	-0.002	-0.002	-0.002	-0.002
all companies	-0.002	-0.002	0.000	-0.001	0.000	-0.001	0.000	-0.001
market proxy: Developed-EU								
	1-factor	+oil	3-factor	+oil	4-factor	+oil	5-factor	+oil
Eastern Eur	0.004	0.002	0.004	0.002	0.004	0.002	0.003	0.002
Western Eur	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
all companies	0.001	0.000	0.001	0.000	0.001	0.000	0.001	0.000
market proxy: Emerging-EU								

Notes: this table presents the change after incorporating market dummy into the model in average adjusted R^2 values of the estimations for the whole sample and the regional breakdown of the oil and gas companies.

As the results presented in Table 5 the effects of adding the proxy representing the general market condition are mixed as the explaining power of the models are lower in some cases than the adjusted R^2-s presented in Table 1.

The results of the company level regressions show that market dummy is significant only for 4 Eastern European and 3 Western European companies (but only at 5% and 10% level using the emerging European index and only for two Eastern European and no Western European companies using the CRSP developed Europe market proxy), so general market condition does not seem to have a significant impact on the returns of oil and gas companies.

5 Conclusion

In this empirical paper we investigate the main factors influencing returns of 60 European oil and gas firms; 39 representing developed Western European countries and 21 from Central and Eastern Europe. We test four different asset pricing models applying different market proxies, and we extend all the models with the oil price as well. We also test different situations regarding the movement of general market prices, and oil price as well to examine regime dependency. We find that oil price factor increase the explanatory power of all the models. We find that by involving firm size, book-to-market ratio, momentum and liquidity factors the explanatory power of the model is gradually increasing both for western and eastern European companies. The increasing and decreasing market dummies are insignificant for most of the companies regardless of their region contrary to the oil price regimes, which proved to be significant in most of the cases. The explanatory power of the models include oil price dummy is increased.

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Cointegration-Based Active Portfolio Selection in the European Stock Markets

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

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

[2] Budapest University of Technology and Economics
Financial Mathematics
Egri József utca 1, H-1111 Budapest, Hungary
nagyl@finance.bme.hu

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

Abstract: *We analyze the return gained by cointegration-based pairs trading arbitrage strategy in Western and Eastern European capital markets. We find contrarian evidence to the weak form of market efficiency. The aim of the paper is to explore the mean reversion nature of the highly cointegrated stock pairs and create a trading strategy with predefined entry and exit points. We create portfolios by using 250 day long test periods based on the cointegration selection of the pairs and then traded for 125 days. The realized net return between 1995 and 2012 are 10.4% and 15.2% 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 is market neutrality we find low correlations. The portfolios' Sharpe-ratios for the full sample period are 2.25 (western) and 2.67 (eastern).*

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

JEL codes: C53, G17

1 Introduction

We investigate the cointegration-based pairs trading strategy on the European stock market. A pair trading is a market neutral statistical arbitrage strategy based on the convergence of stock prices. Stock pairs which present significant cointegration are selected, and then by adding equivalent long and short positions we create zero-investment portfolios; 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 results in abnormal return. In our paper we compare the above mentioned active portfolio strategy to passive portfolio holding, that is 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. We use 20 years of market data and we divide the European sample into Western and Eastern European countries. We analyze the mean reversion nature of cointegrating stock pairs and create a trading strategy with predefined entry and exit points. Mean reversion is a behavioral effect, which as De Bondt and Thaler (1985) argue connected to overreaction and misbeliefs similarly to intellectual capital determination (Tóth and Jónás, 2011, 2012; and Jónás et al., 2012). As a result of our empirical study, we argue that the strategy gains an average annual return of 10.4% in Western Europe and 15.2% in Eastern Europe in the recent 17 years. In Western Europe, the standard deviation is 4.6%, and the Sharpe-ratio is 2.25. In Eastern Europe, the standard deviation is 5.7%, and the Sharpe-ratio is 2.67. Annual returns are calculated as simple arithmetic averages contrary to the proposition of Andor and Dülk (2013).

The applied pairs trading method is an investment strategy developed by Gerry Bamberger and Nunzio Tartaglia quantitative analyzers of Morgan Stanley against the perfect market of the Black-Scholes-Merton model appearing in the 1970s, which 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 further developed by Elliott et al. (2005), Mohanty et al. (2010) and Andor et al. (2011) by replacing two different businesses with a single one and modeling the correlation between its internal value process and its market price with stochastic methods. The model can also be applied in real option analyses see Andor and Bóta (2006a, 2006b and 2007).

In the 1980s, pair 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 still in 1987, then its efficiency reduced as a result of the intensifying spread of the method, and therefore the group of Tartalgia was dissolved by 1989.

2 Theoretical Background

Gatev et al. (2006) analyze 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 contain the twenty best pairs and generate an average monthly gross return of approximately 1.44 percent (t-statistics=11.56), their research also explore significant differences between profits before and after the 1980s. While on the basis of data before the 80s 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 pair trading has 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 80s. In their scholarly paper Gatev et al. (2006) also prove that the portfolio is sensitive to parallel yield curve movements, and it results in higher profits in the case of a rising yield curve.

The study on the composition of the portfolio 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. During the back test, the yield generated by the strategy is double the yield of S&P 500 with less standard deviation. We note that this is a completely market neutral investment strategy since the portfolio is hardly sensitive to the systematic risk factors.

Following the 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 pair 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 during the back test contains the best twenty pairs with even weights. The results obtained during the research are significantly similar to the results obtained by Gatev et al. (2006). The average excess return of the portfolio built during the analysis of the prices of the TSEC is 10.18% per year against the portfolio of the Taiwanese market, while the excess return is 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, whole in accordance with the analysis by Gatev et al. (2006) 19.30 out of the twenty pairs of the portfolio used by them could obtain a position. The periods covered are divided into half-years (125 day) periods. Each half-year trading period is preceded by a 250 day observation period, and therefore the portfolio is adjusted on the basis of the new data every half year.

$$\hat{P}_t^A := \prod_{\tau}^{t} 1 + r_\tau^A \quad (1)$$

After calculating the $\hat{P}_t^A$ values of each company involved in the index, their standard deviations are calculated (i.e. the standard deviation of 127,750 time series for 500 listed stocks, and of 208,981 time series for 647 listed stocks), then the pairs are ranked on the basis of the standard deviations of the differences, and the twenty pairs with the least standard deviations are chosen for further examination. For the determination of the difference between two stocks

$$Cloeseness^{AB} := \sum_{t=1}^{250} \left(\hat{P}_t^A - \hat{P}_t^B\right)^2 \quad (2)$$

is introduced as an index number.

The opening times of the position are determined with a so-called trigger value. The return on the pair containing stocks (A, B) is determined with the method of

$$I_t^{AB} = \begin{cases} 0 & closed\ position \\ 1 & short\ A, long\ B \\ -1 & long\ A, short\ B \end{cases} \quad (3)$$

$$r_t^{AB} = I_t^{AB}(r_t^B - r_t^A) \quad (4)$$

In the creation of the portfolio, each pair is taken into consideration with the same weight, and therefore the portfolio yield is:

$$r_t^{port} = \frac{1}{20}\sum_{i=1}^{20} r_t^{AB,i} \quad (5)$$

The strategy is further developed by Vidyamurthy (2004) he determines his portfolio by introducing another significant already existing concept. He considers short-term deviations from the long-term balance as a stationary noise, and this approach lead to the cointegration and the study of the cointegrity of the stock pairs. The study of Caladeira and Moura (2013) is run on the basis of this approach in which data of BM&FBOVESPA between Jan 2005 and Oct 2012 is examined. The portfolio determined by means of the VAR(p) model applied during the research results in an excess return of16.38% return 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) is performed in relation to the European markets.

3 Pairs Trading Strategy Model

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. The X_t is d-th integrated process, and is marked as X_t~I(d).

The X_t, Y_t~ I(d) time series are cointegrated if there exists β, such that X_t+βY_t~I(d−k) where 0≤k≤d. The k=d is an important special case of the above definition where here there is a perfect cointegration.

The process defined with the following SDE is an Orstein—Uhlenbeck-process:

$$dR(t) = \left(\alpha - \beta R(t)\right)dt - \sigma dW(t) \quad (6)$$

where α, β, σ > 0. The closely interpreted solution of the Orstein—Uhlenbeck-process:

$$R(t) \sim \mathcal{N}\left(e^{-\beta t}R(0) + \frac{\alpha}{\beta}\left(1 - e^{-\beta t}\right), \int_0^t \sigma e^{-2(t-s)\beta}\ ds\right) \quad (7)$$

and *R(t)* has a boundary distribution

$$\lim_{t\to\infty} R(t) \sim\ \mathcal{N}\left(\frac{\alpha}{\beta}, \frac{\sigma^2}{2\beta}\right) \quad (8)$$

4 Applied Pairs Trading Strategy

Our aim is to find an investment strategy since our X_t portfolio value process submartingales. The pair trading strategy is constituted by two steps: (1) Selection of pairs and (2) the Trading.

Selection of Pairs

Our study covers 649 stocks which 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 can perfectly cointegrate, i.e. by pair $\exists\beta_i$so that

$$\ln S_t^{i,1} = \mu_i + \beta_i \ln S_t^{i,2} + \varepsilon_t^i \tag{9}$$

$$\ln S_t^{i,1} \sim I(d) \quad and \quad \ln S_t^{i,2} \sim I(d) \tag{10}$$

where d ∈ N, ε_t^i white noise ∀i∈ [0, n].

The study is performed for each possible pairs, the relevant linear regressions and the u_t^idifference processes are calculated (values β_i specified on the logarithmic scale is considered),

$$u_t^i = \ln S_t^{i,1} - \mu_i - \beta_i \ln S_t^{i,2} \tag{11}$$

then the stationarity of processes $u_t^i$is characterized with the Augmented Dickey-Fuller (1981) test ADF test statistics and the study of the periodogram. n pieces of stock pairs belong 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 in the above methodology. In 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 the periodograms are studied.

$$Z_t^{(i)} = \frac{S_t^{i,1} - \beta_i S_t^{i,2} - \mathbf{E}(S_t^{i,1} - \beta_i S_t^{i,2})}{\sigma(S_t^{i,1} - \beta_i S_t^{i,2})} \tag{12}$$

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

- If in the case of i. pairs at t 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.
- In addition, stop-loss terms must be also 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, the approach to the average might slow down (the β(t) parameter of the modeling Orstein—Uhlenbeck-process significantly reduces) thus we can stuck in a position for a very long time which is undesirable.
- On the other hand we discovered that the strongest cointegrated pairs are not stable during the time. In order to avoid the temporary losses we made every week a new pairs trading portfolio with uniformly weight hence the data decided the weights of each different pair in the whole portfolio.

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, and if a position is closed then the weight of the other open positions is

increased proportionally to the weight of the closed position and 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 to4 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 which are 85 days for the Eastern European stocks, and 70 days for the Western European stocks. To determine the time limit, the time lines calculated from the Z values are approached with Ornstein—Uhlenbeck-processes, and the expected cutting time of these processes are taken into consideration.

5 Data

We use daily closing prices from 30.08.1994 to 30.08.2012. The stock prices are corrected with dividends and expressed in USD, they are available from Thomson Reuters Data Stream database. The stocks covered by the study contain the components of the main European indexes as of 6 September 2013. These are 554 stocks at the end of the period. As the stock indexes reflects the actual content thus the data series is exposed to survivorship bias. The stocks has 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 back to the starting periods can be observed on the yield curves. We do not make restrictions that the stock must to belong to similar industries, we base the generation of pairs only on cointegration results.

6 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 17 years, the average net (short selling cost 20bp) return is 10.4% per year.

Table 1 Annual returns of the strategy

Year	E. Europe P. T.	W. Europe P. T.	Year	E. Europe P. T.	W. Europe P. T.
1995	13%	9%	**2004**	15%	12%
1996	25%	8%	**2005**	13%	9%
1997	12%	11%	**2006**	18%	5%
1998	13%	13%	**2007**	10%	4%
1999	21%	12%	**2008**	7%	18%
2000	24%	20%	**2009**	17%	14%
2001	24%	7%	**2010**	8%	5%
2002	21%	9%	**2011**	12%	9%
2003	7%	4%	**2012**	14%	16%
Avg.:	16.98%	20.74%	**Std.:**	24.17%	19.12%

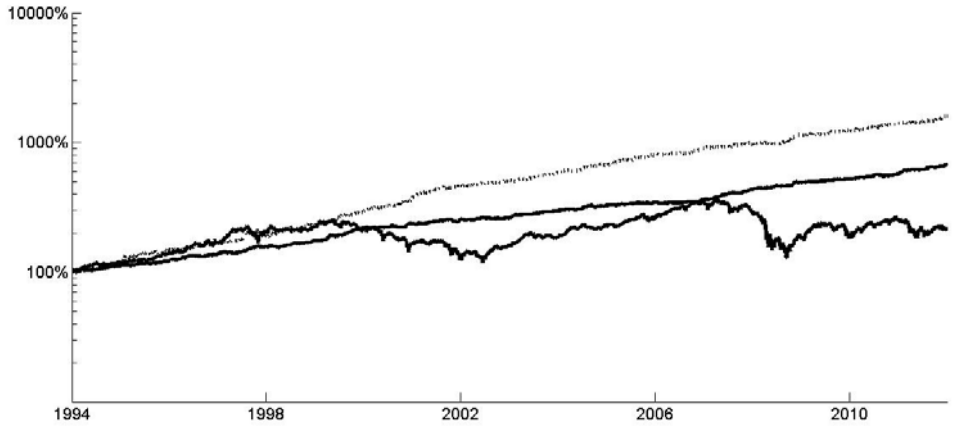
Source: authors' calculations

The standard deviation of the annual returns is 5.7%. 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 17 years, the average annual net return is 10.4%. The standard deviation of the annual returns is 4.6% 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 1.

We prefer to use the MSCI Europe index as a benchmark, as one can see in Section 5. the very low correlation to market returns, which imply the market neutrality of the portfolio.

We present the above process in Figure 1. The returns are above the benchmark levels and there is visually less standard deviation in the second part of the period. We have to state that the results show upwards biases in relation to bid-ask spreads and. The database and the return are exposed to survivorship bias.

Figure 1 Plot of returns



Notes: bold line represents western portfolio values, dashed line stands for eastern and the wavy bold-line represents MSCI values.
Source: authors' processing

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 so we use the Sharpe-ratio to compare the risk adjusted return to different portfolios.

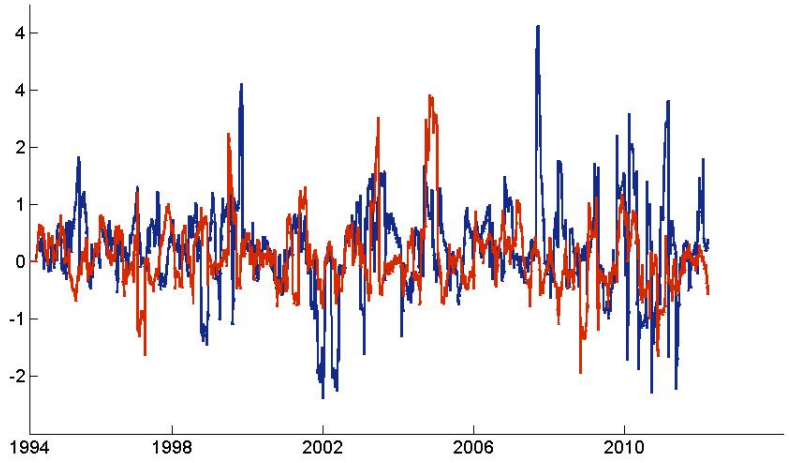
Table 2 Sharpe-ratios of the portfolio

	1995-2012
Western Europe Sharpe-	2,25
Eastern Europe Sharpe-	2,67
MSCI Europe Sharpe-	0,24

Source: authors' calculations

Table 2 shows that the Sharpe-ratios are significantly higher than the average ratios on the stock market. Gatev et al. (2006) shows that Sharpe-ratios can be misleading when considering risk adjusted returns, as the negatively skewed return distribution can increase the Sharpe-ratios. We did not find skewness in both the western and eastern European regions (as presented in Figure 2), which indicates the Sharpe-ratios are reliable.

Figure 2 Skewness of the Eastern (red) and the Western (blue) portfolio returns



Source: authors' processing

Beside the Sharpe-ratio it would be reasonable to have a closer look at the results of the well-known equilibrium models like 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, that is all the yielded return can be interpreted as Jensen (1968) alpha, as only the constants of the regressions became significant, while the determination coefficient (R^2) of the models tend to zero.

Correlation of the Portfolio

On the one hand, Table 1. above clearly indicates that the pairs trading portfolios result in higher returns and exhibit less standard deviation in the case of both stock indexes. On the other hand one of our aims is to prove the strategies market neutrality as defined by Alexander and Dimitriu (2002). Returns were set against the MSCI Europe, S&P 500 and the risk free rate and show low correlations against them as presented in the Table 3. This result means that the portfolio is not dependent on market movements and so it is market neutral.

Table 3 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: authors' calculations

7 Concluding Remarks

In this paper we examine 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 includes 17 years of European stock prices. The results show the Sharpe-ratios were above the MSCI Europe index by 2.43 and 2.01. 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 strategies market neutrality.

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The Importance of Financial Literacy in Consumer's Optimal Choice of Insurance

Zuzana Brokešová, Monika Jurkovičová, Erika Pastoráková

University of Economics in Bratislava
Department of Insurance
Dolnozemská cesta 1, Bratislava, Slovakia
E-mail: zuzana.brokesova@euba.sk, monika.jurkovicova@euba.sk, erika.pastorakova@euba.sk

Abstract: *Current research evidence suggests that one of the causes of insufficient use of options provided by the single market for financial services is a very low level of financial literacy in the population. In case of insurance market, the situation is even more difficult because the specifics of insurance further complicate the ability of individuals to understand the wide range of risk coverage supply, for example compared to conventional banking products. Indeed, to give substance to the term financial literacy defined as "the ability to use knowledge, skills and experience to manage people´s own resources effectively in order to ensure lifelong financial security for them and their households" in the field of insurance, not only insurance products knowledge is sufficient. Also proper evaluation of individual´s own needs, respectively the risks arising from a particular lifestyle, the size of assets, plans for the future etc. are needed. The aim of the paper is to define the key determinants influencing present level of financial literacy in the field of insurance based on the research conducted abroad and to compare it with authors´ own investigation in the case of Slovak market.*

Keywords: financial literacy, insurance literacy, optimal purchase of insurance

JEL codes: G22

1 Introduction

Day-to-day money management activities have become an essential component of every adult person life. It is no secret that in today's world "money really matters". Financial literate individuals should be able to perform basic tasks of managing their personal finances and to make well-informed decisions about important aspects of personal finance, such as earning income, spending, saving, borrowing, investing, and managing money. Sufficient level of financial literacy improves personal finance management and an individual can thus increase his wealth, thereby increasing the wealth of the whole nation. Financially educated and informed consumers have suitable ability to make satisfying economic decisions for their families and thus are competent to enhance their well-being. Financially comfort families create prospering communities and thereby support economic development of the country. „No society can surely be flourishing and happy, of which the far greater part of the members are poor and miserable," said the father of modern economics, Adam Smith. So it can be stated that financial literacy is a considerable tool not only for individual households and families but for the county´s economic growth as well. The necessity of financial education has increased in last decades because the complexity of portfolio of instruments and products offered by financial institutions is growing as well as responsibility of individuals for their own financial security. Households have interacted with financial markets in the last 20 years, much more than in the past, and also have been exposed to increased financial risk as a consequence of financial market liberalization, especially in post-communistic countries. Consumers often do not dispose of required knowledge and do not know, have no time or cannot process of available information and make their decisions depending on the suggestions or their intuition without understanding the nature and risks relating to these products. Therefore, the possession of knowledge and understanding of financial matters emerges as one of crucial skills that everyone needs. "Well-informed and educated financial consumers lead to better financial markets where rogue products are forced from the marketplace and confidence is raised" as has been pointed out at the Meeting of the Finance Ministers (G8, 2006). Financial education is becoming a necessity not only to

survive in financial market but also to achieve a success in today's world, where the ability to solve financial situations is definitely a clear advantage for a person. Financial literacy and financial education make consumers ready for difficult financial times, through planning that alleviate risk like assets diversification, accumulating savings accumulation and insurance purchase. It is evident that consumers´ financial behaviors are significantly influenced by their financial literacy and not only by actual but also by perceived. Academic studies have shown that perceived financial literacy can be as important as or more important than actual financial literacy (Allgood and Walstad, 2013). We would like to point out that there is one area of financial literacy that should be given greater attention in comparison with other financial topics. Latest research on financial literacy has made evident that individuals showed the lowest level of understanding in questions about insurance in comparison to saving products, mortgages etc. How the insurance products differ from other financial instruments and why understanding their nature and thus optimal purchase decisions are more difficult for the consumers? What is the level of insurance literacy in the world and in Slovakia?

2 Insurance Knowledge as a Part of Financial Literacy

Understanding of the term "literacy" as the ability to read and write as opposed to illiteracy or analphabetism is generally accepted. However, the definition of literacy has expanded far beyond reading and writing. The pure read-write literacy is only one part of so called functional literacy. Functional literacy includes a list of necessary skills to understand a particular topic enough to be able apply it and use it in one´s own life, for example: informational literacy, cultural literacy, health literacy, emotional literacy, visual literacy, media literacy and financial literacy (McCaffery, 2007). On the contrary functional illiteracy is reading and writing skills that are inadequate to manage daily living and employment tasks that require reading skills beyond a basic level (Schlechty, 2000). An increasingly important component of functional literacy is financial literacy. This relatively new term has been defined in different ways depending on various academic studies and authors. The simplest interpretation provides Hilgert and Hogard (2003) explaining financial literacy as a "financial knowledge". National Council of Economic Education (2003) defines it as familiarity with basic economic principles, knowledge about the economy, and understanding of some key economic terms. The President's Advisory Council on Financial Literacy (PACFL, 2008) specifies financial literacy as the ability to use knowledge and skills to manage financial resources effectively for a lifetime of financial well-being. Common bases of financial literacy definitions are following: a specific form of knowledge, the ability or skills to apply that knowledge, perceived knowledge, good financial behavior, or financial experiences (Hung, Parker, Yoong; 2009).

Financial literacy is an important tool to acquire knowledge of the variety of financial services and it is not equally difficult to understand all of financial products. One area should be considered to be more challenging and harder to understand than the others – insurance. Personal finance management mostly consists of ability to take a loan with favorable rate for the borrower, choose the right mortgage or to open the most profitable saving account. Let´s take the saving account opening as an example - the calculations are universal for all consumers. The basic skills include understanding and distinguishing between simple and compound interest and to consider a maintenance fee that would be charged. A decision about buying insurance is much more complex. As with other financial products, there is also a need for numerical literacy. But the element which makes the choice about insuring oneself more complicated is risk and uncertainty (Péliová, 2013). Insurance literate individuals should be able to evaluate and compare insurance products, such as life, health, liability, property or travel insurance policies, so as to make optimal decisions - optimal for a particular consumer, taking into account the specific risks they may face in lifetime. Universal package of insurance products does not exist, because individuals have various needs, standards of living and lifestyles and therefore their insurance needs are different and cannot be generalized.

Current research evidence suggests the insufficiency of consumers' understanding and proper decision making ability related to purchase of insurance (Ondruška, 2013). The insurance literacy has received less research attention than the other segments of financial literacy. Recent studies of consumer financial literacy (conducted in USA) detected that only 16 of the 52 surveys (30.8%) contained any questions about insurance or risk management and most of the studies devoted effort to saving and investing (Huston, 2010). This fact indicates that insurance is often a missing element of financial literacy studies and research. Therefore the need for learning associated with insurance is often not identified and financial education programs do not place an adequate emphasis on this important component of financial literacy. Although the surveys vary regarding to the respondents targeted, the methodology used or the methods of measuring financial literacy, we can recognize some common features and conclusions. Lusardi and Mitchel (2006) have compiled a set of three simple questions (1.Compound, 2.Inflation, 3.Risk diversification) to measure general financial literacy and implemented it into major U.S. surveys. The sample (Health and Retirement Study, 2006) of respondents were in age over 50 and only a one third of them answered all three questions correctly. The most difficult for the asked sample were the third topic related to risk diversification (in addiction one third of them refused even to answer the question), which confirms our assumption about the difficulty of understanding the financial areas that are associated with risk, uncertainty and thus insurance. The study revealed that financial mistakes are more prevalent among people with lowest levels of financial knowledge. Hilgert and Hogarth (2003) have looked at knowledge about specific financial topics (Credit, Saving, Investment, Mortgages, Other). The measure of knowledge was based on a quiz containing twenty-eight true-false questions ''What's Your Financial IQ,'' that was a component of the Surveys of Consumers (University of Michigan's monthly Surveys of Consumers conducted in November and December 2001). To the question: "Whole life insurance has a saving feature while term insurance does not." (True) which was a part of section "Saving" in the questionnaire, only 60% of respondents answered correctly. The question was the only one about insurance in this section and the percentage of correct answers was the lowest in the section. Other insurance related question "The cash value of a life insurance policy is the amount available if you surrender your while you are still alive." (True) with correct responding score in amount of 56%. Consumers were most knowledgeable in section Mortgages, scoring about 80 % and the average score for whole quiz was 67 % of correct answers. The results indicate below-average knowledge in the field of insurance among respondents. Authors concluded that overall scores were in line with similar financial knowledge quizzes. For instance surveys of youth and adults realized in 1997-2002 in the United States (Jump$tart Coalition's biennial financial literacy tests) showed low scores for economic, financial, and consumer literacy. Adults taking the tests obtained higher scores than youth but missed some basic insurance questions. Relatively low consumers' insurance literacy was also indicated in a survey developed by Tennyson (2011) to assess consumers' knowledge, confidence and capability in insurance decisions, prepared as a 10-question quiz about insurance. The average score on the quiz was 58 %. The study detected relatively low levels of confidence in respondents insurance decision-making and identified a positive relationship between confidence and quiz score, respondents who stated that they were "not at all" confident or "not really" confident about insurance decisions had clearly lower average scores on the quiz than other respondents. The results concluded that educational efforts in insurance knowledge area would be beneficial for consumers.

In Europe, a number of international surveys have made evident a rather low level of understanding of financial matters and of basic economics among asked European citizens. For example a UK questionnaire pointed out that at all income levels many people do not plan their financial situation, and that 70% reported that they had no provision to cover an unexpected drop in income (Financial Services Authority, 2006). According to a survey conducted in 2007 by the Slovak Banking Association, surprising facts were found and some experts even rated the results to be alarming. Since the survey was dominated by issues relating to banking products and investment, it is

difficult to quantify the financial literacy in the field of insurance. The average percentage score of financial literacy was 56%. The survey also showed that there existed a relatively close relationship between the respondents' real level of financial literacy and their self-assessment: the more negative was their self evaluation the lower was their actual financial literacy (and vice-versa). The growing interest of researchers in financial literacy has led to increased research on how financial literacy affects the financial behavior by both actual and perceived financial knowledge. The European studies have shown that individuals often overestimate their understanding of financial services. Consumers are unlikely to be willing to consider and take part in financial education unless they realize that it is a necessity for their future financial decisions. Also respondents to surveys in the US expressed confidence in their understanding of financial issues but, when tested, demonstrated only a limited understanding (Mandell, 2004).

3 Actual and Perceived Insurance Literacy among a Sample of Slovak Citizens – A Research Conducted at University of Economics in Bratislava

To find the answer to the question "what is the level of insurance literacy of Slovak population"; insurance literacy research has been conducted as a part of an overall study (Characteristics, specificities and changes in consumer behavior in the insurance market) at Department of Insurance at the University of Economics in Bratislava. The research has been carried out in two phases (in the periods: from June 1 to July 31, 2013 and from November 15 to December 15, 2013). The questionnaires were distributed both in electronic and paper forms. Target sample of respondents represented Slovak population in age over 18 years (from 18 years to 61 years). After data collection, we obtained a total of 1,044 respondents who had fully completed the questionnaires. Then we selected a random representative sample of 849 respondents, which corresponded to the Slovak population distribution by age and sex according to the Statistical Office of the Slovak Republic. The respondents were asked for their basic demographic and economic characteristics (gender, age, education, income or the role of religion in their lives). The subjects were asked if they have concluded at least one contract of life insurance and if they own any form of property insurance (whether movable or immovable property). The most important part of the questionnaire for our research was the questions related to financial literacy. For the purpose of detecting perceived financial literacy the subjects had to self-evaluate their knowledge. Respondents were asked to choose among three possible answers to the question:

What is your level of understanding of financial issues?

- *very good (you understand not only the standard financial products, but also the areas such as investment and family and friends often ask you for advice)*
- *good (you are able to take care of financial issues related to your own funds)*
- *very bad (you do not understand finance and financial products and need an advice from others)*

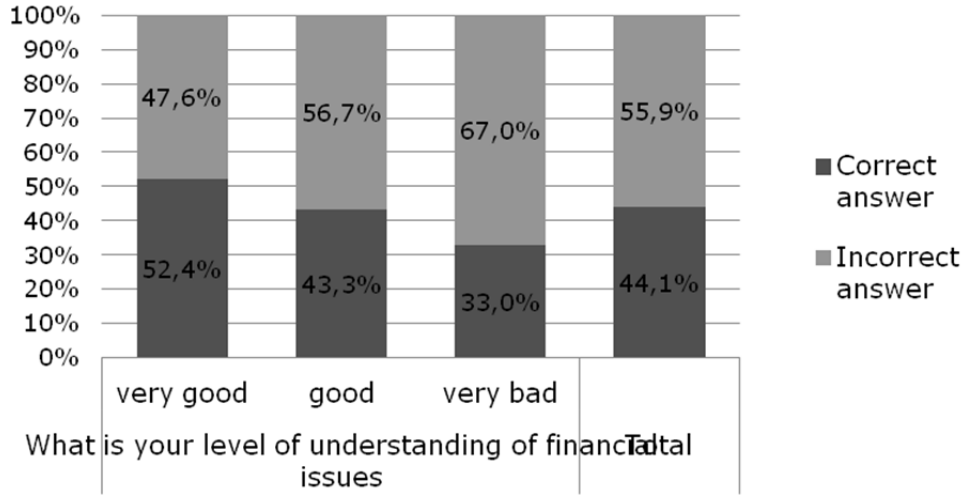
For the purpose of measuring actual insurance literacy, we used the following question, which was included in the questionnaire with possible true/false response:

If you pay insurance premiums set by insurance company regularly and an insured accident occurs, the insurance company it will always reimburse the damage in full amount. (False)

The question examines one of the basic knowledge, which people should dispose regarding to insurance products (we were able to apply only this one question to measure the actual insurance financial literacy because of the content of the questionnaire, so our measurements cannot be considered to be a complex insurance financial literacy rating). In response to question related to self-evaluation, most of those surveyed - nearly 70% indicated that they had good knowledge of financial issues, every fifth respondent evaluated his understanding to be very good and only every tenth of those interviewed suggested that his understanding of finance was very bad. But what is the level of actual insurance literacy of the sample of respondents? Only 44,1% of

surveyed responded correctly, so a majority (55,9%) didn't get the answer right. The correct answer score has been higher among female participants – 46% versus man - 42% of correct answers. As we expected, education had an impact on both perceived and actual level of insurance literacy of respondents. Although it is quite surprising that of those who reported that they have completed their university studies, only 48% answered correctly. Thus, basic insurance knowledge is not widespread, even among a sample of highly educated respondents. From the data in Figure 1, it is apparent that the distribution of those who answered correctly to the question is highest in the group with "very good" level of financial literacy self-evaluation. This group is the only one where most of the respondents answered correctly although the score was only 52.4% and for those who have identified their knowledge as very good, this is very insufficient and unsatisfactory result. The level of financial (insurance) literacy within a group decreases with decreasing level of self-evaluation ($p = 0.002$ based on the Mann–Whitney U test). This result is consistent with the findings of a survey on financial literacy conducted by the Bank Association of Slovakia in 2007.

Figure 1 Perceived financial literacy and the percentage of correct answer within a group



Source: the survey results, University of Economics in Bratislava (2013)

As mentioned before, the fundamental question regarding insurance was answered correctly only by 44,1% of our respondents. Research sample consisted of both insured and uninsured subjects. It is important for every person who owns insurance policy to understand the way the insurance company will reimburse him, thus it is crucial for him to be aware of the amount of insurance deductible he agreed in insurance contract. So it could be expected that insured people achieved a higher score than the group average. It is quite surprising that those insured received a lower rate of correct answers than those uninsured (although there was only slightly difference: 43.9% for insured versus 44.9% for uninsured). This means that when it comes to basic knowledge about insurance it is not important if the subject owns insurance policy. Therefore it can be assumed that insured respondents did not care about the terms of their insurance policy or did not read the insurance contract deeply enough. We are able to verify this assumption because in one part of the questionnaire the subjects were asked to confirm the following statement: *Before signing the insurance contract I always read the policy conditions carefully (yes/no).* In this statement, 80.6% said they read the contract carefully, but when we look at their success in answering the question about insurance - surprisingly, only 41.8% of those who stated that they read the policy conditions disposed this basic knowledge of insurance in reality. Taking into account the assumption that the respondents have no reason to lie whether they read an insurance policy before signing (the questionnaire was anonymous), we can suggest possible explanation. If a majority of those who read the contract carefully were not able to answer basic question about insurance, the explanation may be the fact that respondents actually did not understand the entire specialized terminology used in insurance contract (in this case probably the

term *deductible*). If the customer wants to choose the optimal insurance product, to read the insurance contract is not enough. The skill to really understand all the conditions and basic insurance terms is indispensable when buying insurance coverage.

4 Building Consumer Knowledge Through Financial Education

The concept of financial literacy is closely linked to financial education which can be defined as "the process by which financial consumers/investors improve their understanding of financial products, concepts and risks and, through information, instruction and/or objective advice, develop the skills and confidence to become more aware of financial risks and opportunities, to make informed choices, to know where to go for help, and to take other effective actions to improve their financial well-being" (OECD 2005). The importance of good financial education has been acknowledged at the global level. It is important to identify personal finance knowledge and skills an adult should possess. According to The National Standards for Adult Financial Literacy Education recommended by The Institute for Financial Literacy (USA) includes five standards: Money Management, Credit, Debt Management, Risk Management, and Investing & Retirement Planning (National Standards for Adult Financial Literacy Education, 2007). In Slovakia, financial education is a part of the government program trough "Strategy for financial education and personal finance management" (2006) with particular attention to the promotion of long-term financial education to the general public. To develop and provide financial education focusing on insurance in Slovakia is undoubtedly necessary because consumers with low levels of insurance literacy may not be able to make optimal choice when buying insurance. In our view, the most important components in the area of financial education should be following:

- to increase the level of financial literacy of the population with sufficient emphasis on insurance literacy
- to teach the consumers to recognize their needs based on their own lifestyle with the aim to identify potential risks that they may face in their lifetime
- to familiarize consumers with the options that the insurance market offer and teach them how to choose a proper product from wide offer of insurance companies
- to include the insurance related questions to the national surveys and academic studies on financial literacy

5 Conclusion

Latest research on financial literacy has made evident that individuals showed the lowest level of understanding in questions about insurance in comparison to other financial areas. However, these findings were difficult to obtain because of a lack of insurance related questions in national surveys designed to identify the level of financial literacy among the population. We consider the area of insurance to be more challenging for consumer´s understanding. The universally optimal insurance product for everybody does not exist because different people face different risks and in addiction there is uncertainty that plays an important role in insurance purchase decision. According to the study conducted at the University of Economics in Bratislava, the reason for suboptimal choice of insurance product may be not the unwillingness to read the insurance contract in detail, but the insufficient knowledge in the field of insurance of those surveyed. Customers´ false sense of good self-assessment of financial knowledge may lead to hesitation to ask the insurance company employee about for him unclear terms in the contract. To measure a level of insurance literacy among Slovak citizens, we used a question that has checked basic and very necessary knowledge about insurance - a system of deductibles. If the insured person does not know how the "system works", the decision about insurance and also his reimbursement expectations cannot be optimal. Therefore, when the insured person makes a claim, he may not receive insurance benefits in expected range and thus could be disappointed and explain it as a lack of credibility of the insurer. Insufficient knowledge of people in the area of insurance is

obvious and therefore we want to emphasize that the questions relating to insurance should be included in each national study on financial literacy. Because until serious insurance literacy deficiencies are not found among the population, financial education programs cannot be set appropriately.

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Market Structure and Performance of the Life Insurance Industry in the Slovak Republic

Zuzana Brokešová, Tomáš Ondruška, Erika Pastoráková

University of Economics in Bratislava
Faculty of National Economy, Department of Insurance
Dolnozemská cesta 1, 852 35 Bratislava, Slovak Republic
E-mail: zuzana.brokesova@euba.sk, tomas.ondruska@euba.sk, erika.pastorakova@euba.sk

Abstract: *Life insurance industry represents an integral part of the financial market in all developed economies. In the Slovak Republic, its importance begun to increase during the first decade of new millennium, when the life insurance exceeded the non-life insurance measured by the amount of gross written premium. This newly elicited demand also flew into the changes on the supply side of life insurance and the structure of the Slovak insurance market varied significantly during this period. It has developed from monopolistic market with one dominant insurance company and few very small ones to competitive market with 19 insurance companies offering life insurance operated on the market in 2012. However, have these changes also affected the performance of the industry? And do lower concentration evoke higher performance? As from the well-performing life insurance industry benefits consumers, producers and whole economic system alike, understand these tendencies is particularly important. The aim of the paper is to answer these questions through the analysis of the data from Slovak life insurance industry.*

Keywords: life insurance, industry performance, market structure

JEL codes: G22, L10, L25

1 Introduction

Life insurance industry represents an integral part of the financial market in all developed economies. For example in 2012, life insurance penetration was 3.57% in North America and 4.58% in Western Europe (Swiss Re, 2013). However in the Slovak Republic, insurance penetration continues to be far below from the desired benchmark, when this ratio represented only 1.26% in 2012 (Swiss Re, 2013). The difference in the performance of Slovak life insurance market is evident. However, due to the enhanced growth in the amount of written premiums of the industry, this indicator slowly converges to the level of life insurance penetration in western European countries. Faulkner (2002) sees the reason for this development in continuous raise of the wealth among the population on the one side as well as cultural and social development and convergence of Slovak Republic to developed countries on the other side.

The importance of life insurance started to grow slowly after the origin of Slovak Republic in 1993. While non-life insurance dominated among Slovak population for more than decade, since 1995 and during the first decade of new millennium the role of life insurance has started increasing faster and more dynamically. After all, the life insurance consumption exceeded the non-life insurance measured by the amount of gross written premium in 2008 for a first time. This increased interest and newly elicited demand also flew into the changes on the supply side of life insurance. The structure of the Slovak insurance market varied significantly during this period. From the starting point, when only 6 life insurance companies (as a life insurance company, we consider all insurance companies that offer life insurance products on the market) operated on this market in 1993, to 19 insurance companies offering life insurance products in 2012. Market structure was developed from monopolistic market with the one dominant insurance company and few very small in 1993 to medium concentrated and competitive market in 2012. However, have these significant changes also affected the performance of the industry? And does lower concentration evoke higher performance?

The main aim of the paper is to reveal the presence of a link between the development of market structure and market performance in Slovak republic during the period 1993 - 2012. Based on the Structure Conduct Performance paradigm, we suggest a statically significant relationship between these two variables.

The remainder of the paper is organized as follows. In the first section, we provide the basic theoretical background and a literature review of the Structure Conduct Performance and results of previous research. In the second part, we discuss the methodology used and the data. The next two sections cover the main results, their analysis and the resulting conclusions.

2 Literature Review

The Structure Conduct Performance (SCP) hypothesis explains performance via conduct market structure (Mason, 1939; Bain, 1951). Seminal work in this area is done by Bain (1951), who expects that concentrated markets encouraged oligopolistic behaviour among the competitors. Further research supports his assumptions about the existence of relation between market structure and market performance. However, direction of this relation lacks consensus and varies across the literature.

Empirical investigation of SCP paradigm was mainly implemented on the banking system data (e.g. Smirlock, 1985; Goldberg and Rai, 1996; Berger and Hannan, 1998; Maudos, 1998) and there is only a few studies, which analyse insurance industry data (e.g. Cummins, Denenberg, and Scheel, 1972; Weiss, 1974; Jung, 1987; Carroll, 1993; Chidambaran et al., 1997; Bajtelsmit and Bouzouita, 1998; Choi and Weiss, 2005; Pope and Ma, 2008; Bikker, 2012). Only one of them, Cummins et al. (1972), focuses on life insurance industry at our knowledge. In addition, banking studies are primarily focused on individual companies, while majority of the insurance studies use country aggregated data (Carroll, 1993; Bajtelsmit and Bouzouita, 1998; Chidambaran et al., 1997). Results of these studies are ambiguous. For example, Bajtelsmit and Bouzouita (1998) focus on automobile insurance and their results show positive and significant relation between market performance and market concentration. According to Weiss (1974) and Choi and Weiss (2005), collusive behaviour should be more frequently observed in highly concentrated market, since only a relatively small number of firms must agree to collude. Therefore, higher concentrated market may causes higher prices as well as higher profits and performance (Ellickson, 2014). On contrary, Cummins et al. (1972) find also statistical significant but invers relation between market concentration and market performance. According to their analysis of the U.S. life insurance market, these variables are inversely related, which indicates a positive relationship between market concentration and profitability. However, these results are weaker in comparison to banks and non-life insurers.

3 Methodology and Data

In the research, we focus on the verification of the SCP hypothesis in Slovak life insurance industry during the period from 1993 to 2012. We use a linear regression model on a country level with robust standard errors. Data are log-log transformed for interpretation as elasticity.

Model specification is as follows:

$$\text{Profit\_life}_t = \beta_0 + \beta_1 \text{HHI\_life} + \beta_2 \text{gGWP\_life} + \varepsilon_t \quad (1)$$

where t refers to time, $t \in (1, 2\ldots, 20)$, ε_t refers to unobservable random disturbance and $\beta_0, \beta_1, \beta_2$ are regression coefficients of key explanatory variables used to evaluate SCP hypothesis. We use underwriting profit in life insurance industry in Slovak Republic (*Profit_life*$_t$) as a dependent variable. In our analysis, it represents an indicator of market performance, while underwriting profit is a profit that insurance companies obtain from direct insurance services, i.e. earned premium remaining after deduction of paid claims

and administrative costs linked to life insurance. By this profit, we can approximate real profit from life insurance products in Slovak insurance market while these values are adjusted from non-direct insurance operations of insurance companies. As for log transformation, positive values are required and this assumption is not fully applicable to all values, we have to add a constant to all observations. Life insurance market concentration approximated by the Herfindahl-Hirschman index (HHI_life) represents an explanatory variable. Herfindahl-Hirschman index is a sum of squared market shares of firms, where increased value of index represents increased market concentration as well. According to the U.S. Department of Justice, market with a result of less than 1,000 to be a competitive marketplace while a result of 1,800 or greater indicated highly concentrated marketplace (Rhoades, 1993). In the estimation, we also incorporate a control variable for market growth - growth of Gross Written Premium ($gGWP\_life = (GWP\_life_t - GWP\_life_{t-1})/GWP\_life_{t-1}$). However, the role of market growth varies based on the barriers to entry (Choi and Weiss, 2005). When the barriers to market entry are low the market growth entices new insurers to enter the market. But on the other hand, when the barriers to market entry are significantly high then the growth of market evoke increasing in profitability of insurance companies.

As SCP hypothesis predicts, simultaneous cause-and-effect relationship between market structure and market performance (Choi and Weiss, 2005), Augmented Durbin-Wu-Hausman (DWH) test are conducted for the Equation (1) to determine whether the suspect variables are endogenous. In the time series sample, we rejected presence of unit root by Augmented Dickey–Fuller test ($p<0.001$). Serial correlation in regressions were rejected by Durbin–Watson statistic ($p>0.05$).

Dataset is obtained from the database of the National Bank of Slovakia and descriptive statistics are shown in Table 1.

Table 1 Descriptive statistics

Variable	Obs.	Mean	St. Dev	Min	Max
Profit_life	20	162 173.1	150 363.7	-23 927.15	581 774.8
HHI_life	20	2 858.97	2 196.598	1 231.266	7 271.633
gGWP_life	19	1.172472	0.1516657	0.9359061	1.551661

Source: Authors' own calculations

4 Results and Discussion

The life insurance industry has developed dynamically in the Slovak Republic during the analyzed period, which was driven mainly by socio-economic, law and institutional changes. Step by step with these changes arose the integration efforts of Slovak Republic into international organizations like OECD, NATO and the European Union. Necessary harmonization of the legislation and integrated financial services supervisions had a major impact on the changes that occurred in the private insurance industry. Since 1995, the role of life insurance has started increasing faster and more dynamically. Changes in needs of population started to turn mainly property and liability coverage oriented insurance market on to market offering wide variety of life insurance products.

Improving life insurance industry performance also motivated new insurance companies for enter to the market. Market benefited not only by the entry of new specialized foreign companies that brought new know-how and labor opportunities but also by the increased competition between new and established companies. Efficiency and competition on the life insurance sector are important not only for companies but also for households to keep premiums low and innovation and quality high (Bikker, 2012). Those changes did not result only in the increased number of insurance companies but in overall benefits in supply as well as demand for life insurance products. Attractiveness of the life insurance had increased especially during the years 2006 and 2011, when clients could use tax advantage of life insurance. Entrant insurance companies offering life insurance products brought also new types of policies for consumers with wider coverage and services that were usual in developed economies. Majority of these "new" companies were subsidiary

firms of international companies with foreign capital. Turning point in the Slovak insurance industry was the merge of the dominant insurance company Slovenská poisťovna, a.s. (with life insurance market share 28,32% in 2002 followed by Kooperativa poisťovňa, a.s. with 11,86%) and Allianz poisťovňa, a.s.(with life insurance market share 5,43% in 2002) in 2003. The life insurance market share of new merged Allianz – Slovenská poisťovňa, a.s. was 30,08% in 2003. But its market share in life insurance was decreasing during the following years and nearly equalized the share around 20% with the Kooperativa poisťovňa, a.s. in 2012. However, half of the life insurance market according to gross written premium was controlled by three insurance companies.

Main indicators of life insurance market development as gross written premium, share of life insurance, insurance penetration and density are shown in reduced form of four years periods in Table 2. Chosen period is illustrated by not only growing numbers of entities offering life insurance products but also by the increase in the gross written premium, share of life insurance, insurance penetration and density.

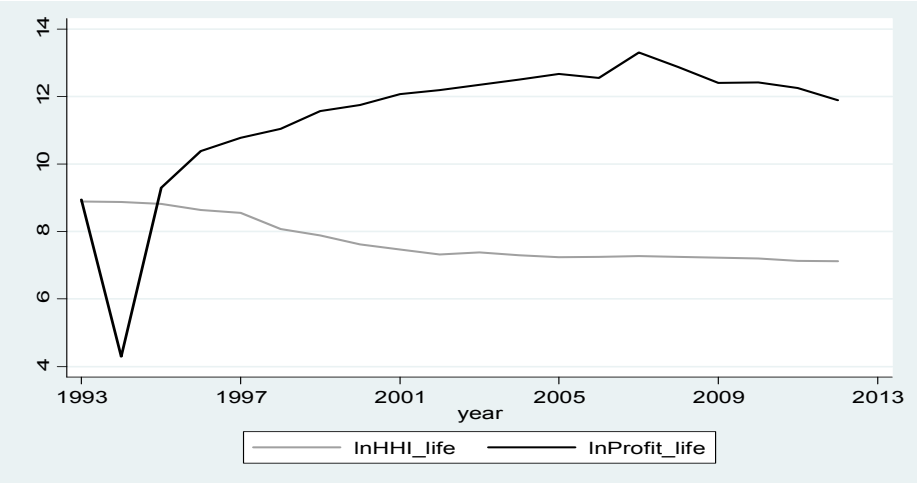
Table 2 Indicators of life insurance industry in the Slovak Republic

Variable	1993	1997	2001	2005	2009	2012
Gross Written Premium (millions EUR)	65.43	156.79	457.41	731,33	1 062.1	1 165.6
Share of Life Insurance (%)	23.47	26.94	42.90	42.50	52.39	55.13
Insurance Penetration (%)	0.38	0.51	0.94	1.85	1.69	1.63
Insurance Density (EUR)	1.28	29.13	85.02	135.75	196.02	215.55
Market share of foreign life insurance companies in the domestic market	N/A	25.14	55.95	92.43	91.56	90.20
Underwriting Profit (thousands EUR)	-16.23	24.18	151.88	295.89	221.38	122.31
Herfindahl-Hirschman index	7272	5199	1739	1391	1377	1231
Number of life insurance companies	6	22	22	21	17	19

Source: National Bank of Slovakia, OECD

From the Table 2, it is evident that during the analyzed period, the gross written premium in life insurance industry has increased by almost eighteen times. Also the share of the life insurance on the whole industry has risen from les then quarter in 1993 to more than 55% in 2012. Market performance measured as underwriting profit of life insurance industry has increased, while life insurance market concentration measured by Herfindahl-Hirschman index has decreased (see Figure 1).

Figure 1 Market performance and market concentration



Source: Authors' own calculations

Regressions results supported results of Figure 1. In table 3, we can see inverse relation between market performance and market structure. Due to identified endogenity, with respect to the concentration variables and gross written premium growth in Equation (1) by Augmented Durbin-Wu-Hausman (DWH) test, we decided beside the Ordinary least square regression (OLS regression) conduct also Instrumental variables (2SLS) regression. In this model, we assumed that market concentration in life insurance industry (ln_HHI) is in relation with the amount of gross written premium in life insurance industry (lngGWP_life) and the year change of absolute value of life insurance companies (lngIC_life). We decided to implement this variable mainly due to fact that traditional SCP hypothesis omits the possibility of insurance companies to entry the market (Choi and Weiss, 2005). However, due to the observed development in Slovak Republic, the number of insurance companies varies during this period. The industry has also witnessed tremendous growth in the number of life insurance entities, mainly between 1993 and 1996, when their number more than doubled.

Table 3 Regression results

lnProfit_life	OLS Regression	Instrumental variables (2SLS) regression
lnHHI_life	-2.743438**	-2.713257***
	(0.9283807)	(0.8076294)
lngGWP_life	4.683789	1.405165
	(1.463963)	(1.436591)
Constant	32.31828***	32.09582***
	(6.752665)	(5.870782)
R-squared	0.6603	0.6602
Prob > chi2	0.0282	0.0031

Note: ** and *** denote significance at the 5% and 1% level, respectively. Regarding the Instrumental variables (2SLS) regression: Instrumented: ln_HHI_life, Instruments: lnGWP_life, lngIC_life

Source: Authors' own calculations

In general, similar results were obtained by OLS regression as well as Instrumental variables (2SLS) regression. Both models show that with decreasing market concentration increases profit, which supports the results of Cummins et al. (1972). Our results also support empirical evidence of Zhang and Zhu (2005) and Sliwinski et al. (2013) that monopolistic insurance markets are less developed than competitive and also the level of performance of the market is significantly lower. Therefore, the social and economic transformations, the break-up of monopolies and growing competition in the Slovak Republic have contributed to the increase of life insurance industry performance.

5 Conclusions

The paper examines the relationships among market structure and performance of Slovak life insurance industry over the period 1993–2012. We performed OLS regression and Instrumental variables (2SLS) regression to identify the statistically significant relation between the development of market structure and market performance. Both models proved that decreasing market concentration increases profit, which supports previous results of Cummins et al. (1972). In addition, our results support empirical evidence of Zhang and Zhu (2005) and Sliwinski et al. (2013) that monopolistic insurance markets are less developed than competitive and likewise the level of performance of the industry is significantly lower. Improving of the Slovak life insurance industry performance caused several changes in the market. As the positive changes in life insurance industry during the analyzed period, we consider: increased market share and gross written premium; growth in the number of insurance entities and increased competitiveness; wider coverage and services; and better performance. On the other hand, changing conditions caused also the negative consequences on the market performance linked primarily with fusions and acquisitions. These increase the market

concentration, which according to our results may lead to the decrease of market performance and affects life insurance companies as well as their clients. Regulation authorities, therefore, should be very careful with the mergers and acquisitions permission in the area of life insurance.

It is important to note that while in the manufacturing industry, the benefits of merger and acquisition transactions lie primarily on the acquisition of know-how as well as on mutual research and development to reduce costs (Péliová and Kováč, 2009), in case of life insurance companies and other financial institutions mergers and acquisitions are on the front burden the enhance of a market position and gain of the potential of the clients. This is the reason why the interest of the regulators should be concerned on the fusions and acquisitions and moreover our results are confirming that the monopolistic markets cause less efficiency and performance from which neither insurance companies nor clients benefit. For the better performance of the insurance industry, as the significant part of the economy, is necessary to focus on the effects of the fusions and acquisitions to the market structure.

The main limitation of our paper is the aggregated character of used dataset, where the results are based on very few observations. Therefore, our current results about the presence of relation between market structure and market performance development are not robust. However in the further research, we would like to confirm our results by extended model based on individual companies' data and incorporation of the analysis of efficiency changes role in this relation. In addition, deeper analysis of endogenity among analyze variables will be in the area of our further interest.

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Management and Criteria for Selecting Commercial Insurance Company for Small and Medium-Sized Enterprises

Viktória Čejková, Michal Fabuš

School of Economics and Management in Public Administration in Bratislava
Department of Economics and Finance
Furdekova 16, 851 04 Bratislava, Slovakia
E-mail: viktoria.cejkova@vsemvs.sk, michal.fabus@vsemvs.sk

Abstract: *The paper shows the characteristic of risks of small and medium-sized enterprises (SMEs), which represent a significant market economy element. Insurance is comprehended as a type of business entities protection in case of the occurrence of business risks. Decision-making criteria of a company upon the selection of a commercial insurance company to insure the given company are an up-to-date issue nowadays. Commercial insurance companies provide insurance protection and company management decide what criteria they choose selecting a commercial insurance company. The main criterion of most companies for selecting a commercial insurance company is the price of insurance. We believe that the price of insurance is an important although not the only criterion for selecting a suitable commercial insurance company.*

Keywords: insurance, commercial insurance company, risks, small and medium-sized enterprises, decision-making criteria

JEL codes: G22

1 Introduction

Trading in small and medium-sized enterprises (SMEs) fulfils a significant and irreplaceable role in all countries with a market economy. We can claim that small and medium-sized enterprises are a backbone of the European economy, as well as the key employer in the long term. Great advantages of SMEs include their flexibility, lower capital demand, possibilities of innovation and the coverage of more and more differentiated market segments. They are considered to be the most effective, the most progressive, and thus the most important part of economics. The article will characterise the risks of small and medium-sized enterprises and the possibility of their insurance. The objective of the paper was to characterize the risks of SMEs and recommend criteria for selecting a commercial insurance company.

2 Methodology and Data

The aim of this paper is to characterise the risks of small and medium-sized enterprises and the possibilities of their insurance and recommend criteria for selecting a commercial insurance company. The methods of description, analysis, synthesis, deduction and comparison will be used. The conclusion will present several possibilities of broadening the criteria for selecting commercial insurance companies and making SMEs risk insurance more effective. This paper is the output of a scientific projects IGA no. 3/2014 „Risk insurance for small and medium-sized enterprises" and VEGA no. 1/0208/14 „ Insurance market efficiency and insurance" authors of the paper are researches of these projects, as well as authors of numerous publications in this area.

3 Results and Discussion

Economic activities carried out in small and medium-sized enterprises also reflect in negative terms. These enterprises are also jeopardized by risks occurring in business activities in the given enterprises. A significant form of risk financial coverage is insurance. Insurance is focused on the coverage of risks whose occurrence would cause significant damage to a business entity and could lead up to bankruptcy. The role of risk insurance of small and medium-sized enterprises is gradually increasing nowadays.

Problematic spheres particularly include complex legislation, low level of law enforcement, high contributory burden as well as administrative burden of business. On the other hand, companies are jeopardized by risks resulting from business activities (e.g. manufacturing, technical and technological, market, social, financial risks, etc.).

The range of risks to which business entities are exposed has broadened over the last decades. The number of risks related to various natural disasters, vandalism, fraudulent behaviour and others has increased. The solution of damage caused by the given risks is offered by insurance and insuring.

3.1 Risk Insurance of Companies

In order for a company to do business smoothly, it has to have an overview of risks which could jeopardize the smooth operation of the given company in future. Prior to risk identification, the owner and employees of a company need to carry out the inventory of all company values (material, financial, intangible assets, manpower) which could be a subject to losses or destruction. They have to do it in order to find out which risk factors represent potential threats for their company.

The risk of business entities or companies can also be viewed on the grounds of whether the factors work from the inside of an entity or from its environment. It concerns internal and external risks. Internal risks include e.g. the non-fulfilment of safety regulations, which can lead to employee health impairment. External factors include e.g. flood, which can cause damage to property, health and life of persons. The risks occurred suddenly, particularly as a result of a change of natural conditions, are called natural hazards.

Many risks can be eliminated. They can be interacted and subsequently controlled. Such risks are called influenceable risks. They include e.g. damage or theft of property. A business entity can use different means to decrease the risk of property theft, e.g. the implementation of safety service, safety system, porter and others. However, some risks are hardly influenceable. An example is a volcanic eruption.

We can state that there are many different risks which can be divided according to different viewpoints – pure and speculative risk, risk due to a natural factor and risk due to the human factor, natural and non-natural hazards, internal and external risks, influenceable and non-influenceable risks, and others.

Insurable risks are predominantly concerned in risk insurance and insuring of SMEs.

For each risk, the insurer considers whether it is possible to precisely identify a risk, whether it is possible to precisely quantify a loss following a risk occurrence, and whether a risk is economically advantageous, and thus acceptable for the insurer. If a risk is accidental, identifiable, quantifiable and economically advantageous, it can be insured, i.e. it is insurable. Each insurance company publishes the risks they insure.

Negative events result in direct and indirect losses of people and business entities. Direct losses are quantifiable – e.g. damage or destruction of property. Indirect losses are incurred by an interruption of the main activity of a business entity (e.g. market position loss) or damage to a good reputation. Such losses are hardly quantifiable, and thus also hardly insurable.

Various risk factors and risk levels are important for premium amount specification in practice. Calculating premium, insurance policies are divided into tariff groups according to different factors and risk levels. A tariff group represents a group of insurance policies with approximately identical risks. For example, there can be four risk factors regarding motor hull insurance – the age of driver, gender, car type and residential address. On their grounds, various levels can be considered, e.g. there are three levels regarding the age of driver – from 18 to 25, from 26 to 58, and 59 and more; two levels are considered regarding gender – male and female, etc. The number of tariff groups then equals the product of the number of factors and levels. Each tariff group has a certain different amount of premium. This is how the procedure of its calculation is simplified in practice.

Further risks of SMEs also include credit risk, liquidity risk, market risk, currency risk, interest rate risk, operational risk and other risks (Čejková et al., 2011).

Risk management: Neither people nor business entities can insure all risks which threaten their lives or business activities. Some risks can also be eliminated otherwise. It is important for them to know risk management tools and to implement the process called risk management. Risk management is the process of risk monitoring, its influencing, prevention and damage reduction, and exploring the options of financial coverage of its consequences (Martinovičová and Čejková, 2013).

It is first of all important in risk management to know risks jeopardizing an entity, which includes their identification, seriousness specification, probability of their occurrence, and the evaluation of measures possibly reducing the given risks. They include different precautionary measures, e.g. different trainings, safety features like fire detectors, safety service implementation and others. Risk diversification and risk financial coverage predominantly by insurance and insuring is an important part of risk management.

Risk identification: The following (model) and other risks can be found and classified during the identification:

Table 1 Risk division - model

EXTERNAL RISKS	➢ Natural hazards ➢ Risks of theft, vandalism
	➢ Credit risk ➢ Risk of non-payment of debts ➢ Payment risks
	➢ Transportation risks – risks of national and international transport
INTERNAL RISKS	➢ Risk of the occurrence of a work injury ➢ Risk of the loss of qualified workers

Source: own processing under IGA Project No. 3/2014 School of Economics and Management in Public Administration in Bratislava, 2014

Companies conclude policies enforced by law (i.e. compulsory insurance policies) and voluntary insurance policies which they decide for. Compulsory insurance includes e.g. liability for damage caused by motor vehicle operation, liability for environmental damage, and other policies. Voluntary insurance includes motor hull insurance for the events of damage resulting from several risks, e.g. traffic accidents, theft, vandalism, unauthorized usage of a means of transport or a natural disaster. Such risks can include windstorms, hailstorms, floods, fires, landslides, earthquakes, etc. Insurance covers damage during the transport of goods as well as damage to property of a company.

Many risks were found during the identification of risks, with only a negligible part having insurance coverage. Risks having catastrophic effects on a company, e.g. natural hazards and risks of theft, are sometimes not covered at all. To cover these risks, property insurance or motor hull insurance can be implemented, and the most appropriate life assurance can be implemented as one of the forms of the motivation of employees of a company.

The insurance of risks related to business activities is frequent in companies, predominantly including the following:

- **Property insurance**: The insurance coverage of property for the events of natural hazards and risks of theft. It is important that companies insure for the events of the occurrence of these as well as other risks. The objects insured are different office buildings, service shops and other operational buildings.
- **Credit insurance**: Credit insurance insures the inability to pay off a credit in the events of the occurrence of different risks specified in an insurance policy, e.g. in the events of the loss of employment, illness, injury or death of the insured and others. This insurance is also offered by banks themselves upon credit provision.

- **Loss of profits insurance**: In case of profit insurance, the object insured is the profit of a business entity in the events of the occurrence of different risks specified in an insurance policy, e.g. unfavorable weather conditions, uncollectible debts, etc.
- **Legal expenses insurance**: Concerning legal expenses insurance, indemnity in case of an insured event is not the provision of an agreed financial amount to the insured but the provision of legal services. Legal services can be provided in various cases, e.g. in labor disputes, neighborly disputes, disputes related to property rentals, or related to the accidents of motor vehicle drivers, etc.

3.2 Possibilities of Further Insurance and Insuring of the Risks of Small and Medium-Sized Enterprises

In case of insurance and insuring of the risks of SMEs, predominantly so called insurable risks are concerned, particularly including insurance against natural disasters, which protects the insured property (a group or individual objects) in case of a damage resulting from natural disasters, caused by accidental insured events, e.g. fire, explosion, lightning, windstorm, fall of objects, flood or deluge, hailstorm, landslide, fall of rocks, earth and avalanche, earthquake, and other risks. Buildings and sites are also insured for the case of a damage caused by snow or icing weight. This insurance also provides insurance protection in case the insured objects have been damaged or destroyed by water from water supply equipment and the substance flowing from fire extinguishers. If the insured object is a building, insurance also covers water piping, discharge piping, and heating and solar systems damaged due to an overpressure of fluid or steam, or water freezing in them. Insurance for the event of theft provides insurance protection in case of a theft or burglary, if the perpetrator overcame an obstruction protecting the insured objects or used violence. Insured objects have to be protected for the case of theft by means corresponding to their value (safety lockers and foils, safe-deposits, etc.). Insurance can also be related to the theft of money during its transport by an authorized person. Insurance of sites is implemented for the cases of natural disasters and other risks. An advantage of this insurance product is that complex property and liability insurance according to the needs and interests of a company can be agreed within a single insurance policy. Insurance for the case of the loss of employment and other types of insurance can also be implemented (Čejková and Fabuš, 2012).

3.3 Criteria for Selection of Commercial Insurance Company for Small and Medium-Sized Enterprises

SMEs determine their own criteria for insurance selection, on the grounds of which they subsequently decide in their selection of a commercial insurance company. These criteria can be generalized, however each business entity prefers and considers different criteria on the grounds of which they decide. Decisions of business entities in selecting a commercial insurance company are also affected by the price of insurance. They mostly want to get the greatest possible profit for the lowest possible costs.

Selecting a commercial insurance company and its insurance products, SMEs take various criteria into consideration, including the following:

- recommendations of a commercial insurance company by acquaintances;
- the portfolio of a particular insurance company;
- the amount of its capital;
- the solvency of a commercial insurance company;
- own experience with a selected commercial insurance company;
- the amount of premium;
- the intensity and type of risk;
- offered insurance services;
- the speed of insured events processing, indemnity payment, etc. (Martinovičová and Čejková, 2013).

Each business entity prefers a different criterion playing the greatest role from their viewpoint; however, the most frequent are those aforementioned. Premium, i.e. the price

a business entity is to pay for an offered insurance product of an insurance company upon insurance policy conclusion, can be emphasized. Another frequent criterion is the solvency of the given insurance company, as business entities are mistrustful in current economic situation and do not want to put their money in an insurance company which is irresponsible, respectively unable to provide them an optimum indemnity in case of an insured event occurrence. The third frequent criterion is the speed of insured events processing, which is partially related to recommendations regarding an insurance company. In case of the occurrence of a damage against which a business entity has been insured, the speed of indemnity payment is considered.

Some SMEs prefer insurance companies on the grounds of the criteria they might find more important. However, a very significant factor is the satisfaction of a company with their cooperation and the insurance company, and an insurance relationship based on trust. By means of insurance, business entities have to be in permanent contact with their insurance company, which is why it is important for them to select a commercial insurance company with which they will be satisfied and able to communicate with well.

The main criterion of some SMEs is the amount of premium. However, we recommend to several SMEs to broaden their criteria for selecting a commercial insurance company to insure their business-related risks by the following criteria:

- the market share of a commercial insurance company on the insurance market;
- the image of a commercial insurance company;
- the reference and experience with a commercial insurance company;
- the solvency of a commercial insurance company;
- the availability of provided services;
- the type of risk;
- insurance terms and conditions;
- the speed of insured events settlement;
- the insurance products of a commercial insurance company, etc. (Martinovičová and Čejková, 2013).

4 Conclusions

Economic and other activities of small and medium-sized enterprises have certain risks. A significant form of risk financial coverage is insurance. Insurance is focused on the coverage of risks whose occurrence would cause significant damage to a business entity. That is why the role of insuring the risks of small and medium-sized enterprises is increasing nowadays.

These entities conclude various insurance policies regarding their risks. However, SMEs conclude voluntary insurance policies in a smaller extent, e.g. insurance of liability for damage caused by the operation of an organization, insurance of liability for damage caused by an employee, and other liability insurance policies. SMEs also conclude life assurance policies for company employees in a smaller extent. Risks of various financial losses resulting from business activities, e.g. profit loss, employment reliability, insufficient income, legal protection, etc. are frequently not insured. On the grounds of the aforementioned, we proposed some other insurance products. These products are included in the portfolios of commercial insurance companies.

The objective of the paper was to characterize the risks of SMEs and recommend criteria for selecting a commercial insurance company. According to the already mentioned state of SMEs, they predominantly decide on the grounds of the premium amount criterion.

We also consider the inclusion of other criteria, e.g.:

- the share of a commercial insurance company on the insurance market,
- the image of a commercial insurance company,
- the speed of insured events settlement,
- the solvency of an insurance company,
- the availability of provided services,

- insurance terms and conditions,
- the type of risk and others, among the selection criteria for selecting a commercial insurance company to be important.

SMEs can choose the most appropriate commercial insurance company and transfer the risks of their business. By means of this transfer, SMEs ensure the effectiveness and profitability, and eliminate losses of their own financial means.

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The Single Supervisory Mechanism and the Czech Republic

Hynek Černý

Masaryk University
Faculty of Economics and Administration, Department of Finance
Lipová 41a, 602 00 Brno-Pisárky, Czech Republic
E-mail: hynek.cerny@cnb.cz

Abstract: *From November 4th, 2014 the ECB, acting on its responsibility as regional supervisor will be launching the Single Supervisory Mechanism (SSM). The Mechanism puts in place a system of community banks supervision that involves national supervisors and the ECB. Participation in the SSM is not mandatory for the countries outside the euro area. They have the option to participate in the system by entering into close cooperation agreement with ECB. For this purpose, the ECB will have to issue and adopt many rules and operating procedures before the commencement of the SSM. The ECB has already completed the design of ECB SSM Framework Regulation, which has dealt with the implementation of Council Regulation No 1024/2013 on SSM in the supervisory practices of the ECB. The proposal is submitted for public consultation. In terms of surveillance activities it will be interesting to evaluate the implications and possible consequences, whether the Czech Republic steps into the SSM or not.*

Keywords: authority, banks, supervision, regulation

JEL codes: G01, G28

1 Introduction

The European Central Bank (hereinafter referred to as "ECB") published, on February 7th of this year, a proposal of the Regulation of the European Central Bank (hereinafter referred to as "the Proposal"), which establishes a framework for cooperation between the ECB, the national competent authorities and national designated authority (hereinafter referred to as "NAs" or "NA") within the single supervisory mechanism (hereinafter also referred to as "SSM").

The SSM is the result of several years of effort by the EU institutions on the closer integration of financial market supervision. The trigger (or excuse?) for increasing the dynamism of this process was the 2008 financial crisis, whose consequences are still outpacing Europe. The European Commission was afraid of a bailout of the banking sector and the threat of recession. Thus, it has decided to create a new model of regulation, which would be able more effectively, and in a timely manner, to indicate the negative events on the financial markets and through closer supranational cooperation on these phenomena in time to react. The first result was the report of a team led by Jacques de Larosière. The report identified weaknesses in the current regulatory system and proposed new solutions. Although the document was accepted largely without opposition, in some cases it was not possible to fully identify with his findings. In particular with the regulation of Credit Rating Agencies, influence exert over IASB, the extension of regulation to all firms or entities conducting financial activities of a potentially systemic nature (even if they have no direct dealings with the public at large), proposals to further develop common rules for investment funds in the EU, tighter supervisory control over the independent role of depositories and custodians, interconnection between compensation incentives and shareholder interests, high and robust protection of all customers (also in the insurance and investment sectors) etc.

The cause of the crisis was the failure of the supervisory institutions and the regulation of banks exposures in the area of complex structured instruments (e.g.. ABS). To this failure may have significantly contributed a sectoral fragmentation of financial supervision authorities and related gaps in coverage of the markets of those instruments by the supervision. The attention thus should have been paid especially to how these gaps close and not the projects of further enlargement of the scope of regulated entities.

The material was adopted relatively quickly and smoothly over the background of subsiding panic and lingering recession and became a pillar of the new European supervisory institutional architecture. By a decision of the Council of the EU (hereinafter referred to as "Council") of 9.6.2009 came to the consolidation of the financial market supervision. The Council decided in the meaning of Jacques de Larosière report on the establishment of the European Systemic Risk Board (ESRB) and the European System of Financial Supervisors (ESFS), umbrella European Supervisory Authorities (ESAs).

Although the Jacques de Larosière report was ambitious, it did not mean, in connection with the ESFS and ESRB, such a significant integration step, as the formation of the SSM. The current project is probably beyond the scope of the original claims.

One of the Jacques de Larosière proposals (adoption a balanced group support regime) shifting the power from the host to the home regulator became the basic pillar of the SSM design. The aim of this work is to evaluate the benefits and drawbacks of cooperation schemes in the area of the surveillance and regulation of banks after the takeover of the supervision by the ECB starting November this year.

2 The Single Supervisory Mechanism

2.1 The Scope

The design of ECB SSM Framework Regulation is based on the Council Regulation No 1024/2013. The purpose of the ECB's Proposal is to establish the rules and procedures for cooperation between the ECB and the NAs of the participating states in order to ensure the good functioning of the SSM. The Proposal addresses the following areas in particular:

- a methodology for the assessment of the relevance of the supervised entity or group in order to determine whether it falls under the direct or indirect exercise of supervision,
- cooperation and exchange of information between the ECB and the NAs,
- the language regime of the various processes within the SSM,
- the general principles for the performance of the ECB'S supervisory procedures,
- procedures related to macro-prudential tasks of the ECB,
- the organization of close cooperation (see below) with the states whose currency is not the euro,
- imposition of administrative penalties.

2.2 Organization, Principles, Supervision on a Consolidated Basis

Joint Supervisory Teams (hereinafter referred to as "JST") carries out the supervision in the case of significant institutions. Their main tasks include the design and implementation of surveillance monitoring and evaluation activities and coordination of examinations on the spot. It is composed of staff of the ECB and the staff nominated by the relevant NAs. Supervision on site is also carried out on the basis of the ECB's decision. The ECB has a major say in the formation and composition of the team carrying out the on the spot examination.

The ECB shall exercise supervision over the significant credit institutionson on a consolidated basis. Consolidated supervision of groups that are "less significant" institutions, continue to ensure the relevant NAs.

If the groups operate in more than one state, there shall be established, for the performance of the consolidated supervision, the Colleges of supervisors, with the following composition:

In the case of significant institution with maternity institution in the participating state, the ECB is the Chairman of the College. NAs of credit institutions subsidiaries in the not-participating states, or branches in the not-participating states, that are significant, are members of the College and the NAs of credit institutions subsidiaries in participating states are in the role of observer.

In the event that the controlling institution and thus consolidating supervisory authority does not have a registered office in the participating state, then it is the status of the ECB and the NAs of credit institutions subsidiaries in participating states following:

- in the event that all of the supervised bodies in the participating states have the status of significant institutions, the ECB becomes a member of the College, while the NAs are in the role of observers,
- in the event that all entities have the status of less significant institutions, members of the College are the only NAs,
- in the case that some of the bodies of the participating states are significant institutions and some of the bodies of these states are less significant institution, the ECB and the NAs of those less important institutions are members of the College, while the NAs, in whose state has registered a significant institution, have in the College the role of observers.

2.3 Important and Less Important Institutions

The SSM Regulation sets out the basic criteria for determining significance in article 6(4) of the SSM Regulation. The criteria laid down are:

- size, the volume of assets in the amount of at least 30 billion EUR,
- importance for the economy of the EU or a participating Member State, the volume of assets in the amount of at least 5 billion EUR and the ratio of assets to GDP of the participating state at least 20%,
- significance of cross-border activities, controlling person of the group has a subsidiary of a credit institution in at least two EU Member States and the proportion of non-resident assets or liabilities on the total balance sheet of the entire group is at least 10%,
- request for or receipt of public financial assistance directly from the EFSF or the European Stability Mechanism (ESM), relevant areboth, the supervised entity that has applied for aid, as well as all other supervised bodies of his group, and
- qualifying as one of the three most significant credit institutions in a participating Member State.

Whether a supervised entity or a supervised group are regarded as significant is determined at the highest level of consolidation in a participating Member State. All credit institutions that are part of a significant group will be subject to direct supervision by the ECB on a consolidated and on an individual basis.

The ECB sets the body between the significant institutions by its decision and shall publish a list of all significant institutions.

2.4 Cooperation in the Context of the ECB's Macro Prudential Tasks

NAs on one side and the ECB on the other side, shall be entitled to apply to the bodies macro-prudential measures, in particular in the form of a requirement to maintain capital reserves beyond minimum regulatory capital requirements (counter-cyclical reserves, the reserve for the G-SIIs, reserves to cover systemic risk).

NAs and the ECB are obliged to inform each other, that they intend to introduce certain macro-prudential measures, at least 10 working days before they decide and the counterparty has the right to raise objections within 5 working days prior to the applicable date.

2.5 Procedures in the Framework of Close Cooperation

The non-euro area Member States that decide to enter into the SSM through close cooperation are referred to as closely cooperating states. The ECB is not entitled to exercise its supervisory powers in a closely cooperating states against the supervised bodies directly, but only through the NAs. The ECB may however in such cases issue in relation to the significant institutions general or specific instructions, requests or guides requesting the NAs, to issue decisions relating to these significant institutions. Without

the instructions of the ECB the NAs cannot issue any decision (NAs may, however apply for the instruction).

In relation to the less significant institutions, the ECB publishes the guidelines not in relation to specific supervised bodies, but the groups or categories of the bodies. Similarly, in case of macro-prudential tasks entrusted to the ECB, the ECB may issue specific instructions, requests, or guides to the NAs. NAs will bear responsibility for any damages, if the instructions of the ECB were not timely applied.

In the case of non-participation in the SSM the ECB shall conclude with the Czech National Bank (hereinafter referred to as "ČNB") and other NAs of not-participating states a multilateral MoU on cooperation in the area of supervision.

2.6 Administrative Sanctions

The sanctions are the result of violation of the obligations of significant or less significant institutions arising from the relevant regulation or decision of the ECB. The Proposal establishes an independent investigative group, composed of staff appointed by the ECB, which should examine possible breaches and prepare draft decisions. Revenue from administrative sanctions granted by the ECB shall become the property of the ECB.

2.7 Transitional and Final Provisions

At least two months before the 4. November 2014 sends the ECB to all significant institutions decision on the takeover of exercising supervision. In the case of a body that is part of a group, the ECB shall send the decision to the parent company. NAs must, within 4. August 2014 send to the ECB a list of licensed credit institutions.

3 Evaluation Method, Criteria

The evaluation was necessarily influenced by the fact, that, for a given topic, there were not sufficient amounts of available publications. This is due to the fact, that the project is still in the praparatory stage and, at the same time, it is not very hot for the majority of the EU countries. The findings will also be burdened with a certain degree of subjectiveness, since it was impossible to quantify them exactly. The criteria for the evaluation of the cooperation schemes are therefore established by individual choice, but with regard to the quality and effectiveness of surveillance at both, the Community level and the NA level, who, as the stakeholder, takes a signifiant part on the responsibility and costs (without taking the proportional part on the decision making process).

For assessment purposes there were used ordinary criteria like

- Administrative demands
- Simplicity and clarity of the arrangement
- Economy
- Communication and cooperation
- Readiness for action
- Enforcement options

3.1 The Impact of the Proposal on the Regulatory Environment in the Czech Republic

ČNB remains not-participating NA

- the czech banks, which are subsidiaries of controlling persons registered in one of the participating states, will be subject to supervision on a consolidated basis in the framework of the SSM,
- new coordination of the activities of the not-participating country NAs with ECB will be established, conclusion of new agreements on cooperation within colleges will be required,
- the ČNB would have the same supervisory powers as before the creation of the SSM, the SSM should not have any significant impact on the objectives and methods of the performance of the supervision of credit institutions,

- communication with the consolidating foreign supervisory authority should be simplified, as the ECB takes over the current position of the consolidating supervisors.

ECB will chair the colleges while NAs from the participating countries will, instead of the current position of the members newly be in the role of observers. Currently consolidating supervisory authorities (the European parent banks) will be replaced, in exercise of their powers newly by the ECB. Paradoxically, the European supervisory authorities will become an observer in the College, while the ČNB, as the supervisory authority of the not-participating state, will remain a member of the relevant Colleges. In case the other supervisory authorities have entered also into a close cooperation, the ČNB and the ECB would have been members of the colleges, and all of the other supervisory authorities, would have just observer status. Joint decision of those Colleges might be a joint decision of the ECB and the ČNB.

ČNB participates in close cooperation

Supervisory powers of the ČNB over banks would be limited by the guidelines and instructions of the ECB and spun from the fact of significance or, conversely, the smaller significance of the supervised entity or group.

In the case of supervision of less significant institutions would be the ČNB obliged to follow general guidelines and instructions issued by the ECB and at the request of the ECB to take decisions (not in relation to individual supervised body, but in relation to specific groups or categories of supervised entities).

In the case of supervision of significant institutions would the ČNB have far more tasks, inter alia:

- to ensure that the ECB has received all the information and statements that the ČNB received from or in connection with the examination of significant institutions,
- designate a local coordinator or other staff in the JST under the direction of a main coordinator of the ECB,
- take a decision (only) on the basis of the instructions of the ECB, the ČNB should be able to apply to the ECB for the release of the instructions,
- ensure that the supervised institutions in the Czech Republic can be subject to the assessment which institution will be considered significant and the procedures of close cooperation,
- impose administrative penalties (only) on the basis of the ECB guideline and inform ECB of decision drafted by the ČNB,
- use the powers of investigation in accordance with the instructions of the ECB, including the obligation to invite the staff of the ECB to the investigation in the role of observer and inform the ECB of the outcome of the investigation.

Provisions of the Proposal in the area of macroprudential instruments, creates a fairly broad space for the implementation of a whole range of measures at the local level, however, these measures will be necessary to consult with the ECB.

NAs of states participating on the basis of close cooperation have the right to request the termination of close cooperation with immediate effect, under the conditions laid down in the regulation on SSM. The Proposal deals only with the time limit of this process.

4 Conclusion

In the case of supervision of signifiant institutions would the NA have far more tasks since it becomes the service point of the ECB. Administrative demands attributable to both, to the NA and to the Community, would therefore be higher.

Simplicity and clarity of the arrangement does not appear to be the worrying factor. Only the need for interpretation of some terms or the neccesity to scrutinize the range of signifiant subjects would make the future arrangement a bit more complicated.

Economy - in the case of supervision of signifiant institutions would the NA have far more tasks which would require additional capacities.

Communication and cooperation with the consolidating foreign supervisory authority should be simplified as the ECB takes over this consolidating position. All the communication would be directed at the ECB.

Readiness for action (from the NA point of view) would be limited because of the loss of the supervisory power over the host signifiant institutions. The influence in the colleges of supervisors on the consolidated basis would be weak (would depend od the strength of the observers role).

The off/on site examinations and following steps would have to proceeded in line with ECB instruction including the obligation to invite the staff of the ECB to the investigation in the role of observer and to inform the ECB of the outcome of the investigation. This may complicate the enforcement opportunities in the cases, where the national rules and practices are well and effectively developed and cover fairy good the national conduct of business. Potential conflicts with the national admistrative procedures may thus arise despite the direct applicability of the community regulations.

It is obvious, that five of six simple basic criteria are not in favour of the close cooperation.

Problems can be expected due to the different segmentation of entities, the differences in the arrangement of supervision (functional versus sectoral arrangement), differences in the number and focus of supervisory institutions in EU countries. Many countries have their own system of specific financial institutions, which must be treated specifically (saving unions, building societies, etc.)

The project of close cooperation would on the other hand bring a lot of positive changes. It may, in the Czech Republic, touch approximately 23 legal standards. It would trigger the acceleration of the unification of many legal concepts, procedures and terms. For example the use of the principle of the individualization of penalties or the determination of its size which usually depends on a number of factors, like severity of the misconduct, the way the tort was committed (by the act, omission, fraud or otherwise seriously), the circumstances and consequences of committing a tort, the duration of the infringement, relapse, property circumstances of the delinquent (the inadmissibility of the winding-up of the fine) etc.

The positive impact could be seen also in the examination steps. There were different standards of supervision across the EU countries. Many authorities did not collect enough data about specific transactions. This led to the inability to detect defective practices using off site surveillance tools. Many authorities did not check the individual credit files of banks, they relied on the in advance prepared presentations. There was no deeper knowledge of the functioning of the systems and processes at the examined institution (no defects could be revealed without that in the internal control mechanisms of the banks that are the source of uncontrolled risk taking). A thorough verification of the quality of the assets has not yet been subject to the normal activities of European supervisors, a thorough review is running within the SSM now.

The bank supervision in the Czech Republic has not failed in any of the designated areas so it is well prepared to become a part of the project that unfortunately the high supervisory standards just started to design.

Finally, there is also the question of subsidiarity, which the EU has incorporated in all basic documents. I.e., whether due to significant historical, cultural and customary differences of European regions were some goals met more efficiently by national and regional authorities.

Long-term benefits of surveillance integration can nowadays hardly be estimated. There are no doubts, that they will outweigh the potential costs. Irrespective of this conclusion, the present accession to the SSM appears to be premature.

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The author is an employee of the ČNB, this work, however, does not represent the opinion of the ČNB.

Comparison of Assessment of Capital Adequacy for Czech Commercial Bank

Michal Červenka [1], Eva Cipovová[2], Angelika Stupková[3], Roman Hlawiczka[4]

[1] Tomas Bata University
Faculty of Management and Economics, Department of Finance and Accounting
Mostní 5139, 760 01 Zlín, Czech Republic
E-mail: cervenka.michal@email.cz

[2] The University of Finance and Administration
Faculty of Economic Studies, Department of Business Management
Estonska 500, 10100 Prague 10, Czech Republic
E-mail: evacipovova@gmail.com

[3] Paneuropean University
Faculty of Economics and Business
Tematinska 10, 851 05 Bratislava 5, Slovakia
E-mail: a.stupkova@gmail.com

[4] Tomas Bata University
Faculty of Management and Economics, Department of Finance and Accounting
Mostní 5139, 760 01 Zlín, Czech Republic
E-mail: hlawiczka@fame.utb.cz

Abstract: *The contribution is dealing with selected assessments of the most important risk in the banking sector in the Czech Republic. The aim of this article is calculate, compare capital requirements and calibrate effective portfolio of business loans regarding to the optimal amount of the final capital adequacy of the given commercial bank in the Czech Republic. Paper is focused on the credit risk management where the evaluation of the capital adequacy with using Standardized Based Approach (STA approach) with external rating and Foundation Internal Rating Based Approach (IRB approach) methodology of legislative framework of Basel III is used. Results of our calculations show that IRB methodology is beneficial only for big banks that are able to choose their clients (with AAA rating, low credit risk and default rate). On the other hand, if the bank would like to make an offer to client with the rating B and worse, compared to the competitor who is used only Standardized Approach without External Rating, it has competitive disadvantage, because of higher entitlement on the amount of bank's equity which has to be hold and which could represent higher prices of provided loans. On the other hand, because of the possibility still using the old STA methodology and their non-sensibility on PDs, small banks could focus on worse customers and offer them lower (better) interest rate because of the possibility to hold lower amount of the capital.*

Keywords: Basel III, Standardized Based Approach without external rating, Foundation Internal Rating Based Approach, Probability of default, credit risk management

JEL codes: G22, G18, G32

1 Introduction

Due to the fact that banks use huge amount of external financial sources in their business models (amount of these sources reached more than 95 %), it is necessary to adjust this area by some legislative framework. This legislative framework consisting primarily of the regulatory agreements of Basel III sets legal rules which govern the capital adequacy of banks. Therefore following rules have to be followed for establishing of the effective loans portfolio of commercial banks. On the other side there is obvious demand of the banks' owner to maximize the return on equity. The aim of effective active business management should be to create such a portfolio which respects the legislative framework, but also bring the highest return on equity for the banks' owner in the same time.

The aim of this article is calculate, compare capital requirements and calibrate effective portfolio of business loans regarding to the optimal amount of the final capital adequacy of the given commercial bank in the Czech Republic.

Lastra (2004) also argues that banks with the arrival of Basel II standards and the possibility of development of their own IRB models banks will try to use these methodologies to reduce their equity and thus to increase ROE. Härle et al. (2010) states that most banks in Europe did not reverted to the new credit risk approach. With the arrival of higher capital requirements in relation to the new implementation of Basel III, there is offering the opportunity for banks to defend these new costs. The aim of this paper is to prove that for effective modeling portfolio of business loans in the context of capital adequacy is more advantageous for the usage of the IRB approach compared to using STA (Standardized Approach Based) approach.

According to McKinsey (Härle et al., 2010), the cost of additional capital due to implementation of Basel III within the current state of portfolio of European commercial banks are estimated at € 1,100 billion of additional Tier 1 capital, €1300 billion of short-term liquidity and €2300 billion of long-term resources. At the same time there is an estimation of a reduction in average ROE by 4% in the banking sector. According to authors, the transition to Basel III represents an impulse for banks which have not begun with improvements of their approaches for the optimal level of risk-weighted assets (RWA) yet, because these approaches make the capital and liquidity much less available and much more expensive. Certain solutions for banks (Härle et al., 2010) could be seen in a reduction of the value of risk-weighted assets (RWA) within the credit risk management. In this context, banks are particularly concerned about the loss of capital and liquidity, which are derived from ineffective implementation of the new regulation. Authors see two major events which banks may face challenges of Basel III with: the improvement of capital efficiency especially in the trading portfolio and the determination of the sub-optimal liquidity management practices.

Due to the legislative changes of Basel II, it allows to develop internal rating models for banks and set the capital adequacy on their basis which may lead to improve the efficiency of the capital and the development of efficient portfolio of business loans. (Basel Committee on Banking Supervision, 2009) Basel II came up with this possibility precisely because of the criticism of insensitivity to credit risks of individual borrowers - excellent company, as well as the almost defaulted company had gained the same RWA 100 %. (Reppulo, Suarez, 2004)

In the banking area, there are two perspectives on this topic – the perspective of the owners and the perspective of civil society. Due to the fact that banks works with the deposits of the general population who often do not realize that their savings are on-lent, there is a logical pressure of the society to banks to manage with these funds on the least possible risk level. In contrast, owners require banks to have the greatest profit using the minimal amount of their own funds. Therefore in this case the goal is to minimize the capital requirement of banks. This contribution solves this issue from the perspective of owners and seeks to minimize the need for bank capital.

Internal rating models for credit risk assessment of the client should therefore be an important part of the credit risk management in commercial bank. These models, which are extremely important in the phase of risk measurement, recorded very dynamic development and should become an inevitable part of the assessment of credit risk in banks in the last period. Generally, rating systems are used to determine the credit risk of individual borrowers. Using different methods, the credit rating score is assigned to individual borrowers and indicates the level of their credit worthiness. Aggregate risk of individual clients defines also the relevant amount of capital requirement.

2 Methodology and Data

According to Basel II, commercial banks can use not only Standardized approach (STA) but also Internal Rating Based Approach (IRB) for credit risk measurement and for

calculation of required amount of equity. The issue of capital adequacy of commercial banks, the quality and functioning of the models for credit risk measurement in the macro-economic framework examined the study Belás a Polách (2011).

Standardized approach for credit risk measurement exactly determines risk weights for credit assets. For example, for corporate loans applies: if the bank has available rating scores of recognized rating agency (STA+ ER approach), this rating classifies individual exposures (EaD) to six level of credit quality. First level of credit quality means that given assets has risk weight of 20 % and sixth level of rating quality is assigned risk weight of 150 % to given assets (Czech National Bank, 2007c). If there is no available rating scores of recognized rating agency (STA–ER approach), risk weight of 100 % of given state is assigned to given assets. The amount of capital requirements (KP) for individual exposures is calculated through this formula:

$$KP = EAD \times RW \times k, \tag{1}$$

where k is a coefficient of capital adequacy (0.08).

Internal Rating Based Approach is enable to use own systems for credit risk measurement in banks (Antloch, 2008; G. Falavigna, 2008; Jankowitsch, Pichler a Chwaiger, 2007; Meyer, 2006; Witzany, 2010). If the bank uses Fundamental Internal Rating Based Approach (FIRB), only the Probability of default can be estimated by own approaches and other parameters is determined by a national regulator. If the bank uses Advanced Internal Rating Based Approach (AIRB), then all risk parameters can be estimated by own approaches a models including a Probability of default (PD), Loss Given Default LGD, Exposure at Default EaD and the maturity. IRB is enabling to calculate own calculations of risk weights of exposures, which significantly determine appropriate capital requirements (Czech National Bank, 2007a), (Czech National Bank, 2007b), (Czech National Bank, 2007c).

The Internal Rating Based Approach determines that inputs parameters which are required to calculate an appropriate amount of equity (such as PD, LGD, EaD, M) can be estimated by own approaches of an individual bank institution on the basis of national regulator permission.

The value of risk weighted assets (RWA) is calculated by formula as follows:

$$RWA = RW \times EAD \tag{2}$$

Risk weight (RW) is defined by the following formula:

$$RW = 12{,}5 \times 1{,}06 \times \left(LGD \times N\left(\frac{1}{\sqrt{1-R}} \times G(PD) + \frac{\sqrt{R}}{\sqrt{1-R}} \times G(0{,}999) - PD \times LGD \right) \right) \times s \tag{3}$$

Where s is the maturity, N(x) is a function of the normal distribution of random variable (N (0, 1)), G (z) is the inverse cumulative distribution function for a standard random variable, "R" is the correlation of systemic risk, "M" is effective maturity and "s" is adjusted maturity. The way how to calculate these parameters is set by a national regulator. Probability of default to corporate exposures or institution exposures is at least 0,03 %. Probability of default of borrowers is 100 %. The value of M (maturity) which is used by institution which have no permission to use own LGD, represents 2,5 years. LGD for subordinated exposures without eligible collateral is 75%. Estimates of PD are based on the usage of historical experience and empirical evidence, not only on a personal assessment. (Czech National Bank, 2007a), (Czech National Bank, 2007b), (Czech National Bank, 2007c).

Based on this requirement, PDs which were obtained by ČEKIA Company (today known as Bisnode Česká republika a.s. with nearly 20-years history) for the effective modeling portfolio of business loans in the context of capital adequacy have been used. This Czech Capital Information Agency (ČEKIA) a.s. was founded by Prague Stock Exchange, Česká spořitelna and Komerční banka to provide information about the nascent Czech capital

market. Due to these preconditions, ČEKIA is able to define as accurately as possible the stability of the company and also predict the risk of companies' bankruptcy within the period of next twelve months. Split into groups corresponds to the minimum of credit rating requirement, i.e. 7 rating groups. Data classification of companies should conform to the requirements of the ČNB's internal rating models and estimation of PD. Methodology of ČEKIA's rating model is in accordance with the rules of Basel II". (Bisnode, © 2001-2013)

Belás, Cipovová, Novák, Polách (2012) present the theoretical-methodological and practical aspects of validation of internal rating models of commercial banks. Other related studies can be found here (Horvátová, E., 2013; Horvátová, E., 2008; Chovancová, B., Arendas, P., 2013; Chovancová, B., Arendas, P., 2012)

Foundation Internal Rating Based Approach (FIRB) is based on the fact that that bank evaluates only PDs of individual borrowers. PDs of individual borrowers when using the approved IRB hybrid model CNB should not be significantly different from the values determined by ČEKIA in its model, which is in accordance with the rules of Basel II. Therefore values obtained by ČEKIA as the values which would be achieved in the internal rating model of the bank, have been used. Standardized Based Approach (STA) with the use of external ratings in this paper is neglected because it does not make sense to use this approach in the case where data only from the Czech Republic will be used (the percentage of firms with external rating is negligible). In the calculation, the capital requirement of 8 % is used.

Table 1 Rating groups of ČEKIA and their average of PDs

Name of the group	Rating evaluation	Description	Description of the group	Average PD
Excellent	AAA	Excellent	Stable company, high probability of reliable fulfillment of obligations, the high probability of return on investment, low credit risk, minimal risk of bankruptcy	0.0003
	AA	Outstanding		0.0012
	A	Great		0.0029
Good	BBB	Very good	A quality company, the possibility of a slight delay in the implementation of the commitments, the need for individual assessment of return on investment, acceptable credit risk, low risk of bankruptcy	0.0062
	BB	Good		0.0121
	B	Sufficient		0.0241
Risk	CCC	Risk	Risk companies, the probability of late payment towards meeting commitments, the possibility of future deterioration of the financial situation, a higher credit risk, high bankruptcy risk	0.0518
	CC	High risk		0.1127
	C	Extremely risk		0.2549
Default	D	Default	Inability to meet its obligations	-

Source: (Blumenbecker Prag, 2012)

3 Results and Discussion

On the beginning of this research, following hypothesis has been set:

H 1. Savings of the capital in the transition from STA approach (Standardized Based Approach) to an FIRB approach (Foundation Internal Rating Based Approach) will be more than 10%.

To test the hypothesis, the distribution of Czech companies in terms of rating during the years 2006 -2011 has been used.

Table 2 The distribution of Czech companies according to ČEKIA 2006-2011

RATING	2006	2007	2008	2009	2010	2011	PD
AAA	14.27%	11.31%	2.39%	4.08%	2.06%	2.19%	0.0003
AA	21.65%	22.28%	5.73%	7.20%	4.51%	6.06%	0.0012
A	22.59%	22.21%	21.02%	13.16%	11.14%	13.41%	0.0029
Suma A	58.51%	55.80%	29.11%	24.44%	17.71%	21.67%	
BBB	19.29%	22.05%	37.55%	17.24%	16.90%	20.81%	0.0062
BB	9.40%	10.26%	11.75%	14.63%	13.81%	15.98%	0.0121
B	6.87%	6.73%	13.20%	22.31%	25.50%	18.80%	0.0241
Suma B	35.56%	39.04%	62.50%	54.18%	56.21%	55.59%	
CCC	3.69%	3.37%	5.91%	13.39%	13.11%	13.36%	0.0518
CC	1.47%	1.20%	1.67%	6.94%	8.20%	6.62%	0.1127
C	0.78%	0.59%	0.80%	1.04%	4.18%	1.95%	0.2549
Suma C	5.94%	5.16%	8.38%	21.37%	25.49%	21.93%	

Source: Own source according to data from (Bisnode, © 2001-2013)

As a first step, results of the individual probability of defaults of individual rating groups have been used. These groups in a portfolio which is consisted of corporates' loans have been distributed evenly. This portfolio of € 900 million showed that within the 8 % capital requirement, the bank needs € 131 million using FIRB approach and € 72 million using STA without external rating approach. Regarding to the given PD selection and portfolio distribution, it would be better for the bank to choose a STA without external rating.

Table 3 Equally distributed portfolio with corporates' loans

	LGD	0.7							
	maturity	2.5							
Rating	EAD	PD	R	N(x)	b	RW	RWA	CA IRB	CA STA
AAA	100	0.0003	0.2382	-2.2036	0.3168	0.238	23.8158	1.91	8
AA	100	0.0012	0.2330	-1.7629	0.2371	0.543	54.3431	4.35	8
A	100	0.0029	0.2238	-1.4721	0.1923	0.881	88.1238	7.05	8
BBB	100	0.0062	0.2080	-1.2260	0.1575	1.262	126.177	10.09	8
BB	100	0.0121	0.1855	-1.0226	0.1298	1.626	162.581	13.01	8
B	100	0.0241	0.1559	-0.8220	0.1040	1.994	199.409	15.95	8
CCC	100	0.0518	0.1290	-0.5547	0.0787	2.500	250.048	20.00	8
CC	100	0.1127	0.1204	-0.1491	0.0566	3.325	332.507	26.60	8
C	100	0.2549	0.1200	0.4384	0.0374	4.074	407.383	32.59	8
						CA in total		131.55	72

Source: own source

In the next step, the same distribution of the portfolio according to ČEKIA in 2006 has been used. On the beginning it is necessary to draw attention to the interpretation of data. This table may give a false impression – ČEKIA shows the distribution of companies within each rating groups but it does not reflect their need for capital. For example, a large company with a A rating will be represented in the bank's portfolio as a exposure with € 500 million while a small company with a B rating will be represented as a exposure with € 5 million but this fact does not occur in the portfolio. In other words, our examined bank has € 10 billion and provides to all companies in the Czech Republic the same amount of loans. These companies are situated in each particular rating group. EAD is based on the percentage of the rating group at the whole group of companies in the Czech Republic in 2006. Table also shows that it would be more preferable to choose STA approach without external rating for such portfolio which is largely represented by loans to companies with worse rating than A rating.

In the next year the procedure was taken analogously to the previous year. Again, the portfolio was divided among all companies equally. These companies are found in each particular rating group. EAD based on of the percentage of the rating group at the whole group of companies in the Czech Republic in 2008. Table also shows that it would be more preferable to choose STA approach without external rating for such portfolio which is largely represented by loans to companies with worse rating than A rating. Since the

data is always to December 31, it may observe the impact of the crisis on the financial situation of companies the growth of credit risk. In this case, it can be seen the even more radically demonstration of the benefits of STA approach without external rating for a bank.

Table 4 Year 2006 – portfolio of € 10 billion corporates' loans which is distributed equally among the companies in the Czech Republic in their former state

	LGD	**0.7**				
	maturity	**2.5**				
Rating	**EAD**	**PD**	**RW**	**RWA CAIRB**		**CA STA**
AAA	1427	0.0003	0.238	339.852	27.19	114.20
AA	2165	0.0012	0.543	1176.528	94.12	173.20
A	2259	0.0029	0.881	1990.717	159.26	180.70
BBB	1929	0.0062	1.262	2433.964	194.72	154.30
BB	940	0.0121	1.626	1528.263	122.26	75.20
B	687	0.0241	1.994	1369.940	109.60	54.96
CCC	369	0.0518	2.500	922.680	73.81	29.52
CC	147	0.1127	3.325	488.786	39.10	11.76
C	78	0.2549	4.074	317.759	25.42	6.24
			CA in total		**845.48**	**800.10**

Source: own source

Table 5 Year 2008 – portfolio of € 10 billion corporates' loans which is distributed equally among the companies in the Czech Republic in their former state

	LGD	**0.7**				
	maturity	**2.5**				
	EAD	**PD**	**RW**	**RWA**	**CA IRB**	**CA STA**
AAA	239	0.0003	0.238	56.91985	4.55	19.12
AA	573	0.0012	0.543	311.386	24.91	45.84
A	2102	0.0029	0.881	1852.362	148.19	168.2
BBB	3755	0.0062	1.262	4737.965	379.04	300.4
BB	1175	0.0121	1.626	1910.329	152.83	94
B	1320	0.0241	1.994	2632.199	210.58	105.6
CCC	591	0.0518	2.500	1477.788	118.22	47.28
CC	167	0.1127	3.325	555.2874	44.42	13.36
C	80	0.2549	4.074	325.9064	26.07	6.4
	10002		**SUMA KP**		**1108.81**	**800.2**

Source: own source

In 2012, it was occurred the same situation as in the previous years, just with the difference that a few years of crisis have increased the credit risk and thus the difference between the IRB and STA approach increased again. The capital adequacy using FIRB approach was € 1349.77 billion and for STA approach was € 793.4 million.

Next, we have attempted to model the potential portfolio of commercial banks with different emphasis on the creditworthiness of clients. In the first case, the situation where the bank focuses only on high-credit quality clients has been calibrated. In the case where banks hold only high quality exposure in their portfolio, it shows the advantages of using FIRB approach within the credit risk management as can be seen in the following table. If the bank had in its portfolio loans of creditworthy borrowers only with high ratings, it is significantly better use of to the opportunities of FIRB approach, because capital requirements in this case fell by more than 30%.

Table 6 Banks' portfolio modeling which is focused only on the creditworthy clients in relation to FIRB and STA approach

	EAD	PD	R	N(x)	b	RW	RWA	CA IRB	CA STA
AAA	2000	0.0003	0.2382	-2.2036	0.3168	0.238	476.316	38.110	160
AA	4000	0.0012	0.2330	-1.7629	0.2371	0.543	2173.724	173.90	320
A	4000	0.0029	0.2238	-1.4721	0.1923	0.881	3524.952	282.00	320
	10000					**CA in total**		**494.00**	**800**

Source: own source

On the contrary, in the case where the portfolio consisted only of corporates' loans with the internal rating around intermediate level, it is again more favorable to use STA approach, as can be seen in Table 7.

Table 7 Banks' portfolio modeling which is focused on corporates' loans with the internal rating around intermediate level clients in relation to FIRB and STA approach

	EAD	PD	R	N(x)	b	RW	RWA	CA IRB	CA STA
A	2000	0.0029	0.2238	-1.4721	0.192372	0.881	1762.476	141.00	160
BBB	2000	0.0062	0.2080	-1.2260	0.157592	1.262	2523.55	201.88	160
BB	2000	0.0121	0.1855	-1.0226	0.129851	1.626	3251.624	260.13	160
B	2000	0.0241	0.1559	-0.8220	0.104	1.994	3988.180	319.05	160
CCC	2000	0.0518	0.1290	-0.5547	0.078786	2.500	5000.975	400.08	160
	10000					**CA in total**		**849.95**	**800**

Source: own source

In the case where only loans of companies with poor internal rating (worse than BB rating with PD of 1.21 %) will be prevailing in the portfolio, FIRB approach will cost excluding the cost of deployment and management as well as the essential increase of cost of capital, as in the case of more than 100 %. Within the calculations, capital adequacy for FIRB approach is twice larger than in the case of using STA approach (FIRB - € 1771.40 billion and STA approach – 800 million).

Based on these findings, hypothesis cannot be rejected or confirmed. It depends on the composition of the portfolio of individual banks. But if the banks had only exposure to clients with internal rating better than A, so the savings would be unambiguous and even higher than 10 % of STA approach.

4 Conclusions

The aim of this article is calculate, compare capital requirements and calibrate effective portfolio of business loans regarding to the optimal amount of the final capital adequacy of the given commercial bank in the Czech Republic.

The modeling of portfolio showed that FIRB approach is worthwhile only for large banks that can choose their customers – those with prestigious rating and low credit risk. On the contrary if the bank would like to make an offer to the client with a B rating and worse, the banks has a competitive disadvantage compared to the competitive bank which is not using FIRB approach because of higher capital requirement which will be reflected in the price of the loan. On the other hand, smaller bank will not offer a good interest rate to creditworthy customers than large banks with FIRB approach. But in the same time, smaller banks can offer better interest rate to bad clients, but only in the case if the client does not have an external rating. This conclusion is confirmed by other foreign studies. (Ruthenberg, Landskroner, 2008) or (Repullo, Suarez, 2004). Cipovová a Belás (2012) analyzed the effects of using the FIRB approach on the financial performance of the bank.

Hypothesis which has been set as follows: savings of the capital in the transition from STA approach (Standardized Based Approach) to an FIRB approach (Foundation Internal Rating Based Approach) will be more than 10%, cannot be rejected either confirmed. It

depends on the composition of the portfolio of individual banks. But if the banks had only exposure to clients with internal rating better than A, so the savings would be unambiguous and even higher than 10 % of STA approach.

Due to the recent situation on the market, worldwide banking industry is facing the need to effectively manage credit risk by techniques for credit risk management. Banks implements modern methods of risk management to their system and not just because of the new regulatory agreement by the Basel Committee, but also because of increasing competition, which is forced them to introduce better internal methodologies and processes. Processes, which will enable to find the optimal combination of risk involved and maximize the revenue of capital and reserves.

New regulatory agreements respond to the recent financial crisis in order to strengthen the resilience of the banking sector to sustainable economic growth through tighter capital adequacy and new standards for liquidity. It could cause financial problem for perspective banks due a business with growing volume of. However, correct settings of internal processes for capital requirement calculation and proper setup of collateral use as techniques to reduce credit risk in legislative term could significantly minimize the growth of equity.

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Inflation versus Deflation and their Impact on Stock Markets

Božena Chovancová, Katarína Gachová, Jana Kováčová

University of Economics in Bratislava
Faculty of National Economy, Department of Banking and International Finance
Dolnozemská cesta 1, 852 35 Bratislava, Slovak Republic
E-mail: bozena.chovancová@euba.sk, gachovak@gogino.sk, jana.kovacova@euba.sk

Abstract: *Many previous studies associated with long-term monitoring of equity returns data and inflation led to the conclusion that, historically, stock prices failed to keep up with inflation and the rate of return on shares was negatively correlated with the rate of inflation. When examining the impact of inflation on stock prices, several aspects can be applied, being an important element the different levels of expected inflation. Currently, analysts point out the danger of deflation, which can have a significant negative impact on both the stock markets and the real economy. The aim of this paper is to examine the impact of inflation on the stock markets accentuating the last decade, which is associated with considerable bubbles in stock markets. It is necessary to analyze the relationship between inflation and the stock market, in connection with monetary policy and its important instrument - interest rates. When doing the quantitative analysis, we pay the attention to the stock market within the European Union.*

Keywords: market, inflation, interest rate, quantitative easing

JEL codes: G01, G15, E44

1 Introduction

Permanent growth of inflation and related depreciation of money leads many laymen and investors to the conclusion that investments in the form of bank deposits or bonds are devaluating and that the only protection against inflation is to invest in stocks. Their thinking proceeds from the assumption that at the time of inflation, the corporate profits are rising, subsequently dividends are rising too, and finally this leads to higher stock prices.

The connection between the evolution of stock markets and inflation has been investigated by many authors who explored this relationship not only in developed capital markets, but also in the countries of emerging markets. Choudry (1999) proved, on the basis of extensive research of the relationship between inflation and stock markets in countries like Argentina, Venezuela and Mexico, that stocks can be really considered as a hedge against inflation. But he also highlights the effect of the time shift, i.e. the stock market responds to inflation lately. In his work he concludes that the inflation from the past provides important information for future inflation. Also studies of Gerrit and Yuce (1999), Jang and Sul (2002) are known. They paid attention to mutual correlation of stock markets and inflation, especially during the Asian financial crisis. Laopodis (2005) also examined the interaction of the stock market and inflation in connection with the monetary policy. In his research he used the method VAR and Vector Error Correction model (VEC). The results of his research point to the fact that certain stock returns are negatively correlated with inflation. Wei (2007) in his study works with the phenomenon of expected and unexpected inflation and its relationship to stock returns. In conclusion, he shows that equity returns can react negatively especially to unexpected inflation. Saryal (2007) examined the impact of inflation on the stock market, being the subject of his analysis developed capital market as well as less developed market. He proved that the higher the rate of inflation, especially in the less developed countries, the greater the nominal rate of return on the stock market, but also the volatility of the stock market will be higher.

All these results of research are based on theories like the theory of tax effect, the theory of mediated effect or the theory of money illusion, which also show that high inflation negatively affects the stock returns, especially in the long run.

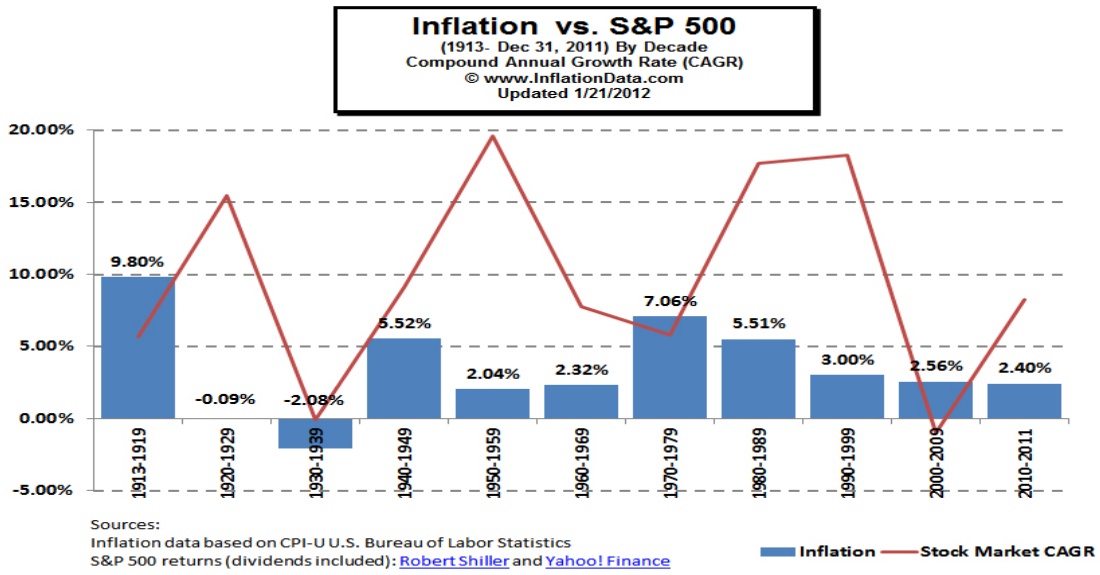
The aim of this paper is to extend the knowledge of the relationship between inflation and the stock market with regard to the euro area.

2 Methodology and Data

An important factor in examining the relationship between inflation and stock market are the changes in the growth rate of inflation. Many analysts now warn that it is necessary to distinguish what the growth rate of inflation can be expected and they illustrate it on historical experience.

The above mentioned background can be observed in the following chart.

Figure 1 Development of inflation and stock index S&P since 1913 to 2011



Source: Inflation data based on CPI-U.U.S. Bureau of Labour Statistics *S&P 500 returns (dividends included)*: *Robert Schiller and Yahoo Finance*

The graph clearly shows that any significant increase in inflation is associated with a significant decline in the stock market and therefore with the increased volatility of the stock market. On the contrary, efforts to lower inflation in the 1950s or in the 1990s led to the growth of stock returns. Particular attention was paid to the correlation between the stock market and inflation at the end of the 1970s, subsequently the inflation significantly decreased especially in the 1980s-90s and the stock market began to soar.

If we introduce the categorization of inflation on its year-on-year basis into our analysis and if we examine its impact on the returns of the stock market (base year 1960), so our analysis can be summarized in the following categories:

- high inflation,
- high and decreasing inflation,
- neutral inflation,
- low and rising inflation,
- low and decreasing inflation.

We will try to indicate how the stock market reacted to the various categories of inflation using historical data.

Given the current situation in Europe, which shows a relatively low inflation in the medium run, and also various opinions about the danger of deflation, we will try to analyze this connection using the stock market benchmark Eurostoxx 50, which represents the 50 largest companies in the euro area and we will analyze the relationship between inflation and the growth of the stock market in a sample of 10 stock companies. This relationship will be also expressed by the coefficient of correlation.

The time horizon is of medium-term nature given that Europe as an integration whole has no long-run history of unified stock market and the history of common stock indices became real in the turn of the millennium.

Inflation Dynamics in Relation to the Equity Market

Based on historical data from 1970 and different dynamics, or levels of inflation, we will express in what way, positive or negative, the inflation has affected the stock market. As a basic indicator we use the stock index, taking into account mainly return of the S&P 500:

a) high inflation
- is determined by the level of 4,5%, in recent years even 3,6% - high inflation negatively affects the profitability of the stock market, which is specifically reflected in the S&P index through the decline in the profitability of about –0,4%

b) high and decreasing inflation
- (interventions in the monetary policy and information about decrease in inflation) expectations of investors are associated with optimism and investors are starting up the stock markets. With high and decreasing inflation the profitability of the stock market reaches a positive value and gradually increases. This connection can be also observed in the late 1980s and early1990s when the profitability of the stock index was continuously growing starting with a positive value of 1,2%, while the inflation was decreasing.

c) neutral inflation
- is associated with the stabilization of prices and, when observing the graph, it is obvious that the neutral inflation also led to the growth of the stock market returns in the annual average of +0,5 %;

d) low and rising inflation
- is defined below 2,5 %, this level of inflation causes a relatively high increase in the returns at annual average of +1,4 %

e) low and decreasing inflation
- below the 2,5 % leads to the growth of returns, but paradoxically in annual average stands at 0,7 %, what in comparison with low and rising inflation reduces returns.

Why the low and rising inflation shows surprisingly better appreciation of the stock market than the low and decreasing inflation? We can state that this paradox stems from investors' expectations. Information about the future growth of inflation leads investors to raise investments in the stock market in an effort to protect their investments from future inflation. This phenomenon can be also observed today on the Japanese stock market. When the Japanese government announced growth and regulation of inflation last year, the stock market began to show a higher appreciation.

3 Results and Discussion

Low and decreasing inflation is also a very negative phenomenon for the stock market, as it may lead to reduced appreciation of investment in the stock market. Persistently low inflation rate paves the way for deflation, which, in the past decade, was reflected in the Japanese economy. A new phenomenon for Europe is currently "lowflation and deflation", which may have a negative impact not only on the real economy, but also on the stock markets.

Impact of Lowflation and Deflation on the Stock Market in Europe

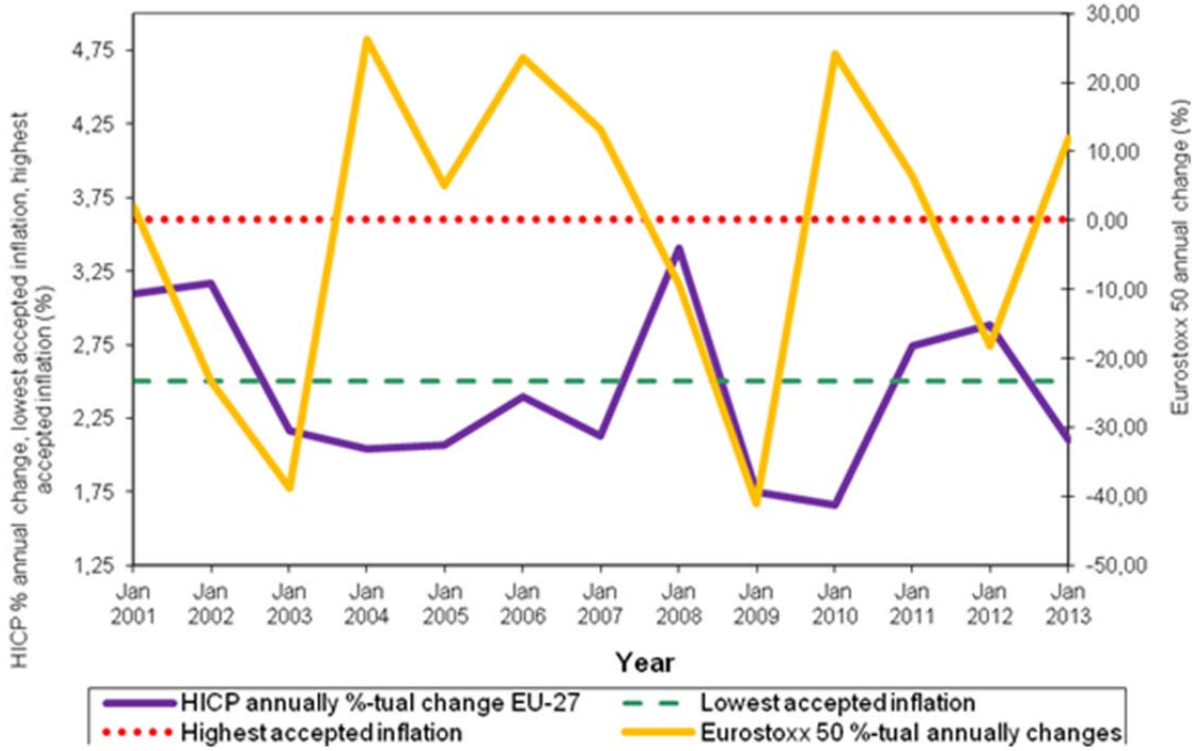
Due to integration tendencies in Europe, there is a significant problem in examining the relationship between inflation and the stock market. The stock index Eurostoxx 50 has worked since 1997, what creates an assumption for research only in the medium run and

also limited opportunities to use econometric models that work with long-term databases.

More significant differences appear when examining the connections between inflation and the stock market, particularly in the last decade and now. The subject of our analysis has been the evolution of inflation and the stock market within Europe. We have observed the evolution of inflation from 2001 to the present and we have adjusted the observation of returns of stock index DJ Eurostoxx 50, which constitutes a representative sample of the 50 largest stock companies in Europe. Given the very low inflation and the current rise in deflationary pressures in Europe we have set the threshold for the transition to high inflation 3,6% and for the low inflation 2,5%.

The following chart studies the changes in inflation and changes in returns of the DJ Eurostoxx 50, based on which we can analyze and characterize the mutual positive or negative relationship between those variables.

Figure 2 Evolution of inflation and stock index DJ Eurostoxx 50 since 2001 to 2013



Source: Own processing according to the data of Eurostat and inflationeurope.eu

As the graph implies the evolution of inflation in Europe over the period 2001-2013 did not exceed the specified range of 3,6%. The maximum level of 3,6% was reached only during a short period in 2002 and 2008. This higher rate of inflation is mainly associated with the increase in prices on the commodities market, which is directly reflected in the rise in total inflation (Árendáš 2013).

During longer intervals the level of inflation was below 2,5%. From this evolution of inflation it can be deduced that such low inflation significantly stimulates the stock market. This connection can be observed from 2002, when inflation began to fall sharply and then, with a certain time lag (year 2003), the stock market started to soar. A similar situation repeated in 2009-2010, when a gradual decline in inflation caused significant growth of the stock market.

On the contrary, during the growth of inflation in 2006 and 2008 there is a sharp decline in the stock index and the situation repeated when signs of rising inflation appeared in 2011-2012. Using the Fisher effect it can be concluded that at very low inflation and high

volatility of the stock index an investor, also in time of great financial turmoil, could achieve an annual real rate of return close to the limit of 20% (particularly in 2004 and 2010).

In this analysis, we abstract from other factors that significantly affect the stock market like the increase in money supply that is observed within Europe through the monetary aggregate M3 and interest rates. Opinions of analysts that which of the above factors influenced the development of stock markets to the greatest extent are characterized by diversity. Recently, the negative impact of very low inflation and the risk of transition to deflation is highlighted, which could also have a negative impact on the development of the stock markets in Europe. This trend is often compared to the previous development of the Japanese economy, which since the early 1990s to the present failed to start up the economy and the stock market. The Bank of Japan and the government used all the classic instruments of monetary policy like quantitative easing, near-zero interest rates, low inflation and transition to the deflation, fiscal stimulus. Nevertheless, the Japanese stock market is still at the level of the 1980s before the big bubble and the economy stagnates in the long run. This scenario is often associated with the current and future development of the European market and economies.

Observing the stock index Eurostoxx in absolute terms since 2000, when it showed more than 5000 points, to the end of 2013, when it reached 3000 points, it implies that an investor, who entered the European market in early 2000, has to the present a devalued investment.

Individual Stocks and Their Relation to the Inflation

The index Eurostoxx 50 is currently the benchmark of the European stock market. The largest and the most significant companies of EU, especially of the euro area, are included in it, which significantly affect the development of the stock market in this area, both in terms of market capitalization and trading. Therefore, we decided to look at the composition of the index and select a sample of stocks, subsequently we have examined their sensitivity to inflation, resp. deflation.

In our selection we have decided to proceed on the basis of the principle of diversification, i.e. we have selected stocks from different sectors of the economy, but also from different countries of the euro area. Our sample represents the following stocks:

	Company	**Sector**	**Country**
1.	Bayer	Chemicals	Germany
2.	Carrefour	Retail	France
3.	Enel	Utilities	Italy
4.	Intesa SanPaolo	Banks	Italy
5.	L´oreal	Personal and Household Goods	France
6.	Philips	Industrial Goods and Services	Netherland
7.	Unilever	Food and Beverages	Netherland
8.	SAP	Technology	Germany
9.	Telefonica	Telecomunications	Spain
10.	Volkswagen	Automotives	Germany

In the following table changes in the development of particular stocks can be observed, we have also included changes in the index Eurostoxx 50 and subsequently we have introduced the relationship between inflation and changes in stock prices using the correlation analysis.

Table 1 Changes in stock prices for the years 2001-2013 and their correlation with inflation

	Bayer	Carrefour	Enel	Intesa San Paolo	L´oreal	Philips	Unilever	SAP	Telefónica	Volkswagen	Eurostoxx 50
2001	32.46	-17.93	0.25	59.09	25.19	9.91	12.78	-14.21	-20.58	8.95	2.04
2002	-29.69	-14.73	-17.65	-42.10	-5.06	-23.65	6.55	-1.82	-33.64	-7.95	-23.21
2003	-56.35	-35.09	-19.60	-36.51	-18.40	-49.97	-12.58	-47.11	-34.21	-29.70	-38.75
2004	50.22	8.43	9.45	-97.45	-1.01	53.35	-3.57	54.53	39.42	15.37	26.29
2005	0.04	-1.42	24.53	19.46	-9.74	-17.04	-8.02	-9.91	11.50	-15.03	5.12
2006	40.92	-1.74	-3.33	31.46	16.28	38.21	17.01	41.25	-10.03	31.18	23.68
2007	31.51	13.74	16.50	23.50	21.41	7.42	6.41	-15.93	33.36	81.15	13.20
2008	21.31	6.36	-8.37	-17.82	1.68	-12.27	6.71	-9.07	16.66	79.36	-9.23
2009	-24.11	-43.01	-40.99	-48.00	-36.82	-45.76	-20.74	-13.51	-28.71	68.37	-41.02
2010	18.89	31.91	-11.16	12.55	46.74	54.23	28.55	18.78	24.62	-71.88	24.13
2011	8.87	1.25	5.90	-12.59	10.92	3.97	-2.70	27.63	5.65	58.55	6.37
2012	-0.59	-51.23	-24.21	-39.92	-4.12	-32.15	17.82	9.40	-27.32	2.38	-18.18
2013	35.75	20.23	2.56	2.74	34.55	49.51	17.09	30.63	-19.88	43.28	11.85
Cor. Infl.	**-0.01**	**-0.23**	**-0.05**	**0.08**	**-0.03**	**-0.27**	**0.20**	**-0.12**	**-0.25**	**0.24**	**-0.20**

Source: data processed according to information provided by finance.yahoo.com; www.boerse-frankfurt.de; www.unilever.com; quotes.wsj.com; www.philips.com

As the table implies, changes in the performance of particular stocks have showed a very different level of correlation. This is also evident from the total situation or the chaos in the stock market, when the inflation was decreasing but at the same time the stock market was decreasing too. This was particularly connected with the onset of the financial crisis in 2008-2009, when excluding Volkswagen there was a significant drop in all stocks despite the decrease in inflation. Important role in this period was also played by a fiscal stimulus in the form of scrapping.

During the whole period 2001-2013 the correlation of the Eurostoxx 50 with inflation was negative, but it reached only a minimum level -0,20. If we follow the behaviour of individual stocks, then the highest level of negative correlation was showed by Philips, Telefónica, Carrefour but they moved only at -0,27 to -0,23. Conversely, a positive level of correlation was showed by Unilever (+0,20) and Volkswagen (+0,24). Hence, the profitability of these stocks was not affected by the growth of inflation.

4 Conclusions

If we take into account the hypothesis that rising inflation negatively affects the stock markets, and, on the contrary, a decline in inflation stimulates the growth of stock markets, then this relationship cannot be applied to the European stock market. The results of our analysis show that lowflation has only a minimal impact on the performance of the stock market in the short and medium run. Individual stocks react positively, which means that when there is a fall in inflation, there is also a decline in their performance.

Fiscal stimulus and interest rate cuts had a significant impact on the stock market in Europe. There are efforts to stimulate the European economy and the stock market through the growth of the money supply at very low interest rates. Low interest rates also require low inflation, because otherwise a negative investment effect is showed. In the longer run, however, low inflation can lead to deflation and therefore to a negative impact on the stock market.

Acknowledgments

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Modeling Financial Surplus of the Housing Projects Developer

Tadeusz Czernik, Daniel Iskra

University of Economics in Katowice
Faculty of Finance and Insurance, Department of Applied Mathematics
Pułaskiego 25, 40-287 Katowice, Poland
tadeusz.czernik@ue.katowice.pl, daniel.iskra@ue.katowice.pl

Abstract: *Recent events taking place on the housing project market provide a strong impetus to the study of risk in housing projects development. This issue is important not only from the point of view of the developer but also his client. This paper proposes a dynamic model of the financial surplus process. The model takes into account structure of the credit payments, the random nature of the real estate sale process (compound Poisson process: the moment of sale and sale price), predictable and unpredictable expenses. Monte Carlo simulations have been performed in order to present model. The purpose of this paper is to present the proposed model below. Proposed model of financial surplus can be a starting point for further research and analysis.*

Keywords: housing projects development, financial surplus, stochastic modeling, simulations

JEL codes: C02, C63, G33, R30

1 Introduction

The events of recent years in the property development market have attested to the urgent necessity to carry out research on the risk associated with the development of housing investments (Tworek, 2010b). The topic of risk of construction investments is not only relevant from the point of view of developers but also of their customers. The literature on the risk of investments related to construction mostly covers the topic of risk arising from the contractor of the construction project (Skorupka, 2007), (Tworek, 2010a), (Huh et al., 2012). The problem of project scheduling with probabilistic cash inflows was discussed in e.g. (Ozdamar et al., 1997). This paper presents a dynamic model of a financial surplus of a property development company.

2 Methodology

For the purposes of this study the authors have assumed that the financial surplus is the balance on the current account of the company. Therefore, negative balance of the surplus will be interpreted as a working capital facility granted by the bank to the developer. In the study, the financial surplus is a random process $N(t)$ with the known initial value $N(0)=N_0$. The dynamics of the surplus is described using the following stochastic difference equation

$$\Delta N = N_{k+1} - N_k = \sum_i P_{k+1,i} \tag{1}$$

where

N_k - financial surplus at time $k \in \{0,1,...,T\}$

T - simulation horizon (days)

$P_{k,i}$ - deterministic or random cashflow of the ith factor at time k.

The time unit is one day, and one year comprises 360 days (no distinction between business days and holidays was made). Additionally, the initial point of the investment was not placed in a specified range within the calendar year.

The following cashflows were taken into account

- interest on current account - interest accrued each day (interest rate was not applied in case of positive surplus capital)

$$P_{k+1,1} = I_{k+1} = N_k \left(\left(1 + \frac{i^{(12)}}{12} \right)^{\frac{12}{360}} - 1 \right) \theta(-N_k) \tag{2}$$

where: $i^{(12)}$ - nominal interest rate of the overdraft on the current account, $\theta(x) = \begin{cases} 0 \ \ dla\ x \le 0 \\ 1 \ \ dla\ x > 0 \end{cases}$ - Heaviside step function

- standard aggregate costs of business activity $P_{k,2}$ – salaries, cost of rental/maintenance of office space, marketing expenses etc. (tax-related aspects were ignored)
- investment loan $P_{k,3}$ - tranches of the loan and installments
- costs related to the implementation of the investment $P_{k,4}$
- revenue from the sale of residential premises $P_{k,5}$
- other unexpected costs $P_{k,6}$.

Tax-related aspects of the undertaking were ignored.

3 Credit Interest Rate

For the purposes of the simulations it was assumed that the process of spot rate (LIBOR ON) is generated by the equation [CIR] (all stochastic differential equations are understood in the sense of Ito (Oksendal, 2007), (Hanson, 2007))

$$dr_t = \alpha(\mu - r_t)dt + \sigma\sqrt{r_t}\,dW_t \tag{3}$$

where

r_t - spot rate (LIBOR ON)

W_t - Wiener process

$\alpha, \mu, \sigma > 0$ - parameters.

The authors decided to employ CIR model because of its appealing characteristics:

- spot rate of zero (also negative) is precluded if the $\frac{2\alpha\mu}{\sigma^2} > 1$ is met
- CIR is an autoregressive mean-reverting model
- the formulas for the valuation of a zero-coupon bond have a simple form.

CIR model allows to analytically determine the price of a zero-coupon bond $P(t,T)$ with a face value equal to one monetary unit

$$P(t,T) = A(t,T)e^{-B(t,T)r_t} \tag{4}$$

where $A(t,\mathrm{T}) = \left(\frac{2he^{\frac{(\alpha+h)(T-t)}{2}}}{2h + (\alpha+h)\left(e^{(T-t)h} - 1\right)} \right)^{\frac{2\alpha\mu}{\sigma^2}}$, $B(t,\mathrm{T}) = \frac{2\left(e^{(T-t)h} - 1\right)}{2h + (\alpha+h)\left(e^{(T-t)h} - 1\right)}$, $h = \sqrt{\alpha^2 + 2\sigma^2}$.

Since it was assumed for the purposes of the simulations that the borrowing rate is based on the rate of LIBOR EUR 3M (the beginning value of the borrowing rate ($WIBOR3M_0$) was converted to the spot rate r_0 using the following formula

$$\left(1+\frac{LIBOR3M_0}{12}\right)^{-12\cdot\frac{90}{360}} = A\left(0,\frac{90}{360}\right)e^{-B\left(0,\frac{90}{360}\right)r_0} \tag{5}$$

where the values of the parameters $\alpha = 0.5$, $\mu = 0.003$, $\sigma = 0.02$ were adopted on an ad hoc basis.

By solving the equation the following is obtained

$$r_0 = \frac{1}{B\left(0,\frac{90}{360}\right)}\ln\left(\frac{\left(1+\frac{LIBOR3M_0}{12}\right)^{12\cdot\frac{90}{360}}}{A\left(0,\frac{90}{360}\right)}\right). \tag{6}$$

The values of LIBOR 3M are determined using the formula

$$LIBOR3M_t = 12\left(A\left(0,\frac{90}{360}\right)^{-\frac{360}{12\cdot 90}} e^{\frac{360}{12\cdot 90}B\left(0,\frac{90}{360}\right)r_0} - 1\right). \tag{7}$$

The simulations assumed that the bank updates the borrowing rate every three months based on the current value of LIBOR 3M or based on the averaged values LIBOR 3M from the past few days. For the purposes of the simulation a principle was assumed based on the averaged LIBOR 3M from the last 5 quotes.

Some banks change the borrowing rate only where the change in the value of LIBOR 3M (or its average) is greater than the previously set value (the formula for an update based on LIBOR 3M for a given day)

$$\begin{aligned} i_{k+1} &= i_k + \left(LIBOR3M_{k+1} - i_k\right)\theta\left(LIBOR3M_{k+1} - i_k - w_{up}\right) + \\ &+ \left(LIBOR3M_{k+1} - i_k\right)\theta\left(i_k - LIBOR3M_{k+1} - w_{down}\right) \end{aligned} \tag{8}$$

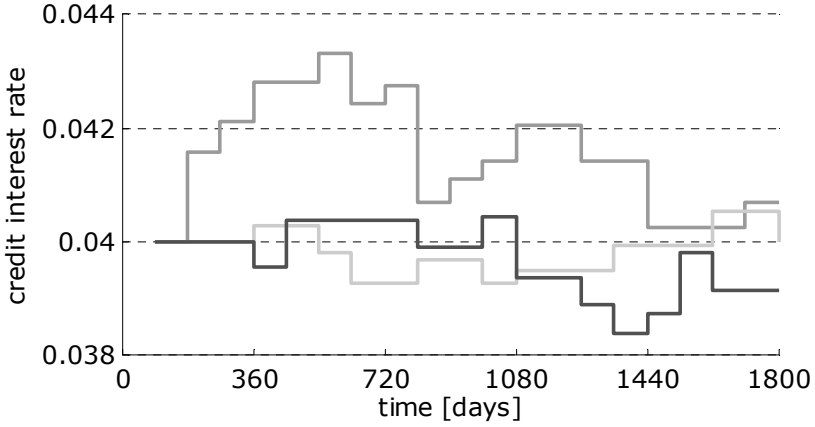
where

i_k - borrowing rate

w_{up}, w_{down} - minimum value of the increase/decrease of LIBOR 3M resulting in a change of the borrowing rate. In general $w_{up} \neq w_{down}$.

The following figure shows example implementations of the borrowing rate (without the margin), taking into account the changes' thresholds. For the purposes of the simulations the beginning value $LIBOR3M_0 = 0.3\%$ was assumed, and $w_{up} = 0.0002$ and $w_{down} = 0.0004$. This asymmetric selection of the thresholds is advantageous to the bank because the bank will raise the borrowing rate if LIBOR 3M exceeds the borrowing rate for the previous period i_k by at least 0.0002. The bank will lower the borrowing rate if LIBOR 3M is lower than the current rate i_k by at least 0.0004. Therefore, the increase of the rate is more likely than its decrease.

Figure 1 Sample credit interest rate realizations



Source: own elaboration

Selling process

Three types of residential premises were considered for the purposes of the simulations. In general, it is possible to consider any number of the classes of premises. The process of the amount of the sold premises within each of the three classes $n_{i,t}$ ($i=1,2,3$) is modeled using independent non-homogenous Poisson processes

- $n_{i,0}=0$
- independent increments
- if $\Delta t \to 1$ then $P\left(n_{i,t+\Delta t}-n_{i,t}=1\right)=\lambda_{i,t}\Delta t+o\left(\Delta t\right)$
- if $\Delta t \to 1$ then $P\left(n_{i,t+\Delta t}-n_{i,t}>1\right)=o\left(\Delta t\right)$

where $\lambda_{i,t}\geq 0$ is the intensity of the sale process at time t.

It can be demonstrated that the probability of a sale of k premises of class i during time period $\left(t,t+\Delta t\right)$ can be expressed as

$$P\left(n_{i,t+\Delta t}-n_{i,t}=k\right)=\frac{m_i\left(t,\Delta t\right)^k}{k!}e^{-m_i\left(t,\Delta t\right)} \tag{9}$$

where $m_i\left(t,\Delta t\right)=\int_t^{t+\Delta t}\lambda_{i,s}ds$.

The intensity of the sales process was modeled based on the shifted gamma distribution (shifted gamma distribution is obtained by excluding the K_i constant)

$$\lambda_{i,t}=K_i\frac{b_i^{a_i}}{\Gamma\left(a_i\right)}\left(t-t_{i,\text{start}}\right)^{a_i-1}e^{-b_i\left(t-t_{i,\text{start}}\right)}\theta\left(t-t_{i,\text{start}}\right) \tag{10}$$

where

$K_i>0$ - proportionality constant, $a_i,b_i>0$ parameters, $\Gamma\left(a_i\right)=\int_0^{+\infty}z^{a_i-1}e^{-z}dz$ - gamma function and $t_{i,\text{start}}$ - start time of selling class i premises.

The intensity of the sales is at its peak at the time

$$t_{i,\max} = \frac{a_i - 1}{b_i} + t_{i,\text{start}} \quad \text{for} \quad a_i > 1. \tag{11}$$

In the simulations authors assumed that

$$t_{1,\text{start}} = t_{2,\text{start}} = t_{3,\text{start}} = t_{\text{start}} \tag{12}$$

$$t_{1,\max} = t_{2,\max} = t_{3,\max} = t_{\max}. \tag{13}$$

On the basis of (11), (12), (13) it is possible to express a_i by b_i

$$a_i = \left(t_{\max} - t_{\text{start}}\right) b_i + 1 > 1. \tag{14}$$

In the simulations it was also assumed that the most likely amount of sold premises within the analysed time frame t_k is equal to the total number of built premises l_i

$$K_i \frac{\gamma\left(\left(t_{\max} - t_{\text{start}}\right) b_i + 1, b_i \left(t_k - t_{start}\right)\right)}{\Gamma\left(\left(t_{\max} - t_{\text{start}}\right) b_i + 1\right)} = l_i \tag{15}$$

where $\gamma(x,y) = \int_0^y z^{x-1} e^{-z} dz$ is the incomplete gamma function.

To determine the value of b_i it was assumed that the most likely percentage of sold premises in class i until time t_{qi} is q_i

$$\frac{\gamma\left(\left(t_{\max} - t_{\text{start}}\right) b_i + 1, b_i \left(t_{qi} - t_{start}\right)\right)}{\gamma\left(\left(t_{\max} - t_{\text{start}}\right) b_i + 1, b_i \left(t_{\max} - t_{start}\right)\right)} = q_i \ . \tag{16}$$

The parameter b_i is the solution of the equation (16), which has no analytical solutions, therefore it was necessary to apply a numerical algorithm.

The presented algorithm generates only the sale process of the premises. The algorithm presented below allows to take into account negotiation of the prices.

Transaction prices of a square meter for each of the classes are within the following ranges

$$\begin{aligned} C_1 &\in \left[k_1 C_{\min}, k_1 C_{\max}\right] \\ C_2 &\in \left[k_2 C_{\min}, k_2 C_{\max}\right] \\ C_3 &\in \left[k_3 C_{\min}, k_3 C_{\max}\right] \end{aligned} \tag{17}$$

where

C_i - price of a square meter in class i

k_i - multiplier for class i

$C_{\min}$, $C_{\max}$ - respectively the minimum and maximum base price.

The minimum base price was determined on the basis of an initial simulation so that there is probability p_1 that the final financial surplus is greater than zero. Price $C_{\max}$ was set so that there is probability p_2 that the final surplus is greater than the initial surplus subject to a set interest rate (i.e. deposit interest rate).

Transaction prices C_i were generated basing on a transformed beta distribution

$$C_i = k_i \left[C_{\min} + \left(C_{\max} - C_{\min}\right) Y\right] \tag{18}$$

where Y is a random variable with a beta distribution (Gentle, 2003) $f_Y(y) = \frac{1}{B(\alpha_i, \beta_i)} y^{\alpha_i - 1}(1-y)^{\beta_i - 1}$ and $B(\alpha_i, \beta_i) = \frac{\Gamma(\alpha_i)\Gamma(\beta_i)}{\Gamma(\alpha_i + \beta_i)}$ is a beta function.

From the point of view of the above considerations on the sale process of premises and the transaction prices, the selling process is a compounded Poisson process.

4 Results

It was assumed for the purposes of the simulations that the time unit is one day and one year comprises 360 days (no distinction between business days and holidays was made). The beginning value of the surplus is $N(0) = €0.5$ million, the planned total cost of the investment amounts to €5 million (construction cost of €4.5 million plus other costs: marketing, etc.).

The missing capital is borrowed. For the purposes of the simulations it was assumed that the repayment period of the loan is five years and the time of payment of the loan is the time of the settlement of the investment (the loan is not repaid in advance). A loan in the amount of €4.5 million was awarded in three tranches. The first tranche is paid at the beginning of the investment and the next ones at the end of the following half-years (the tranches were set to amount to €0.6, €2.6, €1.8 million). The borrowing rate consisted of a fixed 3.7% margin plus LIBOR 3M (generated by the respective process). The simulations assumed that the repayment of the loan is deferred for one year, and during the deferment period the debt accumulated in accordance with the assumed borrowing rate for the given period (monthly compounding in arrears). The first non-zero installment is repaid after a year. Together with the update of the debt to include a new tranche the entire loan repayment plan was updated. As noted earlier, any other costs associated with the loan, such as the commission or insurance, were ignored.

The estimated cost of the construction amounting to €4.5 million was spread over two years (the expected date of completion of the construction), some costs were covered on a monthly basis in the amount of €100,000 and the remaining amount was paid in 4 tranches of €525,000 at the end of each half-year. Additionally two unexpected amounts of costs associated with the construction were generated, each up to 5% of €4.5 million, at randomly generated times between month 6 and 25 of the investment.

Standard aggregate costs of business activity (salaries, cost of rental/maintenance of office space, marketing expenses etc) were assumed to amount to €100,000 plus up to (generated randomly) 10% of €100,000.

The process of selling the premises begins 6 months after the commencement of the investment, the sale of the premises is identified with financial flow – payment. Three types of residential premises were considered for the purposes of the simulations

- 100 premises with an area of 50 m2
- 50 premises with an area of 80 m2
- 25 premises with an area of 120 m2

The maximum intensity of the sale was assumed to occur after two years from the beginning of the investment (planned completion time), whereas it was assumed that a period of five years (the entire term of the investment) is the period in which the most probable amount of sold premises is 100% (this does not mean, however, that all premises will be sold at that time),

Transaction prices are generated randomly within a set range. For each class the price range of the premises is adjusted using the appropriate multiplier ($k_1 = 1, k_2 = 1.1, k_3 = 1.3$). The initial price range is adjusted based on a measure referred to as the probability of failure to achieve the aspiration level. The minimum price was determined so that the probability of the event that the generated final surplus in pre-simulations (50 000) will have a value less (or equal to) zero and will not exceed 0.1. The maximum price was

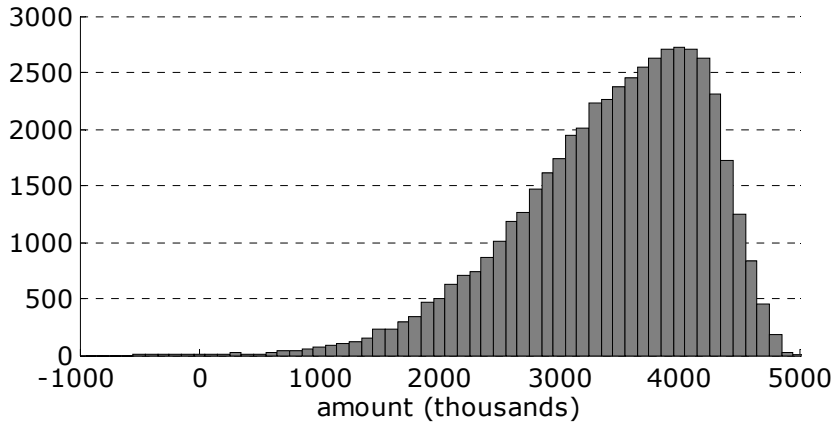
generated in a similar manner (for a probability of 0.01), whereas the aspiration level was then set as the value of the initial surplus value subject to demanded rate of return (assumed at the level of 10% p.a.) for the entire period of the investment. After the determination of the initial price range, subsequent simulations of the implementation of the surplus were carried out, in which the price of the premises (expressed per m2) was generated on the basis of the previously determined range.

The interest rate on the current account with the surplus (the interest compounded on a daily basis) was 15% for an overdraft, interest rate was not applied in case of positive surplus capital (that is, for positive values of $N(t)$ the interest rate was assumed to be 0%).

With the above assumptions, Monte Carlo simulations were carried out by generating 50000 realizations of daily changes in surplus capital both in the pre-simulations (establishment of the initial price range for m2) and in the final simulations. The minimum price in the pre-simulations was obtained at €1100 per m2, the maximum price: €1400 per m2.

A histogram of the final surplus (that is, after five years of the investment, regardless of whether all the apartments will have been sold) is shown below. The histogram shows that the settlement of the investment may result in losses, in extreme cases even up to €0.5 million. Therefore, it should be considered whether it is reasonable to initiate a procedure of early withdrawal from the investment and minimizing losses. However, in vast majority of the cases the final surplus is positive and greater than the initial value (the average value of the financial surplus after the fifth year of the investment amounts to €3.4 million). The average number of premises which haven't been sold is app. 8.

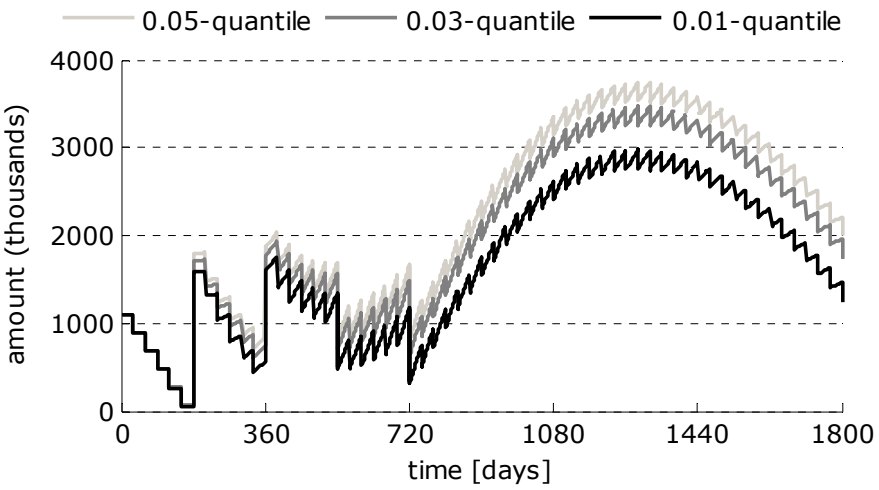
Figure 2 Histogram of final financial surplus



Source: own elaboration

Figure 3 shows the quantile of the final financial surplus for probability levels of 0.01, 0.03, and 0.05. The quantile determined on the basis of the empirical distribution of the final surplus amounts to: €1.3 million, €1.7 million and €2.0 million, for the respective assumed tolerance levels. Corresponding Value at Risk figure would be analogous.

Figure 3 Quantile of final financial surplus



Source: own elaboration

5 Conclusions

The model of a financial surplus presented in this paper is only a starting point for further considerations. As noted above, it ignores the relationships between the quantities, does not allow for the calibration on the basis of the market data (process of the value of the sold premises, process of borrowing rates, price-demand relationship), does not take into account the tax aspects of the investment and the possibility of the initiation of bankruptcy proceedings. allow for the adjustment on the basis of the market data (process of the value of the sold premises, process of borrowing rates, price-demand relationship).

For this reason, further analyses should take into account the calibration of the model, possible decisions of the developer in the course of the investment (additional loans, lowering the price below the assumed minimum level to avoid insolvency, or the possibility of declaring insolvency). Additionally, the possibility of implementing different models of borrowing rate should be considered, as well as different models of the distribution of transaction prices or functional relationships of the intensity of the sales process. Measures of risk/attractiveness that augment the decision making with regard to the attractiveness of the investment can also be employed.

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The Nexus between Sovereign Default Risk and Bank Fragility: Evidence from China

Oleg Deev[1], Martin Hodula[2]

[1] Masaryk University
Faculty of Economics and Administration, Department of Finance
Lipová 41a, 602 00 Brno, Czech Republic
E-mail: oleg@mail.muni.cz

[2] VŠB-Technical University of Ostrava
Economic Faculty, Department of European Integration
Sokolská třída 33, 701 21 Ostrava, Czech Republic
E-mail: martin.hodula@vsb.cz

Abstract: *In this paper we investigate the interdependence of the sovereign default risk and its domestic banks on the example of China during the time period of 2003-2011 using credit default swaps as a proxy for default risk. China's banking industry has predominantly remained state-owned, even after a series of significant reforms in the last two decades. We employ bivariate vector autoregressive (VAR) and vector error correction (VECM) framework to analyze the short- and long-run dynamics of the chosen data series. To describe the direction of the discovered dynamics, we use Granger causality. We find evidence of a stable long-run relationship between sovereign and bank CDS spreads in chosen time period. The relationship was significant only in a state-bank direction and not vice versa.*

Keywords: sovereign default risk, bank default risk, CDS, China, risk transfer

JEL codes: G18, G21

1 Introduction

During the recent financial crisis which started in the US and has quickly spread to Europe and the rest of the World, extraordinary measures were taken by central banks and governments to prevent a collapse of the financial sector. However, certain effects of taking such measures on the interdependence of the financial and sovereign sectors were unknown or undisclosed to the public until the Eurozone sovereign debt crisis.

Bank for International Settlements identifies four main channels through which deterioration in the state's creditworthiness can potentially affects the banking system stability (BIS, 2011). First, since banks traditionally hold a large share of government debt, it might have a negative impact on banks' assets when the government faces certain fiscal problems. Second, higher sovereign default risk significantly reduces the value of collateral that can be used for funding. Third, downgrade in country rating also translates to home country banks. And finally, when the government faces difficulties it has a little chance to provide guarantees for a bank in trouble, hence, increasing its default probability.

When a financial institution faces liquidity issues of any sort, it may cause a contagion process affecting public sector. Sovereign default risk significantly rises when state might intervene to prevent bank bankruptcy. It is this particular private-to-public risk transfer that adjusts the probability of sovereign default, on one hand, and lowers the default risk of financial institution, on the other. The main consequence of the risk transfer from the private sector to sovereign treasuries has been an increased interdependence of banks and countries, causing negative feedback loops between their financial conditions. Acharya et al. (2011) model this feedback mechanism in detail.

If the connectivity between sovereign default risk and bank fragility became apparent in the developed countries only after the crisis, the same connectivity is historically presumed for developing countries, where the biggest banks are mainly state-owned. At the same time, since main channels through which sovereign risk can have an impact on

financial institutions (such as asset holding channel and collateral channel) are significantly smaller in developing countries than in Europe due to significantly lower public debt, the two-way nexus problem is not that apparent and straightforward anymore.

In this paper, we are aimed to test the sovereign default – bank fragility nexus on the world's biggest emerging market. China's banking industry has predominantly remained state-owned, even after a series of significant reforms in the last two decades. Of the Top-10 world banks by total assets four are resident in China and are all controlled by the central government. The so called "Big Four" state-owned banks were allowed to commercialize their operations by the Commercial Bank Law in 1995. Since the government had a major role in government-directed lending, the Chinese banking sector was stuck with a large share of non-performing loans. According to the Central bank report (2003), non-performing loans accounted in average for 25,4% of total lending of China's Big Four banks in 2002. The situation improved only after government's interventions, when most of non-performing loans were transferred under management of specially created financial institutions. However, still growing bubble in the construction sector might significantly affect the banking system in the future. This alone suggests possible dependence of sovereign default risk and bank fragility.

We assume that the increase/decrease in Chinese sovereign default risk should cause the change in the default risk of domestic banks in the same direction. However, the intensity of this direct linkage changes over time with effects of seemingly successful "survival" of the global financial crisis, followed by the domestic credit expansion with higher risks to facilitate higher rates of economic growth. We also test whether the possible problems of growing housing bubble and non-performing loans increase the sovereign default risk even when the government debt remains comparatively low.

Our study contributes to, at least, two strands of literature. On the one hand, it is linked to the literature that investigates the interconnectivity between sovereign default risk and bank stability and its development during financial crisis. On the other, it is related to the analysis of emerging markets banking sector, its status and similarities to banking systems of advanced economies.

Tied to the first strand, the interconnectedness of balance sheets of government and banks has been proven right in various empirical studies. For instance, Alter and Schüler (2012) analyzed daily credit default swaps (CDS) for several European countries between 2007 and 2010. Gerlach et al. (2010) claim that systemic and sovereign risk became more interwoven after the governments began to issue guarantees for banks' liabilities. Acharya et al. (2011) provided an evidence of interconnectedness of financial and sovereign sector credit risk as a result of bailout programs. Kónig et al. (2014) employ a global-game approach to show the importance of balance sheet transparency when trying to use bank debt guarantees as a costless measure to prevent unwilling bank runs. Ejsing and Lemke (2011) argue that the sensitivity of sovereign CDS to the financial crisis in Europe increased after the bailout of the financial sector. Dieckmann and Plank (2011) found evidence of a private-to-public risk transfer for countries whose governments have intervened in the financial system.

As the globalization continues, the financial markets become more and more interconnected and the "diabolic loop" might be also endangering emerging market economies. Hence, within the second strand of literature Zhang et al. (2013) investigates the relationship between market concentration, risk-taking, and bank performance in BRIC countries over the period 2003-2010. They found a negative association between market concentration and performance. Eichler (2014) study the political determinants of sovereign bond yields spreads. He found that political determinants have more significant impact on sovereign bond yield spreads in autocratic and closed regimes than in democratic and open countries. Using GARCH models, Fender et al. (2012) found that that daily CDS spreads for emerging market sovereigns are more related to global and regional risk premia than to country-specific risk factors. Qin and Zhu (2014) tested the

BRICS countries for the "too non-traditional to fail" argument with negative results confirming the validity of "too big to fail" argument instead.

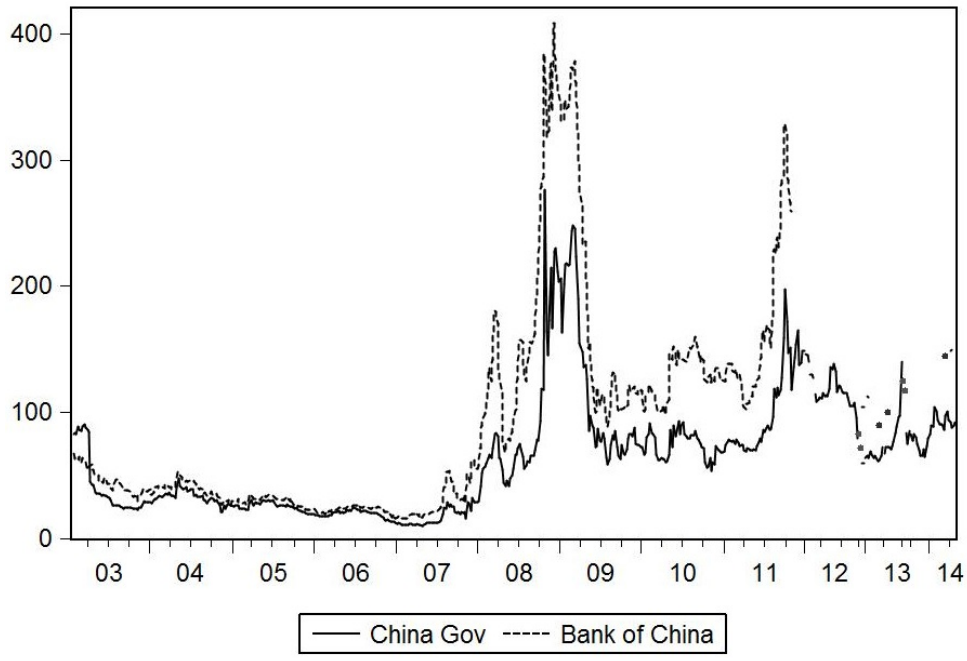
We add to existing literature by quantifying the relationship of the interdependence of the sovereign default risk and its domestic banks on the example of China as one of the world's most expanding economies and member of BRICS countries.

2 Data and Methodology

To study the nexus between sovereign default risk and bank fragility in China, we consider five-year credit default swaps for the People's Republic of China (PRC) and one of the China's Big Four banks – Bank of China, both collected from Bloomberg. Bloomberg reports CMA data, which compiles prices quoted by dealers in the privately negotiated market. To describe it briefly, the CDS is a derivatives contract that hedges the default risk of an underlying state or company that it references by transferring it to a third party on a bilateral basis. Traditionally, CDS spreads represent the fair insurance price for the credit risk of a company or sovereign default risk of a state, and have been used as an indicator to measure the counterparty risk. We have chosen five-year spreads as the benchmark since they are generally considered the most liquidly traded and therefore offer more accurate barometer of risk appetite. The sample data consists of weekly prices from January 24th, 2003 till October 28th, 2011. Further data are only partially available and, hence, excluded from our investigation.

Figure 1 describes data in levels. Casual observation of levels implies that each CDS series appears to be non-stationary and that both CDS spreads tend to move together over time without a trend. The differences of chosen variables seem to vary over a constant level of zero, although there are few large outliers, which should be accounted for in the model. From the inspection of properties of data seen in first differences (not reported here due to space constraints, but available on request), it is indicated that the assumption of multivariate normality might be accepted with minor changes of the model in order to obtain better specification and robustness of further analysis.

Figure 1 CDS level series of PRC and Bank of China



To analyze the dynamics of the long- and short-run interdependencies between selected CDS price series, we employ bivariate vector autoregressive (VAR) and vector error correction (VECM) framework. Such framework allows for testing and interpreting cointegration relation between studied series. To further illustrate the entire dynamics

between the CDS spreads and describe the direction of the discovered dynamics, we consider Granger causality tests. The study employs cointegration analysis and follows theoretical formations described in Johansen (1996) and Juselius (2006).

Cointegrated VAR analysis should be employed with great caution, while several conditions have to be met to achieve trustworthy and credible results. Following Granger (1986) and Engle and Granger (1987), variables are called cointegrated if they have a common stochastic trend. To check the stochastic non-stationarity of the data the unit root is required. We conduct standard Augment Dickey-Fuller (1981) unit root test (ADF), which constructs a parametric correction for higher-order correlation by assuming that the y_t time series follows an *AR(p)* process with *p* lagged difference terms and both with and without constant α_0:

$$\Delta cds_t = \alpha_0 + \gamma cds_t + \beta_1 \Delta cds_{t-1} + \cdots + \beta_p \Delta cds_{t-p} + \varepsilon_t, \text{ where } \gamma = -(1 - \sum_{i=1}^{p} \alpha_i) \quad (1)$$

Alternatively, we use non-parametric Phillips-Perron (PP) test relaxing the ADF test assumption of identically distributed errors. The test is robust with respect to unspecified autocorrelation and heteroscedasticity in the disturbance process of the test equation (1). The parameter of interest in both regressions is γ, being that if $\gamma = 0$, the series contain unit root. The result of the t-test is compared to appropriate critical values.

We employ both Engle-Granger and Johansen procedures to find the common trend in the bivariate time series, which is based on the vector autoregressive (VAR) model of the form:

$$\begin{pmatrix} cds_{sov_t} \\ cds_{bank_t} \end{pmatrix} = \Pi_1 \begin{pmatrix} cds_{sov_{t-1}} \\ cds_{bank_{t-1}} \end{pmatrix} + \Pi_p \begin{pmatrix} cds_{sov_{t-p}} \\ cds_{bank_{t-p}} \end{pmatrix} + \mu_0 + \phi D_t + \varepsilon_t \quad (2)$$

The deterministic components might include a vector of constant terms, μ_0, and D_t contains dummy variables explaining extraordinary effects. The lag *p* is determined by several criteria: sequential modified LR test statistic, final prediction error, Akaike, Schwarz and Hannan-Quinn information criteria.

In the Engle-Granger two step method two time series are cointegrated, when the linear combination of them is stationary. Johansen cointegration technique is based on two test statistics to determine the number of cointegrating vectors (the rank of the matrix) namely the trace statistic and the maximum eigenvalue statistic, which are computed for the null hypothesis of no cointegration as:

$$LR_{tr}(r|k) = -T \sum_{i=r+1}^{k} \log(1 - \lambda_i) \quad (3)$$

$$LR_{max}(r|r+1) = -T \log(1 - \lambda_i) = LR_{tr}(r|k) - LR_{tr}(r+1|k) \quad (4)$$

Trace statistic tests the null hypothesis of *r* cointegrating relations against the alternative of *k* cointegrating relations, where *k* is the number of variables in the system for *r =0,1,2…k-1*. The maximum eigenvalue statistics tests the null hypothesis of *r* cointegrating relations against the alternative of *r+1* cointegrating relations for *r =0,1,2…k-1*. The null hypothesis of no cointegration is rejected, if the rank of the coefficient matrix is at least 1.

The third step of our investigation is based on Granger Representation Theorem, that is if the variables in the VAR, which represents the long-run dynamics between indices, are found to be cointegrated, when there must exist an associated error-correction model, which can be built by imposing as restrictions the number of cointegration relations previously identified:

$$\begin{pmatrix} \Delta cds\_sov_t \\ \Delta cds\_bank_t \end{pmatrix} = \Pi \begin{pmatrix} cds\_sov_{t-1} \\ cds\_bank_{t-1} \end{pmatrix} + \Gamma_1 \begin{pmatrix} \Delta cds\_sov_{t-p} \\ \Delta cds\_bank_{t-p} \end{pmatrix} + \mu_0 + \phi D_t + \varepsilon_t, \quad (5)$$

wher $\Pi = \begin{pmatrix} \alpha_{cds_gov} \\ \alpha_{cds_bank} \end{pmatrix} (\beta_{cds_gov} \quad \beta_{cds_bank})$e represents long-run changes of the system and Γ_1 denotes transitory adjustments.

As the last step, we employ Granger causality test to identify the causality sense between CDS series (causality implies a chronological ordering of movements of the series). If we denote the first analyzed series (its daily returns) as $I_{1,t}$ and the second series as $I_{2,t}$ the Granger causality model takes the following form:

$$I_{1,t} = \alpha_0 + \sum_{i=1}^{p} \alpha_i I_{1,t-i} + \sum_{j=1}^{q} \beta_j I_{2,t-j} + \varepsilon_t \quad (6)$$

Wald's test for joint significance of the parameters β_j is performed to evaluate the null hypothesis that $I_{1,t}$ does not Granger cause $I_{2,t}$.

3 Results and Discussion

The logarithms of the chosen CDS series are tested for unit roots using the Augment Dickey-Fuller (ADF) and Phillips-Perron (PP) tests. The p-values used in the test are MacKinnon one-sided p-values. Several ADF test are calculated in levels and in the first differences with inclusion of constant or constant and trend (Table 1).

Table 1 Results of ADF and PP tests

	Test	PRC	Bank of China
levels	ADF (with intercept)	-1.599	-0.4456
	ADF (with trend and intercept)	-2.833	-1.9398
	PP (with intercept)	-1.5747	-0.7762
	PP (with trend and intercept)	-2.8139	-2.1591
first differences	ADF (with intercept)	-25.5706	-20.1905
	ADF (with trend and intercept)	-25.5809	-20.2456
	PP (with intercept)	-25.5113	-20.4899
	PP (with trend and intercept)	-25.5239	-20.5165

Note: MacKinnon critical values are 3.4443 and -2.8676 for 1% and 5% level of significance respectively

The results of the ADF unit root test show that at logarithm levels all CDS spreads are non-stationary series with a deterministic trend. However, the ADF tests performed at first differences suggest that data are stationary, hence all variables are first-order integrated series or *I(1)*.

Table 2 Lag length determination

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-426.5205	NA	0.023024	1.904536	1.922799	1.911734
1	997.5242	2829.102	4.18e-05	-4.406774	-4.351984	-4.385180
2	1011.687	28.0113*	4.00e-05	-4.451943	-4.360627*	-4.415952*
3	1015.975	8.442976	3.99e-05	-4.453224	-4.325381	-4.402836
4	1020.304	8.484038	3.98e-05*	-4.454685*	-4.290315	-4.389900
5	1021.936	3.185068	4.03e-05	-4.444162	-4.243266	-4.364981
6	1022.963	1.992781	4.08e-05	-4.430944	-4.193521	-4.337367

Note: * indicates lag order selected by the criterion

Having confirmed that studied CDS spreads can be characterized as integrated series with order one, *I(1),* we first examine the long-run relations among selected spreads. Vector Autoregressive model of ten stock markets indicates that the appropriate lag order in the full sample and each sub-period sample is one, which is selected by three criteria: LR test statistic, Schwarz Information Criterion and Hannan-Quinn Information Criterion (Table 2).

The residual analysis is conducted to determine whether chosen model specification is statistically well-specified, or in other words, to check the assumption of the error terms being independently normally distributed (results are summarized in Table 3). It is worth mentioning that valid statistical inference is sensitive to violation of certain assumptions, such as autocorrelated or skewed residuals and parameter inconstancy, and quite robust to violation of others, such as residual heteroskedasticity or excess kurtosis.

Table 3 Multivariate misspecification tests

Test	Model without dummies	Model with dummies
Residual autocorrelation LM(1)	$\chi^2(4)$ =6.5868 [0.159]	$\chi^2(4)$ =26.506 [0.000]
Residual autocorrelation LM(2)	$\chi^2(4)$ =5.4125 [0.247]	$\chi^2(4)$ =13.249 [0.0101]
Test for normality (skewness)	$\chi^2(2)$ =50.900 [0.000]	$\chi^2(2)$ =3.3666 [0.1858]
Test for normality (kurtosis)	$\chi^2(2)$ =1133.3 [0.000]	$\chi^2(2)$ =209.094 [0.000]

Note: p-values are denoted in brackets

The better specified model includes several dummies, allowing for further application of the proposed methodology. Model dummies signify three substantial events on the Chinese banking market. First dummy (April 2003) corresponds to Chinese government extra-ordinary measures to resolve the issue of bank non-performing loans. Up to the end of 2003 the four major financial asset management corporations had disposed of 301.4 billion yuan of NPLs excluding the conversion of liabilities to equities, recovering 101.3 billion yuan including 67.5 billion yuan of cash (Ye, 2003). Second dummy (November 2007) relates to the sudden effects of the global financial crisis on Chinese financial markets through diminishing liquidity for interbank funding. As a result, Chinese stock indexes lose over 60 percent between November 2007 and September 2008. Third dummy (October 2008) illustrates China's central bank measures on handling domestic economic slowdown (growth of the Chinese economy fell to 6,8% in the fourth quarter of 2008 from 13% in 2007). China's central bank cut both interest rate and reserve requirements and released 4 trillion yuan special stimulus package in an effort to boost domestic economy and avoid deflation.

Table 4 Rank determination (Johansen cointegration test)

Null Hypothesis	Alternative hypothesis	Eigenvalue	Test statistic	5% critical value	p-value
Trace test					
r=0	r>0	0.039316	18.41549	12.32090	0.0042
r≤1	r>1	0.000364	0.165708	4.129906	0.7363
Maximum eigenvalue test					
r=0	r=1	0.039316	18.24978	11.22480	0.0025
r=1	r=2	0.000364	0.165708	4.129906	0.7363

For the model including above described dummies, we cannot reject the null hypothesis of no first or second order autocorrelation, while model residuals are found to be normally skewed. Now we can assume the robustness of results of cointegration tests. The Engle-Granger cointegration test requires individual variables to be non-stationary, which was established previously (Table 1). Significant coefficient of the individual variable in the cointegrating regression (p-value of 0.0014) alongside with stationary residuals from the cointegrating regression (F-test (2, 452) = 11.043 with p-value of 0) indicate cointegration of studied CDS series. Alternative test of rank determination also signals the existence of cointegration. Both trace test and maximum eigenvalue test suggests the cointegration rank of the model to equal one (Table 4).

Table 5 Results of cointegration analysis

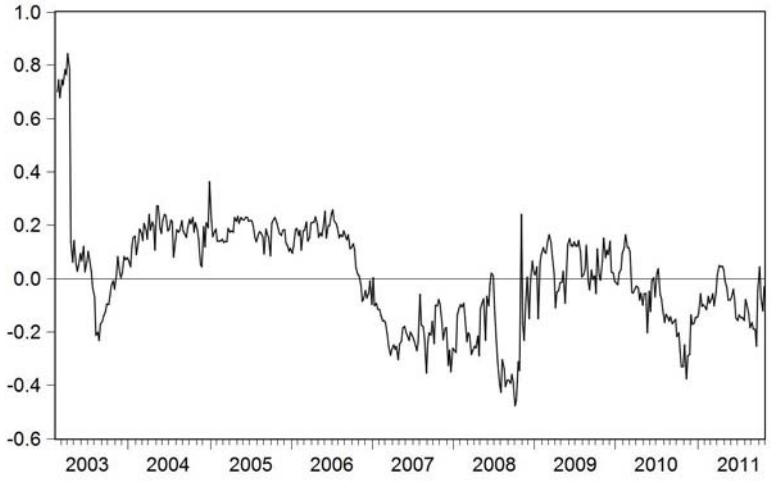
	α_{cds_gov}	α_{cds_bank}	β_{cds_gov}	β_{cds_bank}
Cointegration term	-0.0592719 (0.00565)	-0.0270587 (0.16229)	1 (0.00)	-0.90549 (0.015740)

Error-correction terms	Δcds_sov_t	Δcds_bank_t
Δcds_sov_{t-1}	0.0440 (0.4519)	0.1812 (0.0007)
Δcds_bank_{t-1}	0.0064 (0.9269)	-0.0531 (0.4041)
D_t **(11.04.2003)**	-0.5923 (0.0000)	0.0348 (0.6716)
D_t **(16.11.2007)**	0.5829 (0.0000)	0.6258 (0.0000)
D_t **(24.10.2008)**	-0.6874 (0.0000)	-0.2692 (0.0000)
R-squared	0.3324	0.1621

Note: p-values are denoted in brackets

The results of the error-correction model specification are summarized in Table 5. The α-coefficients in the relations of China's and Bank of China suggests that the bank spread do not adjust to any deviations from the long-run equilibrium, while the sovereign CDS adjusts at a rate of $\alpha_{cds\_gov} = -0{,}06$ to changes in the Bank of China spreads. At the same time, model results suggest that bank risks adjust to short-term dynamics of sovereign CDS spreads. The impact of dummies is found to be significant for both CDS spreads, except for effects of NPL problem on sovereign default risk in April 2003.

Figure 2 Cointegration relations



The graphic representation of cointegration relations allows us to analyze how the studied nexus changes over time (Figure 2). The changing character of cointegration corresponds to extraordinary events in the Chinese banking market, which were partially included into our model specification.

Table 6 Results of Granger-causality tests

Independent variable	Dependent variable	χ^2(2) statistic	p-value
$\Delta\boldsymbol{cds\_bank_t}$	Δcds_sov_t	1.520122	0.4676
$\Delta\boldsymbol{cds\_sov_t}$	Δcds_bank_t	13.01726	0.0015

In order to test short-run linkages between selected stock markets we conduct Granger tests for intertemporal causality. Table 6 shows the results of Granger Causality/Block Exogeneity Wald tests. It estimates the chi-squared value of coefficient on the lagged endogenous variables. The causality is investigated in there periods. The hypothesis in this test is that the lagged endogenous variables do not "Granger cause" the dependent variable. Tests for Granger-causality indicate that only a sovereign CDS Granger-causes Bank of China CDS at the 1% significance level in the observed time period and not vice versa. This can be view as a potential thread in the Chinese banking market.

4 Conclusions

As a result of ever growing interconnectivity in the financial sector, financial stability became a public good when its provider cannot exclude any party from its benefits and any party should not influence its state. The interdependence between the financial and public sector has started to be one of the major concerns of regulators and policy makers. Our main goal was to test this relationship on the example of baking sector of China in the time period from 2003 to 2011. We use sovereign and bank CDS as a proxy for modelling default risk. Our results suggest that the bank CDS spread adjusts to any short-term deviations of sovereign default risk, while the sovereign CDS adjust to the changes in the Bank of China spreads in the long run. Granger causality confirms our findings.

Any significant changes of Chinese sovereign credit risk will significantly affect the banking market in China both in short- and long terms. Growing fragility of the banking

system will affect the public sector only in some time. Even if Chinese public sector is considered to be one of the most stable in the world, the problems in banking sector could raise sovereign default risks. As a recent example, when one of the Chinese major financial institutions China Credit Trust Co. was in danger of default in the beginning of 2014, interbank lending rates started to rise, thus, pressuring sovereign default rates.

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Financial Literacy of Masaryk University Students in "Financial Literacy" Course

Bohuslava Doláková

Masaryk University
Faculty of Economics and Administration, Department of Finance
Lipová 41 a, 602 00 Brno, Czech Republic
E-mail: 175975@mail.muni.cz

Abstract: *The aim of the contribution "Financial Literacy of Masaryk University Students in "Financial Literacy" Course" is to analyse the state of financial literacy among the students who enrolled the very new course "Financial Literacy". This course is intended to be an introduction to the components of financial literacy (literacy monetary, price and budget). My contribution focuses on the level of financial literacy in the time when students were just being enrolled into the course. My question is what level of financial literacy the students have in the time when they are getting started the course "Financial Literacy". The first part of my contribution is concentrated on the description of the basic terms and a summary of theoretical knowledge about them. In the second part I provide the research, which was conducted through a questionnaire survey. The survey was a required condition for enrolment into the course as an entrance test. And in the final part there are analysed the results of the survey based on the research question. From some reasons not all registered students enrolled or passed the course but those who passed have generally improved in their knowledge and abilities connected with financial literacy.*

Keywords: financial literacy, education, personal and family budget, money

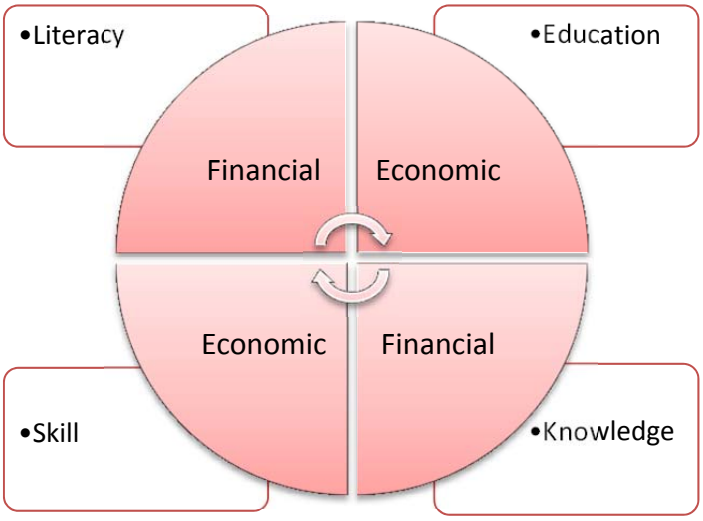
JEL codes: A10, A22, A23

1 Introduction

The term financial literacy is relatively new and the needed skills are now stressed everywhere. There are new subjects created at schools of all levels. Very important is to begin with children and teach them how to handle money. At the university level there is a special situation: young people did not have a financial literacy courses at previous educational stages and there are courses created for them too. The aim of the contribution "Financial Literacy of Masaryk University Students in "Financial Literacy" Course" is to analyse the state of financial literacy among the students who enrolled the very new course "Financial Literacy". This course is intended to be an introduction to the components of financial literacy (literacy monetary, price and budget). At the end of the course students should be able actively participate in the activities of organizations that address the issue of financial literacy. The first part of my contribution is concentrated on the description of the basic terms and a summary of theoretical knowledge about them.

Financial Literacy (FG) is defined rather inconsistently; the individual subjects that are concerned with it have different definitions. Also across the Anglo-American world there is no uniform approach to the FG, the United States used the term "financial literacy," i.e. financial literacy (Roulet, 2009), while in the UK are more likely to encounter the phrase "financial capability", or rather financial competence (Atkinson, 2005). Both terms are translated into Czech in the same words (Balabán, 2011), but their meaning is slightly different. The financial competence and financial literacy are closely linked together, but they cannot be used as interchangeable terms. Financial literacy refers in particular to the knowledge, financial skills rather refers to the ability of adequately usage of these acquired skills and knowledge. The concepts (including the previously mentioned financial literacy and competence) are closely interconnected, as it is evident in Figure 1.

Figure 1 Interpenetration of the concepts related to financial literacy



Source: Gnan et al. (2007)

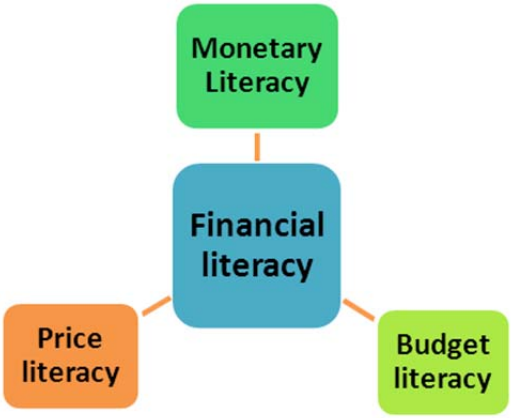
Firstly, Ministry of Finance begun to deal with the financial education and financial literacy in the Czech Republic in connection with the consumer protection in the financial market. Ministry of Finance defined the financial literacy in the National Strategy for Financial Education (Ministry of Finance, 2007 updated 2010). It became the central document for financial education in the Czech Republic. Financial literacy is a set of knowledge, skills and abilities that are necessary for the citizen to financially secure his/her and his/her family in contemporary society and was active in the market of financial products and services. Financially literate citizen with the knowledge about money and prices is able to responsibly manage personal and family budget, including the management of financial assets and financial liabilities with respect to the changing situation (Ministry of Finance, 2010).

As the main motto financial literacy the Ministry states: Citizens are not financial experts, but they should be able to consider what is offered to them - the final solution is their own responsibility.

Ministry of Finance structured the financial literacy into three main components:

- Financial (monetary) literacy,
- Price literacy,
- Budget literacy.

Figure 2 The basic scheme of financial literacy



Source: The author´s own work

Financial (monetary) literacy skills are required to manage cash and non-cash money transactions as well as management tools for this purpose (e.g. current account, payment instruments, etc.).

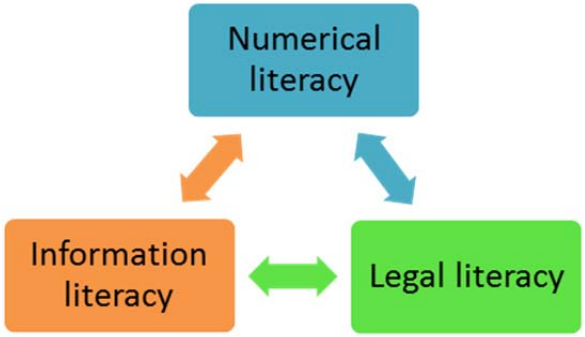
Price literacy skills are essential for understanding the price mechanisms and the inflation.

Budget literacy skills are required to manage personal / family budget (e.g., the ability to manage a budget, set financial goals and make decisions about the allocation of financial resources), and includes the ability to manage different situations in life from a financial point of view. Budget literacy includes not only general components but also two specialized components: management of financial assets (e.g. deposits, investments and insurance) and the management of financial liabilities (such as credits or leases) (Ministry of Finance, 2010).

An integral part of the financial literacy is a macroeconomic policy, i.e. focusing on the fundamental relationships between different sectors of the economy along with an understanding of basic macroeconomic indicators (such as inflation, GDP and interest rates). Necessary are also a basic awareness of the tax system and the role of taxation in society, i.e., knowledge in the field of taxation.

The financial literacy is associated with numerical literacy, which is the ability to obtain, use and interpret mathematical information and ideas in order to actively cope with the mathematical demands that the life of an adult present. It is the ability to handle numerical financial operations and work with numbers, graphs, tables, etc. in the context of real life. Very important is also important information literacy, or the ability to look at the context, understand, use and evaluate relevant information and legal literacy, i.e. the orientation of the legal system knowledge of rights, obligations and opportunities Ministry of Finance, 2010). The complementarity of the three additional literacies is illustrated on Figure 3.

Figure 3 Continuity of additional literacy



Source: The author´s own work

2 Methodology and Data

The very new course "Financial Literacy" started in spring semester 2014. My contribution focuses on the level of financial literacy in the time when students were just being enrolled into the course. The course is open to all students of Masaryk University only the fields directly associated with the programme have the preference. The presumption was that the main part of the sample would consist of relatively new students of the Faculty of Economics and Administration – people who are assumed to be interested in finance generally.

The course "Financial Literacy" requires active participation and many other duties:

- A prerequisite for the granting of credit, the active participation in seminars (seminars), manufacture of team essays, passing tests of financial literacy and cooperation in the exploration of financial literacy.

- Tests of financial literacy
- Entrance test of financial literacy at home subject - by the end of the first week of teaching.
- Second Final verification of financial literacy test after elf Seminar - at the latest by twelve Seminars (is.muni.cz).

Maybe so many duties to pass the course were partly a reason why some students quitted the course and are not going to pass it.

My question is what level of financial literacy the students have in the time when they are getting started the course "Financial Literacy".

The research should answer the basic question:

How much does the course "Financial Literacy" generally help students to improve their financial literacy?

What kind of students is interested in improvement of their financial literacy?

Is it possible to anticipate how many students will quit the course and try to prevent this to happen?

In the next part I provide the research, which was conducted through a questionnaire survey. The survey was a required condition for enrolment into the course as an entrance test. Next I will analyse the final test to see how much the results changed and how much did the students improve their abilities.

Questionnaire usually involved questions that tried to simulate the need to make a decision within the context. It was necessary to find out the real costs and benefits associated with the decision and compare them. Some questions tried the students spending decisions, which entail collecting information, planning and budgeting. There were questions associated with the different choices about the saving money – time, interest rates and inflation were crucial for the decisions. On the other side there was tested the ability to use the credit options and to diverse the risk as an investor. Specific question were connected with debit and credit cards, real impact of taxes on the prices and special knowledge related to the Czech bureaucracy (e.g. what office is responsible for disability pension). Some questions (like the tasks with the interest rate) needed to be calculated but there were other question when there were necessary to know the financial terms (like debit and credit cards different). Some questions asked the same topic but in a different way (the question changed from positive to negative) so it was easier to eliminate some "good tips". The questions were from all of the fields mentioned at the beginning. They tested financial literacy completely: monetary, price, budget literacy and numerical, information, legal literacy too.

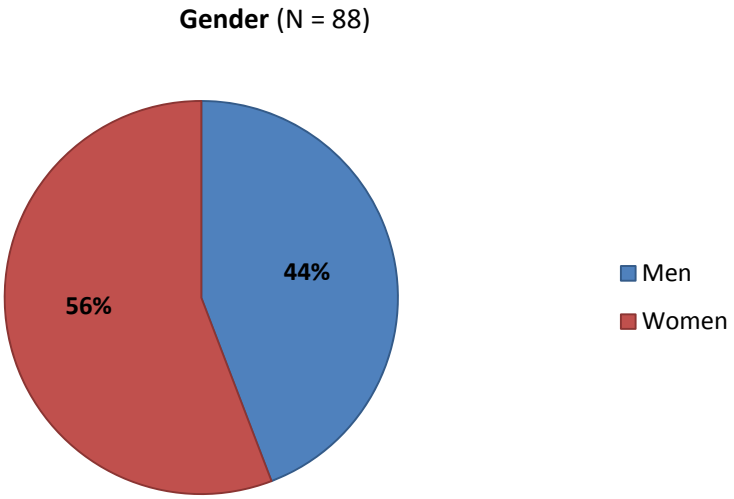
The demands for Entrance and Final tests were very similar, to make the comparison and potential improvement clearer. They were as same level as it was possible.

3 Results and Discussion

Before the beginning of the semester spring 2014 there were 90 students interested in improvement of their financial literacy. Two of them finally decided to enrol the course, so 88 students enrolled the course. There were more women than men, but the difference was not very distinct it is clear from the Figure 4.

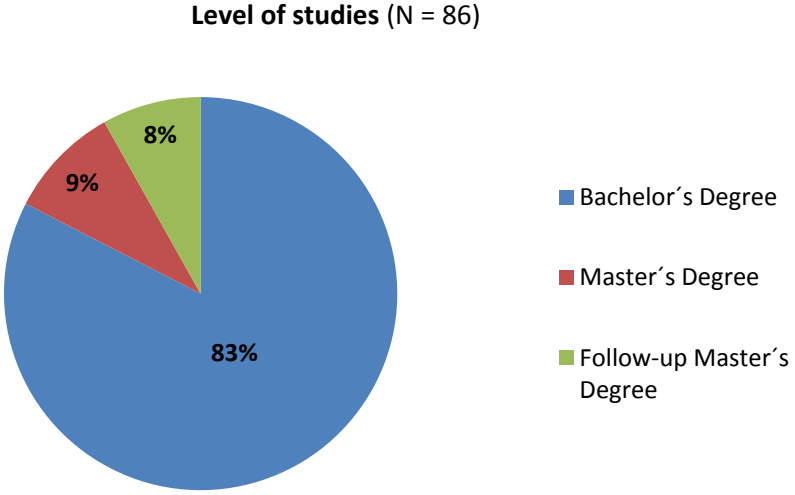
Just after the enrolment 2 students definitely left their studies, so my research sample starts with 86 people (it was getting be smaller as the course was in the process). The students were mainly from the Bachelor´s Degree (see Figure 5). They probably took the course as an opportunity to get some really practical information in one package.

Figure 4 Gender of enrolled students



Source: The author´s own work based on survey results

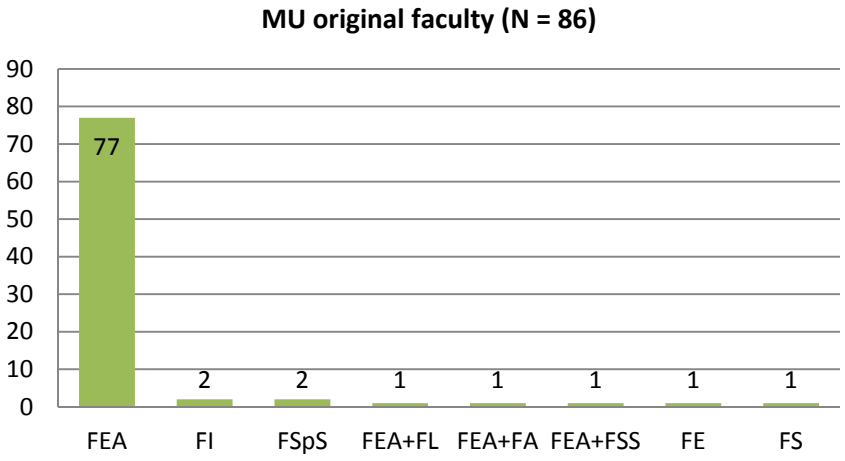
Figure 5 Level of studies of enrolled students



Source: The author´s own work based on survey results

As it is very clear from the Figure 6 absolute majority of enrolled students were students of Faculty of Economics and Administration. In combination with previous information about the study level it is clear that Bachelor´s students of Faculty of Economics and Administration took the chance to get the complete course which most probably was missing in their previous education (the Financial Literacy has just started to be a part of the curriculum of elementary and secondary schools so these students did not have any specialized compulsory course of financial literacy). The rest of the MU students had little interest or information about the course of Financial Literacy (the knowledge about the course among all students was not a part of the research). 2 students were from Faculty of Informatics and 2 from Faculty of Sport Studies. 3 students studied two faculties in one time, every time it was Faculty of Economics and Administration and Faculty of Law in 1 case, Faculty of Arts in 1 case and Faculty of Social Studies in 1 case. 1 student was from Faculty of Education and 1 from Faculty of Science.

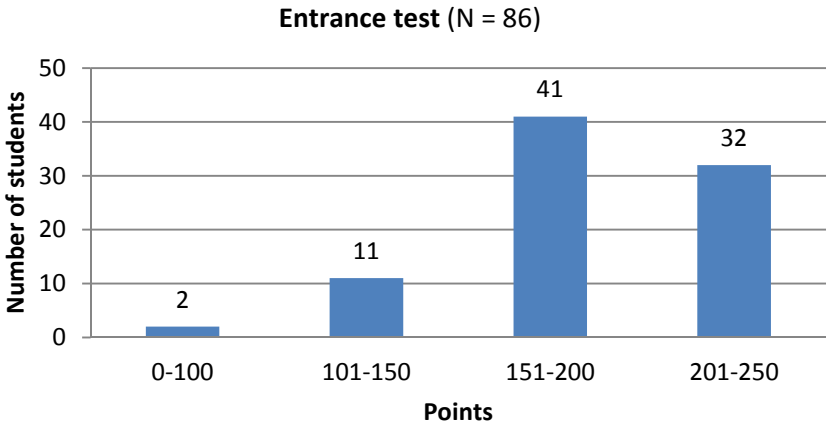
Figure 6 Original MU departments of enrolled students



Source: The author´s own work based on survey results

Enrolled students had to pass the entrance test. The test had 276 questions each per 1 point, no negative points. It was able to enter the test as many times as it was necessary, so students did not have to fill all the questions in one time, they could have done what they want, close it and then open the test again. The received minimum was 61 points, maximum 248. In the Figure 7 there are absolute values of students and from them it is obvious there were some students with very low level of financial literacy. Most of the students belonged to the average and quite a few were already financially educated.

Figure 7 Entrance test results

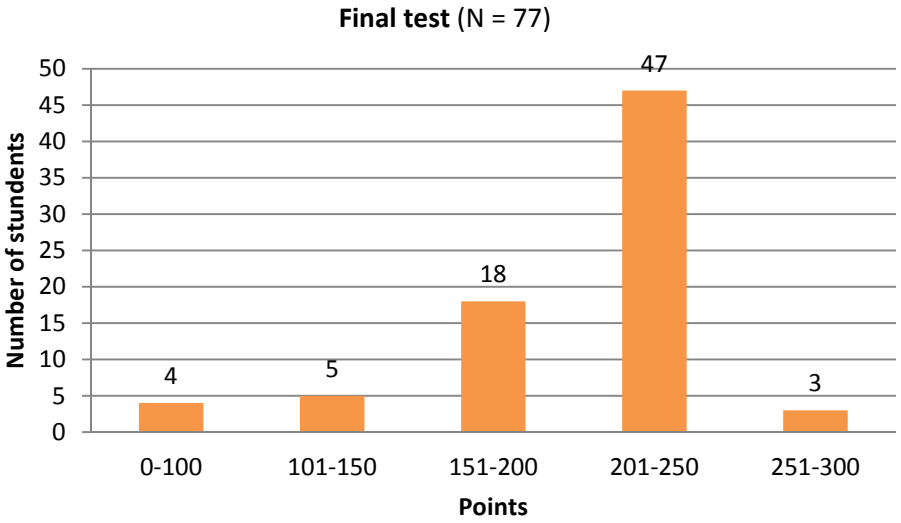


Source: The author´s own work based on survey results

During the semester another student decided to leave the studies completely and other 8 students did not fill the final test in time (maybe they have forgotten or had other duties, but they left the research sample). In the Masaryk university there is a possibility for students who did not pass the course to request for non-repeating of the course (which is not compulsory), so the students who left the course don´t have to enrol it any more in the future, just if they want. The range of obtained points was from 31 points to 259 points. The maximum was 276 points again. The students from the 0-100 points were checked and it was realised they had just very few tries for the final test, some of them just 1 – it is probable they have forgotten to finish it. As it can be seen on Figure 8 the group of 201-250 points-students grew up a lot and it is very possible it was thanks to

the course – they learned the necessary things and did much better. Even 3 students received more than 251 points, so overall the class get better.

Figure 8 Final test results



Source: The author´s own work based on survey results

As follows there are analysed the results of the survey based on the research question. Generally the course "Financial Literacy" helps the students to orientate in word of finance. Overall they did the better in final test than in the entrance test. Interesting would be to directly compare individual student´s comparison. The student which was the best by the entrance test remained the best from the group and got better and did the best by the final test too.

As it was mentioned before the most interested in improvement of financial literacy presented the students of Faculty of Economics and Administration. The rest of the university was included just very little. It must be taken into account that the course is very new and probably there was not much awareness about it. Maybe in next years it will be participating by the students of other faculties too. Actually, it is kind of presumption that the student of Faculty of Economics and Administration will gain the information of financial literacy just in the compulsory courses in that faculty. It would be logical to offer this course to the other faculties. But the problem of financial literacy is that it is too general and most of the lecturers just assume students already have the necessary information. It is not the student s fault because the financial literacy was not taught at the school in the past. Maybe the feeling of inadequacy satisfied the students of Faculty of Economics and Administration to enrol this course in such a big number.

The course "Financial Literacy" has a big target – to improve the financial literacy of many students. It is obvious they have to do quite a lot of work and study. The reasons why overall 13 students decided not to finally enrol or fulfil the requirements are not known but it has to be clearly stated that the course requires a lot of work to make sure just really interested students will have a place there.

4 Conclusions

Very new course of the Faculty of Economics and Administration called "Financial Literacy" is kind of answer on the demand that is visible every where. Basic and secondary schools started their compulsory financial education and the university – the centre of whole knowledge has to do as much as possible to educate its own students in this field. The aim of the course is to familiarize students with the fundamentals of financial literacy. Even when it was not compulsory a lot of students registered in the

course – the topic is very actual and has a direct connection to the praxis. From some reasons not all registered students enrolled or passed the course but those who passed have generally improved in their knowledge and abilities connected with financial literacy.

Majority of students enrolled in the course we the students of Faculty of Economics and Administration. Maybe there could be some bigger offer of financial literacy courses even for students of other faculties. In general, all Faculty of Economics and Administration students must gain some amount of information (financial literacy included), so the course should be more open to the other students. On the other hand who else should be an expert on financial literacy than a student of Faculty of Economics and Administration? Maybe it will take years to coordinate everything so well that all the university students will have the deep financial literacy background from the basic and secondary school that this course will be just for the other than Faculty of Economics and Administration students. The results showed that this course was beneficial nearly for every enrolled student, so it definitely has its reason.

Acknowledgments

Masaryk University Faculty of Economics and Administration, Department of Finance provided the data for my research by sharing the results from Entrance and Final test of "Financial Literacy" course.

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Options of Modern Tools in Cyberspace's Management of E-banking

Jiří Dvořák[1] , Karel Urbanovský[2], Martina Janková[3]

[1, 2] Masaryk University
Faculty of Economics and Administration, Department of Finance
Lipová 41a, 602 00 Brno, Czech Republic
E-mail: dvorakj@muni.cz, karel.urbanovsky@gmail.com

[3] Brno University of Technology
Faculty of Business and Management, Department of Informatics
Kolejní 2906/4, 612 00 Brno
E-mail: jankova@fbm.vutbr.cz

Abstract: *The aim of the article is to inform experts about the potential usage of selected modern tools for models of electronic banking management from the perspective of Applied Cybernetics. The article's content is based on general systems theory and cybernetics with a projection of these theories to the new environment of information and communication technologies and their possible applications in modern information and knowledge society. The paper gives some insights on cyberspace and the possibility of rationally understood management in the application of modern technical and managerial control tools in a fast paced developing environment of the banking world. The content of this article should contribute to the development of systemic integration of models in the field of modern banking in a global and integrated electronic business in a cyberspace (that is e.g. e-business, e-commerce, e-government, etc.) with an electronic banking (i.e. e-banking). An environment of designing new models of electronic banking in the future must be solved by modern means of artificial intelligence for a new economy and taking into account necessary cyber security and protection of the environment against cyberattacks in the upcoming global cyber war in the world.*

Keywords: economic cybernetics, electronic banking, information and communication technology, system integration, cyberspace, cyber security

JEL codes: 032, F15

1 Introduction

The new information and knowledge economy (also known as new economy or e-economy - electronic economy) is and will be more based on the quality information, knowledge, wisdom, visions and especially based on the system-defined understanding of modern cybernetics in all processes of the very fast world dynamics. The new economy as modern economic cybernetics will systematically define cyberspace in theory and practice (cyberspace - Figure 1) for eventually modeling of optimal and optimized control function. The new economy will especially define rational understanding of work with knowledge and data in real time of physical processes of modern world and thus develop e-business with information and knowledge. The Cybernetics trend used on the background of information and communication technologies (ICT) will be developed in all areas of civilized world (in business: e-business, in commerce: e-commerce, in banking: e-banking, in a state and a public sector: e-government ...) and will integrate cyberspace in the education (e-learning, demand-learning,…) especially within preparation of modern virtual schools and universities, and in other areas of service, logistics, etc.

In this article, representing of a rapidly developing field of ICT will in this paper report focus on electronic banking and the development of modern bank transfers for systemically integrated environment of the new economy in intelligent devices equipped cyberspace artificial intelligence models and it is comprehensively addressing the knowledge economy such as robotic agents with high intelligence etc. This systemically integrated profile of the knowledge economy will inevitably and very quickly dominate the modern environment of current and anticipated developmental electronic banking in

the technical, technological and social environment of digital resources in mobile applications on high level of the security, in particular the application of the model in cyberspace modern cryptography and general security of the electronic banking. Already, we have to capture the world's information and communication security (it is generally present in cyber security cyber war) and the very safety of new technical means and new technologies (ICT). We have to incorporate them into new scientific work, research and discoveries - supported by new directions in a physics and philosophy and directed into the dynamics of development of the theory and practice of intelligent robots cyber resources such as voice-controlled - anthropomorphic robots, industrial manufacturing robots, robot or robotized production lines of business or new production activities utilizing 3D printers and their possible applications in manufacturing and repair work in the medical cybernetics, military cybernetics, etc.). Next, we have to pay attention to the field of system integrated capabilities of modern information and communication (now known Internet TV and Internet banking, ...) and other adaptable and intelligent computer networks of the world (energy, transport, etc.). We must also focus on issues of powerfully developed and used and abused global cyber security, cyber terrorism and other potential cyber-attacks profiles within a world cyber war that has already begun. In this huge range of new developments of the world we will only concentrate on the selected parts advanced system of integrated tools in cyberspace management and electronic banking within the conference focused on European financial systems.

2 Methodology and Data

2.1 Methodology Capabilities of Modern ICT Tools in Cyberspace Control

The modern and often neglected "Systems Theory" organizes logical knowledge about abstract and real systems. This theory also describes, classifies and defines precisely the resolution level of the analyzed systems and their essential structure for modeling, as well as the necessary expression of the behavior of these systems in a defined environment and by very thoughtful way defines still underrated immediate vicinity of the systems involved in the life cycle environmental deformations of studied systems (e.g., in terms of information ecology). This theory gives a definition of systems for the practice on real objects, studies their properties, structure and behavior. Then, in this systematic approach, cybernetics develop the theory and also the practical application of systems theory in modern and necessary science which examines the general characteristics and patterns of control and communication in biological, technical, social and other systems. In addition to the theoretical cybernetics (using modern ICT tools of control theory, information theory, automata theory, learning theory, game theory, algorithms, and others) is also Technical Cybernetics and Applied Cybernetics (developed as technical, medical and emerging economic - financial, banking - military, safety and other subgroups of Applied Cybernetics).

In the chosen level of resolution of the economic system we can create (this is to recognize or identify) appropriate analytical methods of the system based on classical methods such as "Operations Research", or given modern methods of recognition scenes environment of the described methods used in "Artificial intelligence", or identification methods and systems described herein developed within the "Theoretical cybernetics" or "Theoretical physics" and indeed other theoretical sciences) for this defined economic environment (for application model of new economic model cybernetics).

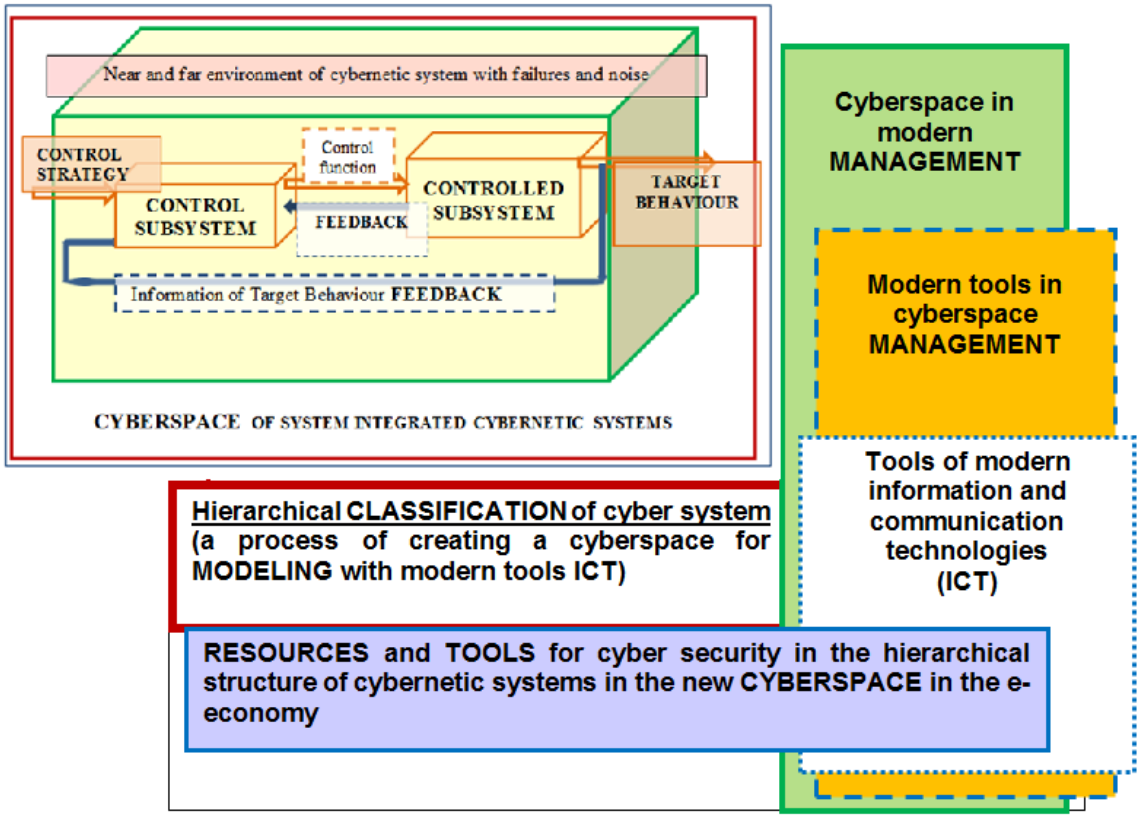
The applied cybernetics methods were adopted for the abstract models of the corresponding systems, for example electronic banking in the modern cyber space (cyberspace) economic cybernetics, in together designed and solved specific system identification by university research. Then the arrangement rational management processes is expressed in the newly spatially oriented hierarchical structure of cybernetic systems (Figure 1). This model is expressed by identifying the real environment as a cybernetic system (cybernetic model) with appropriate strategies, target behavior, relevant feedback and also the immediate surroundings of the system which identifies the appropriate hierarchy of the models described below. The mentioned cybernetic

system is described as a spatially ordered set of strategies, systems, elements from the immediate environs of systems, by the set of resultant target behavior and within these cyber systems is then described by spatially ordered set of control units, corresponding to a set of controlled sub-systems, a set of feedbacks and executive orders. All of this is represented in cyberspace control tools (in our case in cyberspace banking control on the selected level of represented electronic banking in background hierarchy represented by modern ICT tools and closed into environment cyber security of the entire system of economic cybernetics).

Part of the Cyberspace modern management is then Internet and other more modern technological tools (hardware) and program (software) security used to model and simulates the real environment - here the electronic banking. The above mentioned cybernetic security of the modern social system and the electronically supported learning in virtual environment play an important role. (Dvorak, 2013)

ICT tools (Figure 1) are usually defined in terms of the modern concept of theoretical, technical and applied cybernetics like possible and reasonable view of the application of physical laws and regularities in the economic and legal environment such as ICT hardware (technology from the solid phase - silicon, carbon, ... through optical ... to significant new bionic means ...), cyber smart equipment (programming - modeling, simulation, training and learning ... from the perspective of modern methods of mathematics, physics, cybernetics and artificial intelligence on a new technical cybernetics - for example, simulators, etc.).

Figure 1 Cyberspace in modern management



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2.2 Modeling Capabilities of Cyber Systems in Electronic Banking

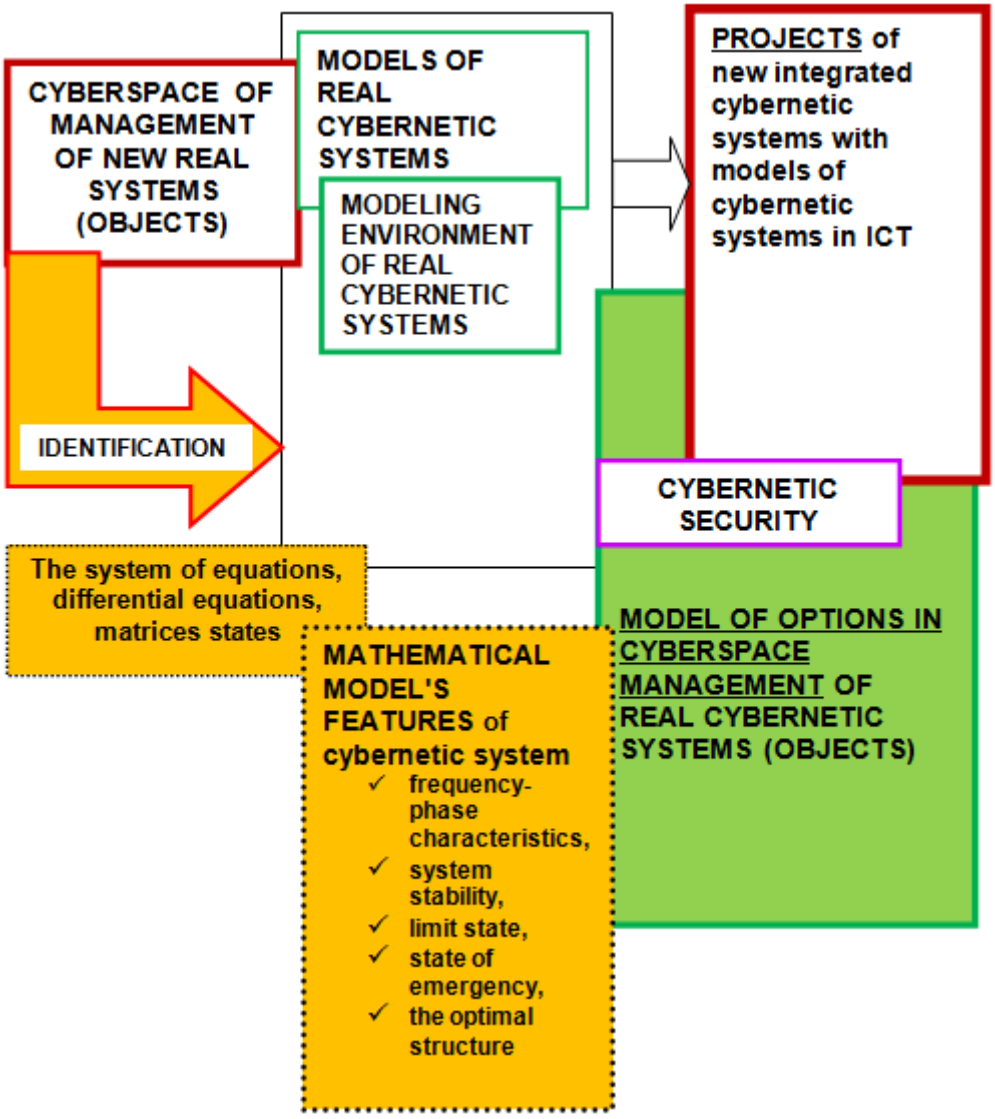
Cyberspace management of new real systems - objects (Figure 2) is defined as a dynamic environment conditions and the behavior of systems described by the system of differential equations (matrix conditions of the state space of the real cybernetic system,

..., phase- frequency and other characteristics of cybernetic systems : the frequency-phase characteristics , stability processes in this cyber systems, optimal and crisis conditions of this cybernetic system and other such as gathering information from data , information and knowledge of their mathematical transformation in areas such as business reporting - Business intelligence - Economic Cybernetics,..., system integration and optimization of socio- technical environment, ... an automated environment and robotic lines and unmanned resources, ...), all as a result of modeling with partial conclusions for the existence of the modern concept of the project of electronic banking project.

All of these components of cyberspace and ICT are linked to an integrated or integrable management environment that is again, in fact, another cybernetic system.

The modern environment is and will always be linked to the implementation of intelligent cybernetic systems (smart intelligent social and technical environment using modern methods of electronically supported education of the social system, i.e. the future of learning at world´s virtual universities (Janková, 2013).

Figure 2 Modelling capabilities of cyber systems in electronic banking



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Resources and tools for modern legal standards adopted in lots of countries clearly define the use of the instruments of ICT, address security management of hierarchical structures of cybernetic systems and their optimal management Figure 2 (projects of new spatial models of hierarchical systems and advanced intelligent cybernetic systems - all related to projects of system integration of electronic banking.

Cyber security shown in Figure 2 focuses on countermeasures using ICT as modern weapons for the military, political and economic environment of Cybernetics, the countermeasures aimed against terrorist abuse of ICT (e.g. misuse of information from data warehouses - in our case, leading to new safety profile of electronic banking in the knowledge economy of the world). Furthermore, for the production and dissemination of harmful hardware and software cybernetic systems …). Disabling committing cybercrimes (cyber terrorism, cyber-bullying, ...), abuse of international networks of ICT (e.g. preventing a spread of destructive resources in cyberspace e-banking, e-government and generally in all electronic systems business services, trade, etc.) in order to avert or eliminate the effects of already planned and gradually implemented in the current world of information and cyber war.

3 Results and Discussion

3.1 Possibilities of Mathematical Modeling in Cyberspace Electronic Banking

In Figure 2, there is generally expressed Profile "Mathematical model of characteristics ..." and in this section then it is briefly expressed by equation (1) and solved in a laboratory way as possibility of a qualified state estimation (Krupka, 2009) using Kalmamn's filter that is loaded with disabilities from the immediate vicinity of the investigated system (Figure 3) solution of the example:

$$x´(t) = F(t)\, x(t) + B)t)\, w(t) \quad (1)$$

$$y(t) = H(t)\, x(t) + v(t) \quad (2)$$

where: F(t) is the input matrix (n x n) at time t,

H(t) is the output matrix (m x n) at time t,
x'(t) is the state vector (n x 1) at time t,
y(t) is the output vector (m x 1) at time t,
w(t) is the process noise (the noise) at time t,
v(t) is the noise modeling in time t,
for modeling the noise w (t) and v (t) there will be Gaussian white with the expected covariances.

For the quality of the estimation of the state vector, we considered average square divergencies in order to minimize possible errors.

3.2 Partial Results of Modeling

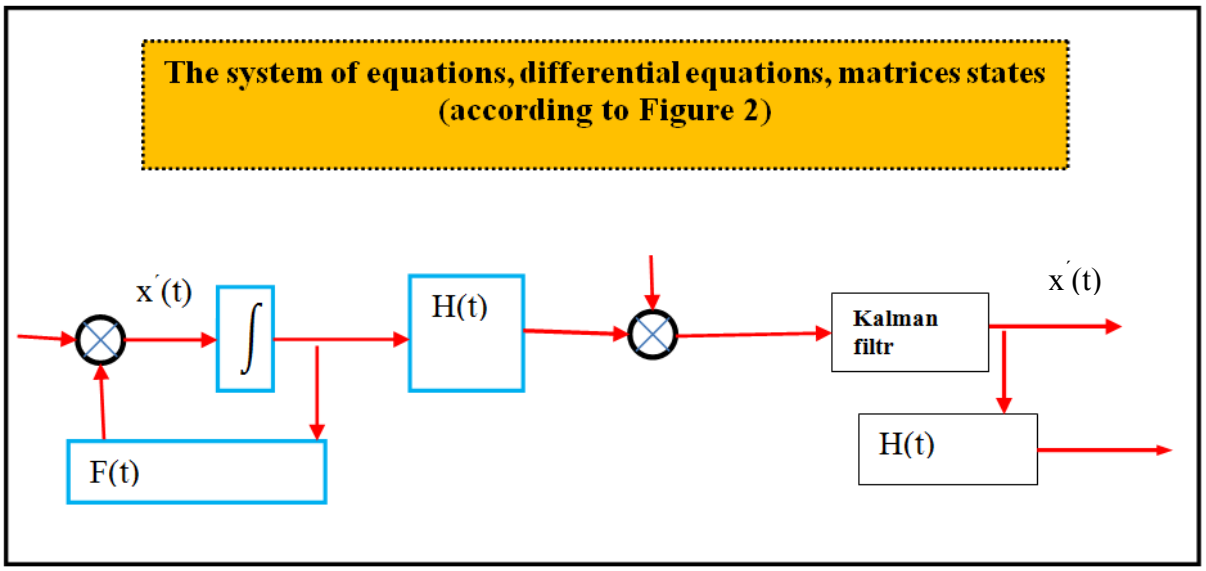
The resulting model in MATLAB led to a solution of the problem mentioned in the block schematic representation in Figure 2.

Modeling confirmed that the described online banking example proves that Internet banking as a part of e-banking, is managerially highly dependent on the process noise and, therefore, this type of secure electronic banking has to be secured with combined communication forms (tiered safety codes, a unique combination of the transmitted security password and usage of a combined form of transmission paths – e.g. accompanied with SMS messages on cell phones, etc.

Another task, prepared to model in our specific research is to obtain information about the possible elimination of noise modeling and the possibility of making the project of safer electronic banking structure combinations. It would certainly be interesting to integrate biometrics into their models and noise properties of our model and upcoming tasks to the overall concept of project management electronic banking considering the

points of contact for integrating new ICT elements into the cybernetic model of secured electronic banking.

Figure 3 Example of solutions as model of state space



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4 Conclusions

New knowledge economy will be associated more and more with intelligent models of hierarchical structures of cybernetic systems (i.e. cyber spaces with the use of modern tools of mathematical modelling), their safe operating conditions of newly designed and actually built system cyber security. Key to success will be primarily the ability to design new integrated system and especially the system of integrable space hierarchically structured adaptable cyber systems and the management of these large scale systems with application of modern and intelligent ICT in a safe ad serviceable condition in the possibilities of modern tools of cyberspace management and communication between socio-economic systems.

The purpose of this paper is to show developing use of cyberspace control and systemically integrated understanding of the role of management in a modern and new concept of cyberspace management, two areas that have not been covered much. It also shows the possibility of modeling and simulations of the system with a resulting in using them to gather data from the information in the status area of cyber systems. In addition to these points, it also shows the links between researches for the future development of cybernetic intelligent robotic systems in future segments of the financial markets.

The contribution of the described specific research is a systemic definition of cyberspace and modelling environment provided with new options systemically integrated user-friendly information and communication systems.

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- This paper is a partial outcome generally formulated specific research project "ICT and mathematical methods in business management" in a particular module 3: *"System integrated environment for the design of intelligent models, modelling and simulation of modern cyberspace of enterprise."* The project is under the Internal Grant Agency of the Technical University in Brno. (Janková, 2013)

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Yield Curve Fitting and Forecasting with Parametric Models – Empirical Evaluation Based on Polish Money Market

Ewa Dziwok

University of Economics in Katowice
Faculty of Finance and Insurance, Department of Applied Mathematics
40-276 Katowice, ul Pulaskiego 25
E-mail: ewa.dziwok@ue.katowice.pl

Abstract: *Among a range of yield curve models are parsimonious methods that become the most popular in countries with well developed debt markets. Since these models let receive the implied forward rate directly they play a crucial role in modern monetary policy. The questions that arise during the modeling process reflect a choice of the best estimation method (the objective function). The solution provided in this paper implements a multiple criteria decision making which through its methodology allows to create an aggregated rating based on different evaluation criteria. The construction of an aggregated measure of the yield curve model for Polish monetary policy requires the adoption of subjective evaluation criteria. During the study two classic measures (which represent the quality of the fit) were taken into account and three based on the characteristics of a 7-day implied forward rate. Such method gives more comprehensive view on and capacity for the selection of the yield curve model. The data used in the paper came from Polish inter-bank market in 2009-2012.*

Keywords: yield curve estimation, multiple criteria decision making

JEL codes: C53, E43, E58

1 Introduction

Among a range of yield curve models are parsimonious methods (Nelson, Siegel 1987) (Svensson 1994) that become the most popular in countries with well developed debt markets. Since these models let receive the implied forward rate directly they play a crucial role in modern monetary policy. A yield curve itself is understood as a plot of zero-coupon rates for different terms and could be easily built from money market data (money market inter-bank rates, FRAs, interest rate swaps).

Different criteria applied for evaluating process of the yield curve prevent from unanimous judgment (Brousseau 2002). It leans towards search for the aggregated measure which represents desirable features of the yield curve.

The solution is provided by a multiple criteria decision making, which thanks to its methodology allows to create an aggregated rating based on different evaluation criteria (Stabryła 2011), (Szreder 2004). The advantage of such procedure is to swing the multi-dimensional problem into one-dimensional one, while the disadvantage is subjectivity in the estimation of the weights of the criteria.

The construction of an aggregated evaluation of the yield curve model for Polish monetary policy requires the adoption of subjective evaluation criteria. During the study two classic measures (which represent the quality of the fit) were taken into account and three additional based on the characteristics of a 7-day implied forward rate. It should be emphasized that these three constructed measures are biased by the subjectivity of the author and are highly sensitive to input data (assumptions). Such method gives more comprehensive view on and capacity for the selection of the yield curve model. In case of additional analysis of any other yield curve's feature a redesign of indicators in order to achieve satisfactory results is required.

2 Methodology and Data

For the further analysis the Nelson-Siegel model with four parameters (NS_) and the Svensson model with six parameters (SV_) are to be utilized.

A set of parameters is estimated by three different objective functions covering mean square errors that minimize sum of squared differences between:

- market prices and theoretical ones, described as: NS_P, SV_P;
- market and theoretical yields, described as: NS_Y, SV_Y;
- prices divided by duration, described as: NS_P/D, SV_P/D;

Taking into account three approximation methods, and assuming that the goodness of fit is not the most important measure, there is a need to apply new criteria which help to point out the most appropriate model. The question arises what kind of criteria should be chosen to achieve the suitable estimation.

Despite various studies concerning yield curves estimating procedures the criteria for the verification of the models due to the choice of optimization criterion (criterion matching the estimated function of the actual data) are not widely adopted.

In this paper, to compare the received functions, the following measures were used expressed in percentage points (Dziwok 2014):

- medium average (absolute) deviation of the MAE, that expressing the average difference between the observed and theoretical rates of instruments of varying maturities, collected on the same day τ, based on the following formula:

$$MAE_{\tau} = \frac{\sum_{l=1}^{k} \left| i_l(\tau, t_l) - i_l^*(\tau, t_l) \right|}{k} \tag{1}$$

- the mean square error MSE for rates:

$$MSE_{\tau} = \frac{\sum_{l=1}^{k} (i_l(\tau, t_l) - i_l^*(\tau, t_l))^2}{k} \tag{2}$$

where $i_l^*(\tau, t_l)$ - rate determined at the time τ based on the estimation result obtained as a vector of parameters
k - number of days in which the construction of the curve was made (test period)

In order to verify the yield curve constructions for the sake of parametric model type and estimation criteria, it is possible to design a subjective measures based on dynamic characteristics of forward rates. The following analysis involve three subjective measures:

- the indicator of short-term volatility of implied forward rates
- the adequacy ratio of a correlation surface
- the indicator measuring the level of the risk premium

Since the interest is focused on the implied 7-day forward rate and its dynamics shortly before the change of monetary policy, the construction of the index is based on the arithmetic mean of the four implied forward rate volatilities using the formula:

$$M(\sigma) = \frac{\sum_{n=1}^{4} \sigma\left(\frac{7 \cdot n}{365}, \frac{7 \cdot (n+1)}{365}\right)}{4} \tag{3}$$

where: $M(\sigma)$ - indicator of short-term volatility of implied forward rates

$\sigma\left(\frac{7 \cdot n}{365}; \frac{7 \cdot (n+1)}{365}\right)$ - standard deviation, calculated for $n = 1,2,3,4$.

Verification of the yield curve could be also based on mutual relationship between the selected implied forward rates.

To describe the adequacy ratio of a correlation surface a matrix of the correlation coefficients that express the distance between the terms of settlement (measured in weeks) has to be presented. The matrix should possess the following features (Rebonato 2002):

[1] $\rho_{m,m} = 1$, for any m;

[2] $-1 \le \rho_{n,m} \le 1$;

[3] $\rho_{m,n} = \rho_{n,m}$;

[4] for a fixed n, $\rho_{n,n+m}$ is a decreasing function of m. This feature, usually described as a de-correlation effect (Brace, Gątarek, Musiela 1997), means that with increasing range between the realization dates of implied forward rates $|n-m|$, their mutual relationship is weakening;

[5] for a fixed n, $\lim_{m\to\infty} \rho_{n,n+m} = a > 0$ tends to the positive value,

[6] for a fixed m, $\rho_{n,n+m}$ is an increasing function of n, which means that in case of short term horizon the market strongly differentiated the expectations, while these differences disappear when the investment horizon is long.

A comparison of yield curve models lead to the pointing out the indicators which let interpret the behavior of the correlation surface in the context of fulfilling the features [1] - [6]. Since the form of the correlation matrix itself satisfies features [1] - [3], the construction of the indicator could be described as a aggregated weighted average taking into account the features [4], [5] and [6]:

$$M(\rho) = \frac{M_{[4]}(\rho) + M_{[5]}(\rho) + M_{[6a]}(\rho) + M_{[6b]}(\rho)}{4} \tag{4}$$

where: $M(\rho)$ - the adequacy ratio of a correlation surface

$M_{[4]}(\rho) = |\rho_{1,2}| - |\rho_{1,10}|$ - measures the degree of decline in the correlation, before aggregation was standardized as a stimulant (stimulus);

$M_{[5]}(\rho) = \begin{cases} \rho_{1,17} & if \quad \rho_{1,17} > 0 \\ 0 & if \quad \rho_{1,17} \le 0 \end{cases}$ - measures the marginal correlation limit, before aggregation was standardized as a stimulant;

$M_{[6a]}(\rho) = |\rho_{1,1} - \rho_{1,3}|$ - measures the strength of expectations' diversity in the short term, before aggregation was standardized as a stimulant;

$M_{[6b]}(\rho) = |\rho_{1,17} - \rho_{1,16}|$ - measures the degree of similarity for correlations in the longer term, before aggregation was standardized as a de-stimulant.

The third indicator measuring the level of the risk premium is the average:

$$M(r) = \frac{1}{n}\sum_{i=1}^{n}\left(f_{\tau}(s, s+\frac{7}{365}) - i^{*}_{NBP}(s)\right) \tag{5}$$

where: $M(r)$ - the indicator measuring the level of the risk premium

τ - days in which the implied forward rate was determined (7-days before the announcement of the MPC)

$f_{\tau}(s, s+\frac{7}{365})$ - 7-day forward rate determined at the moment τ,

$i^{*}_{NBP}(s)$ - the reference rate of the National Bank of Poland

s - means the days on which the message was announced after the meeting of the Monetary Policy Council.

3 Results and Discussion

As a final value of the assessment the arithmetic average of measures was adopted that reflect the characteristics desired by yield curve model.

To compare the yield curve models two types of methods were selected from a number of methods used in multi-criteria analysis, including min-max normalization and the ranking method (Stabryła

Min-max Normalization

The simplest method to create the synthetic evaluation is to calculate the average of the indicators, both in the form of the arithmetic mean and weighted average with weights corresponding to analyst judgment.

The construction of an aggregated indicator for the yield curve evaluation is done according to the scheme:

- ☐ determine the aggregate index formula according to certain criteria,
- ☐ a statement describing the criteria of sub-indices,
- ☐ a normalization of indicators,
- ☐ calculating the ratio of aggregate assessment,
- ☐ ranking the models according to a sliding scale.

The important step involves process of normalization to get the comparable criteria. For the variable which is the stimulant, its normalized value is calculated based on formula:

$$X_i = \frac{x_i - \min\{x_i\}}{\max\{x_i\} - \min\{x_i\}} \tag{6}$$

where: X_i - normalized i-th value of the ratio of the form of stimulants,

x_i - the variable in the form of stimulant

$\min\{x_i\}$ - the minimum of the observed values

$\max\{x_i\}$ - the maximum of the observed values

For the variable which behave in contrast to the stimulant its normalized value could be calculated by the formula:

$$X_i = \frac{\max\{x_i\} - x_i}{\max\{x_i\} - \min\{x_i\}} \tag{7}$$

Due to the normalization, the indexes not only become comparable, but also included in the range $[0;1]$. The closer to one is the value the better the model represents the characteristics described by the measure (Walesiak, E. Gatnar 2009).

Ranking Method

The ranking method is used to evaluate the models on the scale of natural numbers, from best to worst project (or vice versa). Its application to the evaluation of yield curve models allows - through its design based on the natural numbers – for a greater diversification.

The evaluation process using the ranking method comprises the following steps:

- ☐ establishing the criteria to describe the features of the yield curve,
- ☐ putting together the sub-indices describing the criteria,
- ☐ setting ranks (the lower the rank the higher position of the model),
- ☐ calculation of the final ranks as a result of summarizing or averaging,
- ☐ rank the models according to the scale of the growing

At the first stages the ranking method is similar to the min-max normalization. The process consists of assigning following natural numbers (1 to 24), and in the case of the

same rank the joint value is putted in the form of the average. Since features were both stimulants and reversal to stimulants, this fact has been taken into account in the process of setting ranks.

In the next step a Spearman's rank correlation coefficient was calculated to identify whether relationship between two variables is monotonic.

Table 1 Matrix of Spearman's rank correlation coefficient

	MSE	MAE	M(s)	M(ρ)	M(r)
MSE	1,00	0,60	0,16	0,46	0,09
MAE	0,60	1,00	0,44	0,76	0,39
M(s)	0,16	0,44	1,00	0,58	0,83
M(ρ)	0,46	0,76	0,58	1,00	0,61
M(r)	0,09	0,39	0,83	0,61	1,00

Source: own computations

Verification of the Yield Curve Models

The construction of the aggregated measure is based on five criteria (sub-indices) which involve: the statistics of the mean average error (MAE) and the mean square error MSE, the measure of short-term volatility of implied forward rates $M(\sigma)$, adequacy of surface correlation of implied forward rates $M(\rho)$ and the level of risk premium $M(r)$, (Wędzki 2009).

The final result was received by calculating the arithmetic mean of five indicators constructed on the basis of mentioned criteria.

The use of both methods for the aggregated evaluation allows to rank the yield curve models independently. The distance between the minimum and maximum of each scale was divided into three equal intervals, into which the aggregate evaluation of particular model was provided. This procedure led to the division into three groups: good models, average and poor ones.

In both cases the best models are those constructed on the basis of WIBOR (Nelson-Siegel and Svensson one) with the objective function based on the minimization the sum of squared distances between the observed and theoretical yields WIBOR SV_Y, WIBOR NS_Y and prices weighted by the inverse of the duration WIBOR SV_P/D, WIBOR NS_P/D. In addition, well behaved models can be obtained using the 3M FRA rates for both types of parametric models with the objective function based on the minimization the sum of squared distances between the observed and theoretical yields.

The best model - according to both methods – is the Svensson one built for WIBOR data with the objective function based on the minimization the sum of squared distances between the observed and theoretical yields WIBOR SV_Y.

Table 2 Positioning of yield curve models

RANKING METHOD		MIN-MAX NORMALIZATION	
WIBOR Sv_Y	**4,73**	WIBOR Sv_Y	**0,97**
WIBOR NS_P/D	**5,63**	WIBOR NS_Y	**0,96**
FRA 3M Sv_Y	**7,40**	WIBOR NS_P/D	**0,95**
WIBOR NS_Y	**8,01**	WIBOR Sv_P/D	**0,92**
FRA 3M NS_Y	**8,35**	FRA 3M Sv_Y	**0,81**
WIBOR Sv_P/D	**8,75**	FRA 3M NS_Y	**0,80**
SWAP NS_P	**10,75**	WIBOR NS_P	**0,79**
FRA 3M Sv_P	**11,45**	FRA 3M Sv_P	**0,78**
FRA 3M NS_P	**11,50**	FRA 3M NS_P	**0,78**
FRA 3M NS_P/D	**11,60**	FRA 3M NS_P/D	**0,77**
WIBOR Sv_P	**11,83**	SWAP Sv_P	**0,73**
WIBOR NS_P	**11,98**	SWAP NS_P	**0,73**
SWAP Sv_P	**13,63**	FRA 6M Sv_P/D	**0,70**
FRA 6M Sv_P/D	**13,86**	FRA 3M Sv_P/D	**0,69**
FRA 6M Sv_Y	**15,05**	FRA 6M NS_Y	**0,65**
FRA 6M Sv_P	**15,08**	FRA 6M Sv_Y	**0,61**
FRA 6M NS_Y	**15,38**	WIBOR Sv_P	**0,59**
FRA 3M Sv_P/D	**15,55**	FRA 6M NS_P/D	**0,58**
SWAP NS_Y	**15,65**	SWAP NS_P/D	**0,57**
SWAP Sv_Y	**15,78**	SWAP NS_Y	**0,56**
FRA 6M NS_P	**15,88**	SWAP Sv_P/D	**0,55**
FRA 6M NS_P/D	**16,50**	SWAP Sv_Y	**0,47**
SWAP Sv_P/D	**18,23**	FRA 6M Sv_P	**0,43**
SWAP NS_P/D	**18,78**	FRA 6M NS_P	**0,39**

Source: own computations

4 Conclusions

The adoption of min-max normalization and ranking method to verify the yield curves models for Polish inter-bank market in 2009-2012 allows to formulate the following conclusions:

- Due to the fact that the positioning differences were small, the indication of one type of a parametric model with appropriate objective function is not possible. A more detailed analysis carried out only for WIBOR 3M FRA would allow to receive more diversified results.
- In 2009-2012 these models were considered to be good models constructed on the basis of WIBOR (Nelson-Siegel and Svensson one) with the objective function based on the minimization the sum of squared distances between the observed and theoretical yields. In addition, well behaved models can be obtained using the 3M FRA rates for both types of parametric models with the objective function based on the minimization the sum of squared distances between the observed and theoretical yields. The criterion of minimizing the sum of squared distances between the observed and theoretical prices should not be used
- A satisfactory alternative to the model based on minimization the sum of squared distances between theoretical and actual prices is a criterion adjusted for the reversal of the duration. The application of this criterion into the Polish market helped to increase the quality of the curve for instruments with a shorter maturity. The results obtained were comparable to those achieved by applying the criterion of minimization the sum of squared differences between theoretical and market rates.

- The concept of aggregated measure which helps to evaluate the yield curve models requires the adoption of new assessment criteria that are biased by the subjectivity of the author. In case of additional analysis of any other yield curve's feature a redesign of indicators in order to achieve satisfactory results is required.

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Firm Default Prediction Model for Slovak Companies

Slavomír Faltus

University of Economics in Bratislava
Faculty of National Economy, Department of Finance
Dolnozemská cesta 1, 852 35 Bratislava, Slovak Republic
E-mail: slavomirfaltus@gmail.com

Abstract: *The study is aimed at finding the optimal default prediction model for Slovak companies. As partial goals, the accuracy of 49 individual ratios as well as 17 most established comprehensive default prediction models used through the history of predicting default was compared. The dataset for comparing and creating own model consists of more than 300,000 individual observations for each variable within years 2003 - 2012. Methodology used for comparing ratios and models include Receiver Operating Curves (ROCs) and from them derived Area Under Curve (AUC) indicator. Own default prediction model is created on the basis of logistic regression and utilizes all available data, thereby is referred to as dynamic (hazard) model. Moreover, the combination of the accuracy maximizing (error minimizing) regression algorithm and the variable choice based on maximum AUC ROC (score fusion minimizing) leads to the compromise model.*

Keywords: default, default prediction, default indicators, logistic regression, area under ROC

JEL codes: C53, G33

1 Introduction

The beginning of the exploring of firm default probability is connected with a univariate discriminant analysis represented by Beaver (1966) and Zmijewski model (1983).

The biggest expansion in the amount of models can be noticed using a multivariate discriminant analysis (MDA). It includes Z score (Altman, 1968, 1983, and Altman et al., 1995), Springate model (Sands et al., 1983), Fulmer model (1984), Beermann test (1976), CH index (Chrastinová, 1998), Taffler model (Taffler and Tisshaw, 1977 and Taffler, 1983), Bonity index (Kralicek, 1993), IN 95 (Neumaier and Neumaierová, 1995), IN 99 (Kotulič et al., 2010), IN 01 (Kotulič et al., 2010), IN 05 (Kotulič et al., 2010), Doucha analysis I and II (1995). Similar model building method is scoring represented by Tamari model (1978), Quick test (Kralicek, 1993) and A score (Argenti, 1976).

Logit and probit models are represented by O score (Ohlson, 1980) and Zmijewski model (1984). Hazard model is represented by Shumway model (1999). Moody´s RiskCalc for private companies has a specific model building method, thereby belongs to an individual category. Models based on solely market indicators are not considered in this paper.

2 Methodology and Data

Selected models (17) from those mentioned in the introduction were tested using the area under the curve Receiver Operating Characteristic (AUC ROC). Remaining models contain variables that are not available in used database. The higher the area under the curve is, the better the model performs in terms of score fusion minimizing.

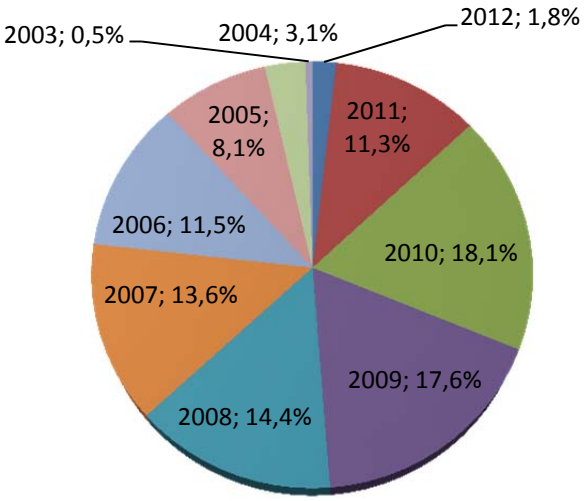
The next step was to choose variables for own model. First, basic indicators (Sivák and Mikócziová, 2009) were included, second, indicators from all models were considered. The indicators that contain the same combination of variables or summed with other variables to one were excluded as they contain no additional information. Likewise, the indicators including variables that are not available in the database were not used. The final number of indicators was 49.

All 49 chosen indicators were tested for AUC ROC. Three indicators with the highest AUC ROC were chosen for the logit model, except for Working Capital/Total Assets. This

variable displays multicollinearity with the variables in the final model causing the opposite sign of the coefficient, thereby it was excluded.

Data for assessing models and indicators as well as for estimating the model are from Albertina database by Bisnode company from 8/2013. Total amount of the vectors of variables is 311,931 within years 2003 to 2012. This includes 82,572 firms, not every year for every company is available in the database. The portion of balance sheets and profit and loss accounts in the individual years, is depicted in figure 1.

Figure 1 The Portion of Balance Sheets and Profit and Loss Accounts in the Individual Years



Source: author, Albertina database

Since all the data are utilized for estimating the model coefficients, the model is referred to as the dynamic or hazard model (Shumway, 1999), meaning that all available years for non-defaulted companies are used as well as for defaulted companies. Proof that this methodology provides more accurate and consistent results in comparison with previously used methodology utilizing data from a year of default for defaulted companies and omitting other years of such companies can be found in Shumway´s article (1999). Companies are considered as non-defaulted until total assets are lower than total liabilities. This approach is opposite to the one used in Ohlson (1980) and Zmijewski (1984), where only data from one year for every company are used. For defaulted companies, those from year before default, for those non-defaulted, those from a year randomly chosen from a certain interval.

Model Specification

The model consisting of three variables takes the following form:

$$y = \frac{1}{1 + e^{-(-1.614023 - 0.000603.X_1 + 0.076568.X_2 - 0.000002.X_3)}} \quad (1)$$

where:

X_1 = (Own Capital/Sales).365,

X_2 = Total Liabilities/Total Assets,

X_3 = Working Capital/Total Liabilities.

3 Results and Discussion

The positive coefficient sign is indicating a relationship implying the higher value of variable is, the higher probability of default and vice versa. The signs of the coefficients coincide with the AUCs ROC.

The number of cases included in the regression was 269,241 including 46,762 defaults. The presented model has the AUC ROC 0.996 (L^2) for the state variable equal to 1 (default) in the year of default (default detection). As the measure of accuracy, a likelihood ratio (LR) was chosen, the LR of the model is 15,434.311.

Table 1 Ten Indicators with the Highest AUC ROC

Indicator	AUC ROC	L/S[2]	Number of observations (positive/negative)
(Own Capital/Sales).365	0.999	S	46,918/226,110
Total Liabilities/Total Assets	0.983	L	55,008/253,838
Working Capital/Total Assets	0.884	S	54,880/254,684
Working Capital/Total Liabilities	0.877	S	55,446/241,561
Short-term Liabilities/Total Assets	0.874	L	54,864/254,619
Short-term Assets/Total Liabilities	0.867	S	55,411/241,558
Short-term Assets/Short-term Liabilities	0.848	S	54,937/238,718
EAT/Labour Cost	0.829	S	38,283/181,874
EBIAT/Paid Interest	0.820	S	24,459/121,646
Operating Profit/Paid Interest	0.816	S	24,457/121,646

[2]L – Larger values of the test result variable indicate stronger evidence for a positive actual state. S - Smaller values of the test result variable indicate stronger evidence for a positive actual state. The positive actual state is 1 (default).
Source: author

Table 2 Ten Indicators with the Lowest AUC ROC

Indicator	AUC ROC	L/S[2]	Number of observations (positive/negative)
(Total Assets/Sales).365	0.504	S	46,918/226,110
Depreciation & Amortization/(Long-term Assets(t) + Increase in period)	0.505	S	29,444/143,960
EAT/Added Value	0.51	S	51,772/240,905
Revenues/Total Assets	0.51	S	54,416/253,789
Stock/Cost of Sold Products	0.513	L	51,670/239,321
Bank Loans/Total Liabilities	0.515	S	55,201/241,136
(Long-term Assets/Sales).365	0.519	L	46,918/226,109
Net Sales/Accounts Receivable	0.523	S	48,983/224,169
Stock/Total Assets	0.525	L	54,648/252,942
(Accounts Receivable/Sales).365	0.53	S	46,918/226,110

Source: author

Since a logistic regression is designed to accuracy maximization (error minimization) (Cortes and Mohri, 2004) and the variables was chosen with respect to the AUC ROC maximization, the model is referred to as the compromise model. It compromises between accuracy maximization and score fusion minimization (AUC ROC maximization).

Nevertheless, the model AUC ROC overcame all tested comprehensive models. Their values of this statistics for the state variable equal to 1 (default) in the year of default (default detection) are displayed in table 3. This result was expected because the only one from the tested models was designed for Slovak companies and it was proposed for one sector of the economy.

Table 3 AUC ROC for the Tested Models

Indicator	AUC ROC	L/S[2]	Number of observations (positive/negative)
Zmijewski	0.967	L	54,303/237,528
Z score 1995	0.919	S	54,728/240,660
Quick	0.912	L	30,362/157,429
Taffler 1983	0.91	S	51,680/232,047
Ohlson	0.871	L	39,583/176,027
Springate	0.835	S	54,319/238,143
IN 01	0.823	S	24,229/120,068
IN 05	0.823	S	24,230/120,067
Z score 1983	0.819	S	54,726/240,658
Bonity index	0.796	S	30,492/157,616
CH index	0.788	S	35,008/168,406
IN 99	0.752	S	54,189/237,448
Taffler 1977	0.736	S	51,675/232,035
Doucha II	0.704	S	23,385/118,775
Fulmer	0.683	S	19,179/99,056
Beermann	0.556	L	24,545/133,616
Doucha I	0.524	S	39,895/184,823

Source: author

Testing the Model Score Fusion for Prediction Horizons

Lastly, the AUCs ROC of the presented model for different prediction horizons were computed. The state variable is equal to 1 (default) in one to five years before default occurred.

Table 4 AUC ROC for Different Prediction Horizons

Prediction Horizon	AUC ROC	L/S[2]	Number of observations (positive/negative)
1 year	0.906	L	34,542/164,966
2 years	0.85	L	22,785/115,826
3 years	0.811	L	14,783/79,393
4 years	0.787	L	8,884/51,122
5 years	0.77	L	4,813/30,300

Source: author

4 Conclusions

The estimated model approximates the relationship between financial ratios and the probability of default for Slovak companies. Due to utilizing data from all available years for defaulted and non-defaulted companies it is referred to as the dynamic (hazard) model. Proof that this methodology provides more accurate and consistent results in comparison with previously used methodology utilizing data from a year of default for defaulted companies and omitting other years of such companies can be found in Shumway´s article (1999). The model also compromises between accuracy maximization and score fusion minimization. In order to maximize just one criterion, AUC ROC (distinctive ability), special software would have to be used, e.g. Rank Boost, as standard statistical packages do not offer such option.

Nevertheless, a comparison with selected models (17) proved the best distinctive ability measured as the area under the curve ROC. For the prolonging prediction horizon, the model score fusion worsening is obvious.

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Rationality and Emotion in European Football: How Share Prices React to a New Coach's Appointment

Eric Frère[1], Martin Svoboda[2], Alexander Zureck[3]

[1] FOM University of Applied Sciences
Department of Finance at Faculty of Economics and Administration
Wolfsbachweg 66, 45133 Essen, Germany
E-mail: frere@frere-consult.de

[2] Masaryk University
Department of Finance at Faculty of Economics and Administration
Lipova 41a, 60200 Brno, Czech Republic
E-mail: svoboda@econ.muni.cz

[3] Masaryk University / FOM University of Applied Sciences
Department of Finance at Faculty of Economics and Administration
Breddestraße 40, 45894 Gelsenkirchen, Germany
E-mail: alexander.zureck@email.de

Abstract: *The appointment of a new coach is often a turning point for the development of a football club's game. But apart from the development of its game, the change affects the club's economic prospects as well. The coach has a position similar to that of a leading manager in "classic" firms. Other studies have intensively investigated reactions in share prices to results of specific games (see, instead of many, Ashton et al. 2011). The relationship between a change in a club's coach and the reaction of share prices has rarely been investigated. The aim of this paper is to find out whether there is a statistically significant influence on the share price performance of a listed European football club following a change in its coach. The findings within the paper demonstrate that the appointment of a new coach immediately affects the stock's performance. The analysis is based on the STOXX Europe Football Index. The index contains 23 European football clubs that are listed on a European stock exchange. The investigation stretches over a period of nine years, from 31.08.2004 to 19.09.2013. The sample contains 46 observations. The event study is on the basis of abnormal returns. The test period covers +/- 3 days around the time of announcement of a new coach. This precludes mistakes arising from other effects, such as results of games.*

Keywords: change in coach, event study, information efficiency, STOXX Europe Football Index

JEL codes: G02, G14

1 Introduction

Football: Is it just fun, or is it a business? The gap between the two is small. Football has a long tradition, especially in Europe. Every weekend, millions of fans of European football clubs watch their teams fight it out for points so as to get better positions in the domestic competition. In addition, during the week, some teams take part in the international competitions, UEFA Champions League and UEFA Europa League. The traditions of the game and the rivalry between fans promote the passion and fascination for football.

But apart from just the passion and fascination associated with it, the economic importance of football has grown in recent times. For example, the total revenue of the 20 clubs with the highest revenues reached EUR 5.4 billion in the past season 2012/2013. More than 30 clubs had revenues of more than EUR 100 million each. In the season 1996/1997, only Manchester United had revenue of more than EUR 100 million. (Battle et al., 2014, pp. 3–4)

At the moment, the general economic importance of football is discussed to a lesser extent in the literature. The aim of this paper is to investigate the economic effects of a change in a club's coach, measured by the reactions of the stocks of the members of the

STOXX Europe Football Index. A change in coach has significance for the approach of a club to the game (Audas, Dobson, & Goddard, 2002), and it is interesting to see whether there is an impact on the club's economic performance.

2 Literature Review and Hypothesis Development

The available literature on soccer provides several findings relating to the relationship between the developments of a football club as far as its approach to the game is concerned and its economic development. Relevant literature in this field of research focuses on game results.

In the literature, there is evidence from other kinds of sports as well. One of the first investigations was into the stock market reactions to international rugby results in New Zealand (Boyle & Walter, 2003). The authors found that game results of rugby matches had an insignificant influence.

The first study with positive findings regarding soccer game results covers all British clubs (Ashton, Gerrard, & Hudson, 2003). The authors use data from 1984 to 2002. There are some other studies, which confirm the findings (see, instead of many, the overview in Sarac & Zeren, 2013, pp. 303–304).

There are fewer studies dealing with subjects of investigation other than game results. If a study does deal with other subjects of investigation, these subjects are explanatory variables in a model (Stadtmann, 2003 or Samagaio, Couto, & Caiado, 2009).

In this paper, the subject of investigation is the change in the club's coach. In relation to the influence of a new coach on its game, the influence on the club's stock returns is interesting. A positive influence on the stock price signals, not only for football clubs but in other organizations, such as companies, as well, that some persons are very important for the company's development, and that the companies are dependent on these persons.

Audas et al., 2002 have shown the reaction in the club's game to a new coach. Now, the effects on a club's stock prices after a change in the coach are investigated. The central hypothesis of this paper is: A change in the club's coach influences the stock performance of a listed football club.

3 Data and Methodology

The database includes the stock prices of 20 European football clubs. All the clubs are members of the STOXX Europe Football Index. The index covers football clubs from Europe, Eastern Europe, and Turkey. (*STOXX Index Methodology Guide*, 2014, p. 88)

The investigation is based on daily stock returns. The returns are calculated with share price data from Bloomberg. All the information on new coaches was picked up from www.transfermarkt.de.

The daily stock returns for all clubs are calculated as $R_t = \ln(P_t) - \ln(P_{t-1})$. R_t is the return for day t, P_t and P_{t-1} are the closing prices on day t and day $t-1$. (Fama, Fisher, Jensen, & Roll, 1969)

The STOXX Europe Football Index is used in the study since it covers all the football clubs analyzed. Furthermore, it reflects the European football market's economic development. The estimated returns of the clubs are calculated with a market model (Brown & Warner, 1985). The model is defined as

$$R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_i, \quad (1)$$

where R_{mt} is the return of the market index on day t, and α_i and β_i are the estimated values for the given period. β_i reflects the sensitivity of the share price in relation to the market risk. Based on the estimated values α_i and β_i from (1), the expected return of i at day t is calculated as

$$E(R_{it}) = \alpha_i + \beta_i R_{mt}. \quad (2)$$

Abnormal returns are calculated as

$$AR_{it} = R_{it} - E(R_{it}). \quad (3)$$

The change in the coach is the relevant event in this paper. The event day is the day on which the particular football club officially announces the change on its website. All events have to fulfill the following criteria:

- The change occurred between August 31, 2004, and September 19, 2013,
- One member of STOXX Europe Football Index was involved in the change,
- There were end-of-day prices for the relevant share, and
- There was news of the change.

After preparing the final dataset, 46 relevant changes in coaches of 20 members of the STOXX Europe Football Index were found. All of them satisfy the criteria defined earlier.

The period of the investigation covers, at the most, three trading days before the event and three after the event [-3; 3]. For detailed information, the following periods are investigated as well: [-1; 1], [-1; 0], [0; 1], [0; 2], [0; 3]. In the literature reviewed, the estimation periods differ. For this paper, a short estimation period is used, so as to separate the effect of the appointment of a new coach from other overlapping effects e.g. game results. The comparable values from the estimation period are built up for the 27 trading days before the event: [-30; -4].

The event periods are calculated with accumulated abnormal returns as:

$$AAR_{it} = \sum_{i=1}^{n} AR_{it}. \quad (4)$$

The statistical significance of an event or an event period is tested under the null hypothesis. The null hypothesis that is to be tested is the abnormal return AR_{it} or the accumulated abnormal return AAR_{it} is equal to zero. (Boehmer, Masumeci, & Poulsen, 1991) This is an implication for the average effect of an event or an event period on returns to the shareholders of the football clubs analyzed.

The test statistic is the ratio of the analyzed abnormal return AR_{it} or the accumulated abnormal return AAR_{it} to their estimated standard deviation. The standard deviation is estimated from the other abnormal returns AR_{it} or the accumulated abnormal returns AAR_{it} in the observation period before the event. (Kolari & Pynnönen, 2010)

4 Results and Discussion

Table 1 provides an overview of the tested values. As far as the standard error is concerned, there is no strong relationship within the tested values. The values are an indicator for acceptable findings in the context of significance. The standard deviation indicates that there is at maximum of 0.010659759 deviations between all investigated means. These circumstances make a general statement much easier.

Table 1 One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
[-3]	46	0.002293873	0.0437329483	0.0064480715
[-2]	46	0.004619449	0.0453249677	0.0066828019
[-1]	46	0.005750625	0.0355838944	0.0052465590
[0]	46	0.000043789	0.0551771941	0.0081354334
[1]	46	-0.00132248	0.0393262429	0.0057983382
[2]	46	0.010626452	0.0377449079	0.0055651831
[3]	46	0.001311995	0.0309277064	0.0045600415

[-3; 3]	46	0.023323706	0.0946232479	0.0139514368
[-1; 1]	46	0.004471936	0.0834078465	0.0122978160
[-1; 0]	46	0.005794414	0.0690339296	0.0101784976
[0; 1]	46	-0.00127869	0.0739389344	0.0109017011
[0; 2]	46	0.009347764	0.0742786114	0.0109517838
[0; 3]	46	0.010659759	0.0726554588	0.0107124630

Note: Table 1 shows the results of the one-sample statistics. Column 1 includes the tested abnormal returns: firstly the daily specific ones from [-3] up to [3]. It is followed by the accumulated returns for the different periods. Furthermore, the table includes the amount of tested events, as well as the mean, standard deviation, and the standard error mean of the tested events.
Source: Own calculation

The following table includes the results obtained from testing the null hypothesis. The null hypothesis is tested with a two-tailed test. The chosen confidence interval of the difference is 99 per cent. The span for the mean difference stretches from -0.0013224781 in [1] up to 0.0106597590 in [-3; 0]. The gap between these values is small. It can be pointed out that no value tears out in case of an extreme.

With a level of significance of 0.996 at the event day and 0.907 for the period [0; 1], the most significant values are straight to the event. This draws attention to the hypothesis formulated. According to the findings, the hypothesis that has been formulated can be confirmed. It seems that there is a stock market reaction to a change in the coach. With an error probability of 1 per cent, the average abnormal return is, on the event day, between -0.021837151 and 0.021924729. Taking the period [0; 1] under consideration, the average abnormal return is between -0.030599741 and 0.028042363, with an error probability of 1 per cent.

Table 2 One-Sample Test

	Test Value = 0					
	t	**df**	**Sig. (2-tailed)**	**Mean Difference**	**99% Confidence Interval of the Difference**	
					Lower	**Upper**
[-3]	0.356	45	0.724	0.0022938727	-0.015048764	0.019636509
[-2]	0.691	45	0.493	0.0046194495	-0.013354514	0.022593413
[-1]	1.096	45	0.279	0.0057506248	-0.008360442	0.019861691
[0]	0.005	45	0.996	0.0000437893	-0.021837151	0.021924729
[1]	-0.228	45	0.821	-0.0013224781	-0.016917602	0.014272645
[2]	1.909	45	0.063	0.0106264523	-0.004341581	0.025594485
[3]	0.288	45	0.775	0.0013119954	-0.010952624	0.013576615
[-3; 3]	1.672	45	0.102	0.0233237059	-0.014199869	0.060847281
[-1; 1]	0.364	45	0.718	0.0044719360	-0.028604086	0.037547958
[-1; 0]	0.569	45	0.572	0.0057944141	-0.021581521	0.033170349
[0; 1]	-0.117	45	0.907	-0.0012786888	-0.030599741	0.028042363
[0; 2]	0.854	45	0.398	0.0093477636	-0.020107990	0.038803517
[0; 3]	0.995	45	0.325	0.0106597590	-0.018152321	0.039471839

Note: Table 2 represents the results of the one-sample test for the null hypothesis. The separation is similar to table 1. It also includes the t-value, degrees of freedom, significance of two-tailed test, mean difference, and the 99% confidence interval of the difference.
Source: Own calculation

If we do not concentrate just on the event day and the days after an event, the levels of significance from the periods [-1; 1] with 0.718 and [-1; 0] with 0.572 indicate that uncertified information about a new coach does influence the share price of a listed football club.

To summarize, the findings indicate that the change in the club's coach is important for the development of its game and for the economic prospects of the football club. It seems that shareholders link greater sporting success to a new coach. Greater sporting success implies more future earnings. In this context, the German football club Borussia Dortmund is a good example. After winning two national championships, the share price rose more than 100 per cent. The stock reacted immediately to the appointment of a new coach, on the date of the official announcement and one day after it.

These findings confirm the hypothesis that a coach is important not just for the development of a club's game. He is also important for a club's financial prospects, as measured by its stock performance.

5 Conclusion

All in all, these findings confirm previous findings that the development of stock returns is connected to the sporting success of a football club. Apart from game results, these findings show that persons who are engaged by a club are important for the club's economic development.

The coach of a team is often the most important person in a football club. Apart from short-term decisions necessitated by the strategy for the next match, he is also responsible for long-term decisions, as when new players are engaged. The big leeway in making decisions shows how important it is for the clubs' leaders to choose the right coach. Their decision in favor of one or against another candidate is a decision, which is crucial for the club's future, for its sporting success as well as for its financial prospects.

In comparison to other businesses, the football business is rather turbulent. Similar to other findings, these findings confirm that the change in coach impacts organizational adaptation. (Tushman & Rosenkopf, 1996)

Apart from the fact that the findings are relevant for the football sector, the findings are important in general terms as well. There are individuals in all companies who are comparable to coaches in football clubs. These persons can be managers, but also experts in specific fields of knowledge. It would be interesting to see whether there is a stock reaction when such people switch companies.

In the final analysis, a new coach is important for an investment in the stock of a football club. Moreover, the coach has an important position in the club's organizational structure. His decision-making exercises long-term influence on the club's successes on the field as well as its economic prospects.

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Satisfaction of the Czech Bank Customers

Lenka Gabčová[1], Valér Demjan[2], Anna Chocholáková[3], Maroš Mikuš[4]

[1, 3, 4] Tomas Bata University
Faculty of Management and Economics, Department of Enterprise Economics
Mostní 5139, 760 01 Zlín, Czech Republic
E-mail: l.gabcova@gmail.com, anna@ivent.cz, mikus.maros@gmail.com

[2] The Banking Institute of Praque
College of Banking, Department of Banking
Cesta na štadion 7, 974 01 Banská Bystrica, Slovak republic
E-mail: valer@valer.sk

Abstract: *The aim of the article was to quantify and compare the overall level of satisfaction of the Czech banking customers, the most important factors of satisfaction and dissatisfaction of these customers and number of used banking products and banks in 2014 compared to 2012. Research on the satisfaction of retail customers in the Czech Republic was conducted through a questionnaire survey in 2012 on a sample of 323 respondents, and in 2014 on a sample of 292 survey participants. The research results are evaluated through Pearson statistics. Our research confirmed that the Czech Republic remains on a relatively low position with satisfying its bank customers with provided services. The main reason for satisfaction was the ability to use electronic banking and most important reason for dissatisfaction were high priced products and services. Number of banking products used by the Czech banking clients did not change significantly.*

Keywords: commercial bank, bank customer's satisfaction, satisfaction factors, factors of dissatisfaction, Cross-selling index

JEL codes: G21

1 Introduction

Customer satisfaction is an important factor in the performance and competitiveness of banks. When analyzing the attributes of the banking client satisfaction, it is appropriate to be based on the specific characteristics of commercial banking (Horvátová, 2013, Chovancová, and Arendas, 2013, Cipovová, and Belás, 2012, Belás, Cipovová, Novák, and Polách, 2012, Belás, and Polách, 2011, Horvátová, 2008, Belás, 2004), which significantly affect business processes and shape attributes of bank customer satisfaction.

Banking experience proves that achieving a reasonable rate of customer satisfaction represents a challenge for the bank and it is a permanent process with varied results. Bank customers in many countries show a considerable degree of dissatisfaction and many banks admit that it's necessary to increase the level of customer care.

In this article satisfaction of the Czech bank customers with the services of commercial banks was examined, as well as the most important factors of satisfaction, respectively customer dissatisfaction and use of banking products and banks in 2014 compared to 2012.

2 Important Factors Determining Bank Customer Satisfaction

Customer satisfaction is a complex of various aspects, which operate in a coherent manner and form attitudes of customers to the bank. In the process of forming of customer satisfaction acting the economic factors, emotional attitudes and habits of consumers. Customers' satisfaction determines their loyalty to the bank and willingness to buy the bank's products.

According to Chavan and Ahmad (2013) bank business increasingly depends on the quality of the customer service provided and overall satisfaction of the customer.

Relationship marketing has become the most critical aspect to corporate banking success.

Maddern, Maull, and Smart (2007) state, that the key elements in building customer satisfaction are employee satisfaction and service quality. In this context Gounaris and Boukis (2014) indicate, that the employee job satisfaction influences a customer´s perception of quality and customer satisfaction. Many authors agree that it is the banks skilled workers with high emotional quotient are the prerequisite for building loyalty among clients. (Rostamy, 2009; Bidmead, 2007) Customers in business relationships require a high degree of acceptance of their own needs from staff and accurate service delivery. (Lages and Piercy, 2012)

According to Baumann, Elliott and Burton (2012) a combination of two factors, namely emotional connection with the bank and economic benefits should protect the bank against competition. In this context Wruuck (2013) submits, that the prices play a central role for customer satisfaction and profitability. Satisfaction with products prices does not automatically mean total and complete satisfaction, but it is one of the most important preconditions. On the other hand Chen, Liu, Sheu and Yang (2012) argue that people rarely try to get the best services; instead they seek only for a fair services and a consistent treatment. In their presented study, the significant direct correlation between a customer satisfaction and the fair approach has been proved.

According to Mandahachitara and Poolthang (2011) customer's loyalty is very important, because getting new customers also brings additional costs and vice versa with the duration of customer relationship profitability of this relationship grows as well. Effective tool for building true loyalty can be e.g. friendly approach to clients, availability of banking products and services, intensive communication and activities in the field of Corporate social responsibility.

On the contrary, Frearing and Minor (2013) in their study indicate, that in the relationship with the customer there are phenomena that extend beyond loyalty. The most outstanding is the effort to remain faithful. Despite the fact that the customer exposed to daily offers from competition develops a conscious effort to remain as there is a complete trust to the product from the client's side. The second phenomenon is the social ties obtained during use or consumption of the product. (although this second factor was not confirmed as a follow-up research on the concept of satisfaction-loyalty). The conclusion of this study is also surprising finding that high levels of satisfaction and loyalty is not only associated with longtime customers. The highest levels of these factors were declared by respondents in the early years of the relationship, means after one year of contract. This also means that financial institutions may induce high levels of customer satisfaction, loyalty and effort to remain with them for over more timely stages of mutual relationship.

The hot topic is the analysis of the satisfaction of banks' customers in context of online banking. According to Liébana-Cabanillas, Munoz-Leiva and Rejón-Guardia (2013) electronic banking has become an essential service to secure clients' loyalty by ensuring greater customer satisfaction and building stronger ties with them. Yang, Lu and Chau (2013) report, that online channel service quality enhances service quality in the offline channel. In this context Genser, Leeflang and Skiera (2012) indicate that online use improves customer profitability by increasing customer revenue and decreasing cost to serve. Authors found out that online customers conduct 2.50 more transactions per month than do their offline counterparts and their customer profitability improves by 0.28 EUR per month.

3 Objectives, Methodology and Data

The aim of this article was to quantify and compare the overall level of satisfaction of the Czech banking customers, the most important factors of satisfaction and dissatisfaction of these customers and number of used banking products and banks in 2014 compared to 2012.

Research on the satisfaction of retail customers in the Czech Republic was conducted through a questionnaire survey in 2012 and then in 2014.

In our research, five scientific hypotheses were set. When establishing quantitative criteria estimation techniques were used.

H1: The overall level of satisfaction of bank customers in the Czech Republic in 2014 compared to 2012 has not changed and is now less than 65%.

H2: Czech clients are the mostly satisfied with the availability of banking products and services through electronic banking. Electronic banking is still the most important factor of satisfaction for Czech customers. More than 60% of Czech clients are satisfied with this factor.

H3: The most important factor of dissatisfaction of the Czech customers are high priced banking products and services. The rate of dissatisfaction of Czech clients in regards to prices is higher than 50%.

H4: The average value of CSI has increased by at least 10% in the last two years.

H5: Average number of banks being used by clients in the Czech Republic increased by at least 10% in the last two years.

Within the questionnaire survey in 2012, in the Czech Republic a total of 323 respondents was approached, of which 37% were men and 63% were women. Age structure of respondents was as follows: 32% were aged less than 30 years, 50% of them were 30-50 years old and 18% were over 50. The education level of respondents was as follows: 1% had primary education only, 62% had secondary education and 37% were university educated bank customers.

In 2014, there were received responses from 292 respondents, of which 43% were men and 57% were women. The age structure of those respondents was as follows: 38% of respondents were aged under 30 years, 43% were aged from 31 to 50 years and 19% of them were customers over 50. The education level of respondents was as follows: 3% had primary education, 52% had secondary education and 45% were university educated bank customers.

Established scientific assumptions in each table were examined through Pearson statistics. P-value less than 5% leads to the rejection of the null hypothesis. Part of the quantitative analysis is the use of indicators and descriptive statistics such as weighted arithmetical average and the percentage figures.

4 Results and Discussion

Table 1 presented the results of overall satisfaction of the Czech bank customers in 2014 compared to 2012.

The proportion of respondents satisfied with banking services can be considered to be the same as it was in 2012 (p-value=0.3157). However, the structure of the responses differs, because there was a shift of dissatisfied customers to a group of „do not know". On the basis of proportional test it cannot be claimed (p-value=0.6751), that this figure is less than 65%.

Table 1 Overall satisfaction of bank customers in the Czech Republic (CR)

Are you satisfied with bank products and services provided to you?	**CR 2012 in %**	**CR 2014 in %**	**p-value**
1. Yes	62.23	66.44	0.3157
2. No	26.32	15.07	<0.01
3. I don't know	11.45	18.49	0.0192
$\chi 2=14.8059$			
p-value<*0.01*			

Source: authors' survey

According to the results of our research, the overall satisfaction rate of the Czech customers is at the European average level. These results are comparable with some of the published results of the satisfaction of bank customers. For example, in the United Kingdom in 2012 the average satisfaction level of bank customers was 62%. (www.dailymail.co.uk). According to the results of research conducted by Deloitte (2012, b) in the Czech Republic, Poland and Slovakia the overall satisfaction rate is 50% and more. The overall satisfaction rate of bank customers in Slovakia in 2012 was at 61%. One reason for the relatively low satisfaction of bank customers in the Czech Republic is also a way of managing the retail staff. Managers of private banks put intense pressure on front office employees, which gets translated into an incorrect approach to clients (Belás, 2012) and the level of moral attitudes of bank employees in the sales process is relatively low (Belás, Burianová, Cipovová, and Červenka, 2013).

In Table 2 are compared the reasons for satisfaction of the Czech banking customers in 2014 compared to 2012

Table 2 Reasons for customer satisfaction in the banking sector of the Czech Republic

What satisfies you the most in the bank? (you can provide up to 3 answers)	**CR 2012 in %**	**CR 2014 in %**	**p-value**
1. quick service in the branch	13.93	11.64	0.4670
2. the possibility of using electronic banking	74.61	77.74	0.4161
3. quality products and services	17.65	17.81	1.0000
4. convenient and friendly service in a branch	17.09	23.29	0.0620
5. availability of the branch	49.54	52.40	0.5299
6. developed network of ATMs	40.25	44.18	0.3660
7. other (account for free)	0	5.14	-

Source: authors' survey

The most significant factors of customer satisfaction in our study were the availability of banking products and services through electronic banking, branch availability and extensive network of ATMs.

Electronic banking is still the most important factor of satisfaction for Czech clients. Level of satisfaction of Czech bank customers was not significantly altered (p-value=0.4161). More than 60% of Czech customers are satisfied with this factor, what was confirmed by the value of the test criteria (p-value<0.01).

According to research conducted by Ernst & Young (2012) 78% of banks' clients in the Czech Republic control their bank accounts by using the internet. This survey indicates that despite the relatively high popularity of electronic banking more than one third of clients keeps giving priority to their personal visit to a branch, which was confirmed in our study, where only 52,40% of respondents in the Czech Republic said they were most

satisfied with the availability of the branch. For comparing it could be stated, that in Slovakia this option was mentioned by 67% of respondents back in 2012. (Belás, Burianová, Cipovová, and Červenka, 2013)

According to Liébana-Cabanillas, Munoz-Leiva and Rejón-Guardia (2013) user satisfaction levels with online banking have increased in recent years, reaching more than 80%. Authors also indicate, that online banking also was favored over other channels that customer have at their disposal (55% selected the online channel as one that satisfied them the most, while 28% chose branches, 13% chose ATMs, and only 2% chose call center and mobile banking as the channel that satisfied them most.

In Table 3 are compared the reasons for dissatisfaction of banking customers in the Czech Republic in 2014 compared to those from the year 2012.

Structure responses in 2014 did not differ from responses in 2012. Most important factor of discontent of Czech clients are still high prices of banking products and services. The proportion of respondents who stated the discontent of high prices for banking products

and services is higher than 50%, as it was truly confirmed by the value of the test criteria (p-value=0.01)

Table 3 Reasons for dissatisfaction of bank customers in the Czech Republic

What dissatisfies you the most in the bank? (you can provide up to 3 answers)	**CR 2012 in %**	**CR 2014 in %**	**p-value**
1. slow service in a branch	22.60	20.21	0.5326
2. poor quality of electronic banking	1.86	4.11	0.1517
3. high price of products and services	65.33	66.78	0.7677
4. poor accessibility of branch	9.60	5.38	0.0770
5. impersonal approach	13.62	14.73	0.7823
6. low acceptance of my needs	13.31	18.15	0.1237
7. other (arrogance of personnel, misuse of financial illiteracy of clients)	0	16.78	*<0.01*

Source: authors' survey

For comparison, it could be mentioned, that in Slovakia in 2012 this ground of dissatisfaction was reported by 63% of respondents. (Belás, Burianová, Cipovová, Červenka, 2013)

According to research by Ernst & Young (2012) a definite number one impulse for change of bank is the amount of bank charges. 69% of the Czech bank clients would change their main operational bank because of high costs (compared to a European average of 53%). Along with that bank clients in the Czech Republic and Slovakia consider many bank fees as absurd. For example in 2013 about 40,000 bank customers from the Czech Republic and Slovakia provided information, that the most ridiculous bank charges were account management fee to the mortgage or consumer loan. Previously customers identified the following fees as absurd: fee for early repayment of loan, fee for cash withdrawal and deposit into their own bank account, fee for excessive deposit, and fee for money withdrawal from bank's owned ATMs and charge for incoming payments. (http://www.bankovnipoplatky.com).

In Table 4 indicated the number of used banking products in the Czech Republic in 2012 and 2014.

Data structure in Table 4 does not provide evidence that would change the number of products used for the past two years. It also confirmed our hypothesis that the average value of CSI has increased by at least 10% in the last two years.

The average value of CSI as per our data is relatively low, indicating that banks in the Czech Republic have quite interesting sales opportunities.

Table 4 Number of banking products being used

How many banking products (current account, consumer credit, mortgage etc.) you are currently using?	**1 product**	**2 products**	**3 products**	**4 products and more**
Number of respondents in 2012 in %	26.00	35.91	23.22	14.86
Number of respondents in 2014 in %	27.74	38.36	20.21	13.69
p-value	0.6940	0.5873	0.4200	0.7670
$\chi 2$=0.1546				
The average value of CSI*2012=2.27 CSI*2014=2.20				

Note: * CSI (Cross Selling Index – number of products/1 bank client)

Source: authors' survey

In Table 5 indicated the number of banks being used in the Czech Republic in 2012 and 2014.

Table 5 Number of banks used in the Czech Republic

Indicate the number of banks whose products and services you use.	**CR 2012 in %**	**CR 2014 in %**	**p-value**
1 bank	48.30	55.48	0.0839
2 banks	36.53	33.22	0.4392
3 and more banks	15.17	11.30	0.1968
$\chi 2$=3.7332/p-value=0.1546			
NBI2012=1.67/NBI2014=1.56			

Source: authors' survey

Structure of responses is not significantly different in the year 2014 compared to answers back in 2012 (p-value=0.1546). The largest growth was registered for the answer of using of one bank. This change is not significant (p-value=0.0839), however indicates that to our research in 2014 have joined relatively more respondents who indicated that they utilize services of only one bank.

5 Conclusion

The results of our research confirm the partial validity of the Hypothesis 1. The overall level of satisfaction of bank customers in the Czech Republic in 2014 in comparison to 2012 did not change. However, we did not find evidence that it is less than 65%.

Our research has confirmed the validity of Hypothesis 2. Electronic banking is the most important factor of satisfaction for the Czech customers. More than 60% of the Czech banking customers are satisfied with this factor.

The most important factor of dissatisfaction of the Czech clients are still high prices of banking products and services. The proportion of respondents who provided the answer of dissatisfaction with high prices of products and services is higher than 50%. The research thus confirmed the validity of Hypothesis 3.

Surprising finding was that the CSI value has decreased, thereby Hypothesis 4 was rejected. Average number of banks being used by clients has slightly fallen, as a result of this, the Hypothesis 5 had to be rejected as well.

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Applying *P*-splines for Mortality Rates in the Czech Republic

Ján Gogola

University of Pardubice
Faculty of Economics and Administration
Institute of Mathematics and Quantitative Methods
Studentská 84, 532 10 Pardubice, Czech Republic
E-mail: jan.gogola@upce.cz

Abstract: *Many important classes of liability in life insurance business are sensitive to the direction of future mortality trends. Therefore the prediction of future mortality rates is an issue of fundamental importance for insurance companies. The Lee-Carter model became one of the most applied models and it is used in different countries around the world to forecast age-specific death rates. The main goal of this paper is to apply the method of P-splines to the smoothing and forecasting of two-dimensional mortality tables for the population in the Czech Republic. We use data on males deaths and exposures for the Czech Republic from the Human Mortality Database. We write the code associated with model in R. Many models of mortality can be fitted simply and flexibly with standard statistical software. However, for actuaries the fitting of a model is usually only the first step and the main purpose is the forecasting of mortality. Forecasting is part of the R-package as well. Probability statements derived from the use of a single model and parameter set should be treated with caution. Particularly, we show that the forecasting of the future mortality of the very old (over 80) is less accurate since data can be poor at such ages. Hence, there is a need for awareness of model risk when assessing longevity-related liabilities.*

Keywords: mortality, forecasting, R language, smoothing, P-splines

JEL Classifications: C22, J11

1 Introduction

The mortality of the population in developed countries has improved rapidly over the last thirty years and this has important financial implications for the insurance industry, since several important classes of liability are sensitive to the direction of future mortality trends.

We apply the method of *P*-splines to the smoothing and forecasting of two-dimensional mortality tables. We illustrate the method with the Czech Republic mortality data.

This paper follows on article Jindrová, Slavíček (2012). They deal with the development and the prediction of life expectancy in selected European countries (Czech Republic, Slovakia, Finland, Spain) by applying Lee-Carter model. Through the article Jindrová, Slavíček (2012) we come to the Currie´s paper (2013) which considering about smoothing in generalized linear model (GLM) with an application to the Lee-Carter model.

Eilers and Marx (1996) used *P*-splines to smooth one dimensional count data with Poisson errors. Durban, Currie and Eilers (2004) have extended this method to two dimensions.

Eilers and Marx (1996) introduced *P*-splines as a method of smoothing in generalized linear models (GLMs). The method has two main ideas:

a) Use *B*-splines as the basis for the regression,

b) Modify the log-likelihood by a difference penalty on the regression coefficients.

We use data on male deaths and exposures from the Human Mortality Database (www.mortality.org). The data are available by country for (a) single ages from age 0 to age 110+, and (b) single years. The periods for which data are available vary by country.

We consider the restricted age range 60 to 90, the range of greatest interest to providers of pensions and annuities.

Let calendar year *t* run from exact time *t* to exact time *t*+1 and let $d_{x,t}$ be the number of deaths aged *x* last birthday in calendar year *t*. We suppose that the data on deaths are arranged in a matrix $\boldsymbol{D} = \left(d_{x,t}\right)$. In a similar way, the data on exposure are arranged in a matrix $\boldsymbol{E} = \left(e_{x,t}\right)$ where $e_{x,t}$ is a measure of the average population size aged *x* last birthday in calendar year *t*, the so-called central exposed to risk. We suppose that $\left(d_{x,t}\right)$ and $\left(e_{x,t}\right)$ are each $n_a \times n_y$ so that we have n_a ages and n_y years (in our case n_a = 31 and n_y = 26).

Let $N = n_a \cdot n_y$ be the number of observations.

We arrange the matrix of deaths by column order into a vector $\vec{d}$ (this corresponds to how **R** stores a matrix) of length $N = n_a \cdot n_y$. Similarly we arrange the matrix of exposures $\boldsymbol{E} = \left(e_{x,t}\right)$ into vector $\vec{e}$.

We denote the *force of mortality* (or *hazard rate*) at exact time *t* for lives with exact age *x* by $\mu_{x,t}$. The force of mortality can be thought as an instantaneous death rate the probability that a life subject to a force of mortality $\mu_{x,t}$ dies in the interval of time $(t, t + \mathrm{d}t)$ is approximately $\mu_{x,t} \cdot \mathrm{d}t$ where $\mathrm{d}t$ is small.

The force of mortality $\mu_{x,t}$ for human populations varies slowly in both *x* and *t* and a standard assumption is that $\mu_{x,t}$ is constant over each year of age, i.e., from exact age *x* to exact age *x*+1, and over each calendar year, i.e., from exact time *t* to exact time *t*+1. Thus,

$$\mu_{x+u,t+v} = \mu_{x,t} \text{ for } 0 \le u < 1, 0 \le v < 1, \tag{1}$$

and so $\mu_{x,t}$ approximate the mid-year force of mortality $\mu_{x+0,5,t+0,5}$.

We suppose that $d_{x,t}$ is a realization of a Poisson variable $D_{x,t}$:

$$D_{x,t} \sim P\left(e_{x,t} \cdot \mu_{x,t}\right), \tag{2}$$

The expected values are the product of exposures $e_{x,t}$ and the force of mortality $\mu_{x,t}$.

Assumption (2) leads us to the estimates of $\mu_{x,t}$ as

$$\widehat{\mu}_{x,t} = \frac{d_{x,t}}{e_{x,t}}. \tag{3}$$

Gompertz (1823) observed that the force of mortality is approximately linear in age (on log scale) over most of adult life. Actuaries are familiar with the Gompertz law in the form $\mu_x = e^{\theta_0 + \theta_1 \cdot x}$.

We express the Gompertz model over the entire mortality table in the language of GLMs as follows:

$$D_{x,t} \sim P\left(e_{x,t} \cdot \mu_{x,t}\right); \; x = 1,2,\ldots,n_a, \; t = 1,2,\ldots,n_y, \tag{4}$$

$$\eta_{x,t} = \log E\left(D_{x,t}\right) = \log e_{x,t} + \log \mu_{x,t} = \log e_{x,t} + \theta_0 + \theta_1 \cdot x. \tag{5}$$

We can write (5) in matrix/vector form:

$$\boldsymbol{\eta} = \log \vec{e} + \boldsymbol{X} \cdot \boldsymbol{\theta}\,, \quad \boldsymbol{X} = \mathbf{1}_{n_y} \otimes [\mathbf{1}_{n_a} : \vec{x}]\,,$$

with $\mathbf{1}_n$ a vector of 1's of length *n*, $\vec{x}$ a vector of ages and $\boldsymbol{\theta} = (\theta_0, \theta_1)'$.

Here $\mathbf{A} \otimes \mathbf{B}$ denotes the tensor or Kronecker product of $\mathbf{A}$ and $\mathbf{B}$.

We have defined a GLM with *linear predictor* $\boldsymbol{\eta} = \log \vec{e} + \boldsymbol{X} \cdot \boldsymbol{\theta}$, log *link* and Poisson error, the term $\log \vec{e}$ is an *offset* in the model.

We refer to $\boldsymbol{X}$ as the model matrix. The model matrix captures the linear structure of the Gompertz law, and more generally a GLM is defined by its model matrix, its link function and error distribution.

We use *P*-spline model to predict force of mortality for years 1997-2011 using data from 1971-1996. The comparison between the observed values for 1997-2011 and our predicted values provides a good test of our method.

Model fitting was done in **R** (R Development Core Team, 2009), which was used for all graphs, as well. Particularly, we are focusing on **R** package for smoothing Poisson counts from Camarda (2012). The function Mort2Dsmooth in the **R**-package MortalitySmooth gives simple fitting of the two dimensional *P*-spline model.

2 One Dimensional Smoothing

For the benefit of readers unfamiliar with smoothing using *P*-splines we present a short introduction to the method. *B*-splines are bell-shaped curves composed of smoothly joined polynomial pieces of degree *q*. The points on the horizontal axis at which the pieces merge together are called *knots*. We will use equally spaced knots. To illustrate smoothing with penalized *B*-splines we are considering some data on male lives at age 60 for years 1966-2011.
The model is:

$$D_t \sim P(e_t \cdot \mu_t)\,; \quad t = 1,2,\ldots,n_y\,, \tag{6}$$

$$\log \mu_t = \sum_{k=1}^{K} B_k(t) \cdot \theta_k\,, \tag{7}$$

(where $x = 60$ has been omitted for ease of presentation).
We can write (7) in matrix/vector form: $\log \boldsymbol{\mu} = \boldsymbol{B} \cdot \boldsymbol{\theta}$, with regression matrix $\boldsymbol{B}$.

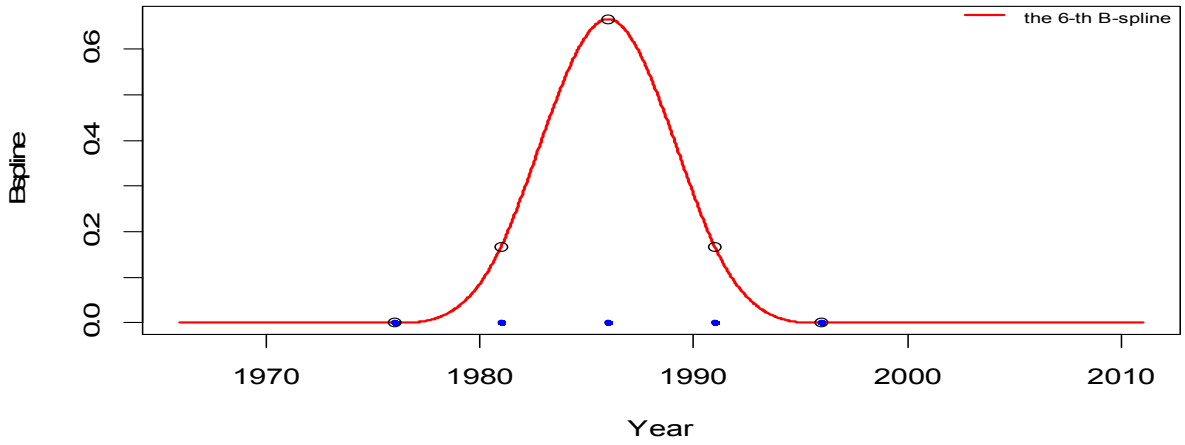
This is a regression type model with the set of *B*-splines $\{B_1(t), B_2(t), \ldots, B_K(t)\}$ providing the regression basis. The regression coefficients are denoted by $\theta_1, \theta_2, \ldots, \theta_K$.

The Figure 1 shows a single cubic *B*-spline. A cubic *B*-spline consists of cubic polynomial pieces bolted together at points known as knots. (Polynomial regression uses polynomials as the basis for regression, but there is no reason why other functions cannot be used.)

In our case the knots are equally spaced in time at 1976, 1981, 1986, 1991, 1996 and the *B*-spline is zero elsewhere. We have chosen knot spacing 5 years.

The *B*-spline pieces are continuous, and have continuous first and second derivatives at the join points, shown "○" in the Figure 1.

Figure 1 A single cubic *B*-spline, $B_6(t)$, with knot positions • and smooth joint ○ .



Source: Own processing

The Figure 2 shows a basis of *B*-splines with *K*=12. The number of *B*-splines basis is the sum of the number of internal intervals and the polynomial degree, *K*=9+3, since with 45 years (1966-2011) we have 9 intervals (10 knots).

This model can be fitted with statistical software **R** since the Poisson distribution together with the linear structure of $\log \mu_t$ defines a generalised linear model. The regression coefficients θ_k are chosen by maximum likelihood.

In Figure 3 we can see the result of fitting the regression with a basis of *K*=12 *B*-splines (dashed line). Each regression coefficient θ_k can be associated with its corresponding basis function. In Figure 3 the estimated values $\hat{\theta}_k$ are plotted ▲ at the maximum value of $B_k(t)$.

In the view of Figure 2 we can interpret the coefficients θ_k as pseudo-observations. Fitted values at year *t* are weighted averages of these pseudo-observations where the weights are equal to the values of the non-zero *B*-splines at year *t*.

Figure 2 A basis of *K*=12 cubic *B*-splines with knot positions

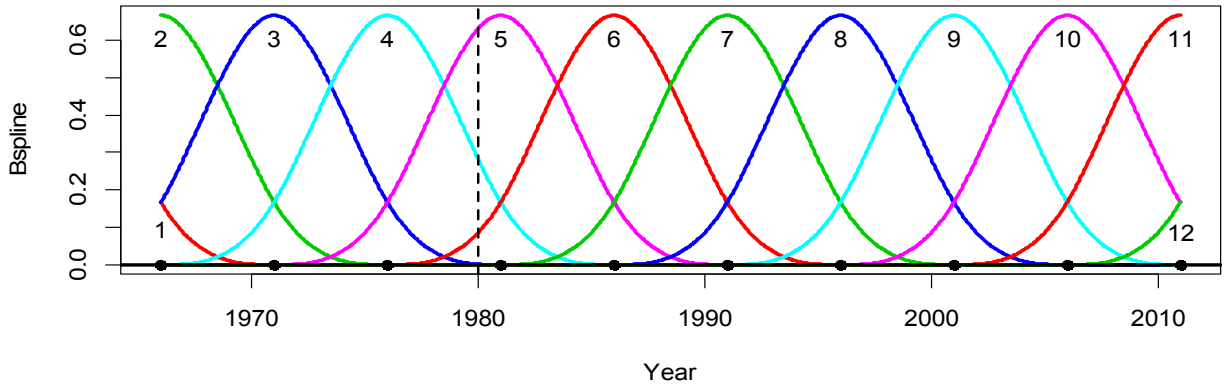


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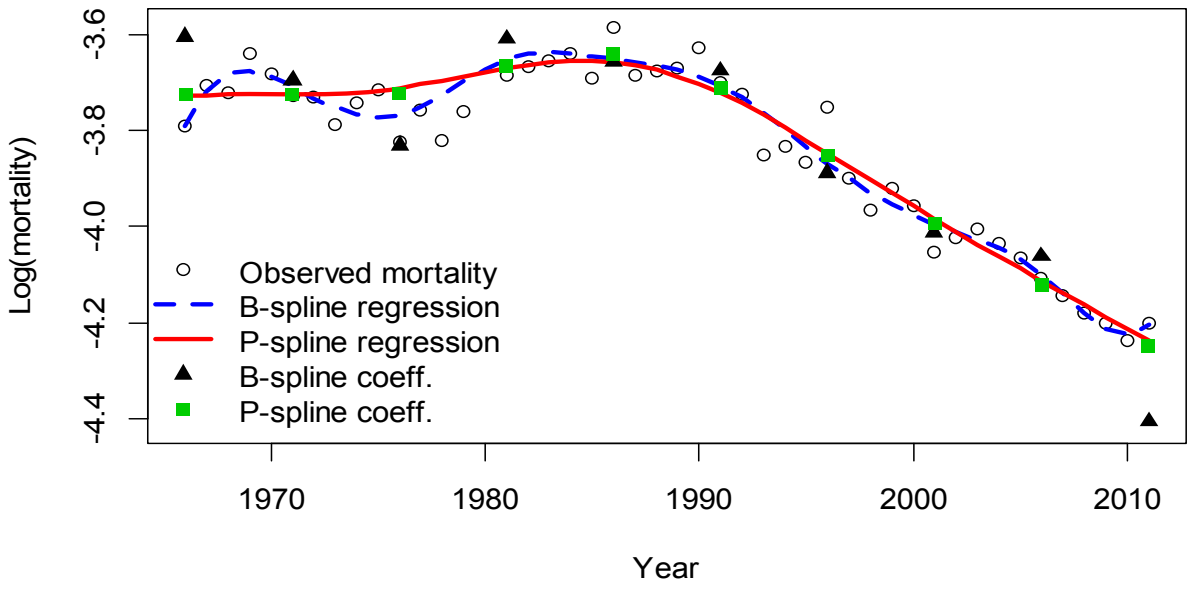
Figure 3 Log mortality for males aged 60 together with fitted regressions and associated coefficients



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For example with the basis in Figure 2 the estimated value of $\log \mu_{1980}$ is:

$$0.001333 \cdot \hat{\theta}_3 + 0.282667 \cdot \hat{\theta}_4 + 0.630667 \cdot \hat{\theta}_5 + 0.085333 \cdot \hat{\theta}_6 , \tag{8}$$

where these weights are given by the intersection of the dashed vertical line in Figure 2. with *B*-splines $B_3(t)$, $B_4(t)$, $B_5(t)$, $B_6(t)$.

We can see that at most four of the weights are non-zero at any year. Notice that the weights in (8) sum to unity.

The *B*-spline weights more across the years from 1966 to 2011 is much the same way as the weights in moving-average.

Eilers and Marx (1996) proposed to place a penalty on differences between nearby coefficients, as in:

$$P(\boldsymbol{\theta}) = (\theta_1 - 2 \cdot \theta_2 + \theta_3)^2 + (\theta_2 - 2 \cdot \theta_3 + \theta_4)^2 + \ldots + (\theta_{K-2} - 2 \cdot \theta_{K-1} + \theta_K)^2 \tag{9}$$

This defines a quadratic penalty (or second-order penalty) function.

The penalty function is incorporated into the log-likelihood function, $L(\boldsymbol{\theta}; \vec{d})$, to give the penalized log-likelihood function $L_P(\boldsymbol{\theta}; \vec{d})$:

$$L_P(\boldsymbol{\theta}; \vec{d}) = L(\boldsymbol{\theta}; \vec{d}) - \frac{1}{2} \cdot \lambda \cdot P(\boldsymbol{\theta}) . \tag{10}$$

This method is known as penalized *B*-spline regression or *P*-spline.

The parameter λ is the tuning constant (or smoothing parameter), the larger the value of λ the stronger the smoothing.

The user of *P*-spline can choose:

- the number of internal intervals *ndx*,
- the degree of the *B*-spline *B.deg*,
- the order of the penalty *P.ord* and,

- the smoothing parameter λ.

Eilers and Marx (1996) and Currie and Durban (2002) discuss the choice of the *P*-spline parameters and propose the following rule: with equally spaced data use one knot for every five observations to guide the choice of the number of knots parameter, *ndx*, (strictly *ndx*-1 is the number of internal knots in the domain), use cubic splines (*B.deg*=3) and a quadratic penalty (*P.ord*=2).

For a given value of λ, the regression coefficients are chosen by maximizing $L_P(\boldsymbol{\theta};\vec{d})$.

Fitting is now a balance between the goodness of fit and the roughness of the fitted curve, i.e. a balance between maximizing the log-likelihood and maximizing the smoothness.

One possibility how choose the value of λ is optimizing some model selection criterion.

We will minimize the *Bayesian Information Criterion* (*BIC*):

$$BIC = Dev + ED \cdot \log N \,, \tag{11}$$

where *Dev* and *ED* are the deviance and the effective dimension of the fitted model, respectively, and *N* is the number of observations.

For Poisson counts the deviance (see McCullagh, Nelder, 1989) is:

$$Dev = 2 \cdot \sum \left[d \cdot \log \frac{d}{\hat{d}} - (d - \hat{d}) \right], \tag{12}$$

where $\hat{d}$ is the fitted death (at age *x* and year *t*).

In Figure 3 we can see the result of smoothing with *K*=12 cubic *B*-splines with a quadratic penalty (solid line). The tuning was chosen with *BIC* (λ= 10).

The coefficients, plotted ■ in Figure 3., have been ironed out, and the resulting fitted curve has a pleasing smoothness to it.

3 Two Dimensional Smoothing

The method of *P*-splines can be extended to cover the two dimensional case as follows.

First we construct a pair of one-dimensional cubic *B*-spline basis, one for age, $\boldsymbol{B}^a = \left\{B_1^a(x), B_2^a(x), \ldots, B_L^a(x)\right\}$ and one for year, $\boldsymbol{B}^y = \left\{B_1^y(t), B_2^y(t), \ldots, B_K^y(t)\right\}$.

Then corresponding to Equation (6), (7), our model is:

$$D_{x,t} \sim P\left(e_{x,t} \cdot \mu_{x,t}\right);\ x = 1,2,\ldots,n_a\,,\ t = 1,2,\ldots,n_y\,, \tag{13}$$

$$\log \mu_{x,t} = \sum_{j=1}^{K} \sum_{i=1}^{L} B_i^a(x) \cdot B_j^y(t) \cdot \theta_{i,j} \quad \text{or} \quad \log \boldsymbol{\mu} = \boldsymbol{B} \cdot \boldsymbol{\theta} \quad \text{(in matrix/vector form)}, \tag{14}$$

where the regression matrix $\boldsymbol{B}$ is given by the Kronecker product $\boldsymbol{B} = \boldsymbol{B}^y \otimes \boldsymbol{B}^a$.

Equation (14) defines a generalized linear model in exactly the same way as Equation (7) and can be fitted with statistical software **R**.

We force smoothness on the fitted surface by penalizing the regression coefficients along both the age and the year axes.

The penalised log-likelihood has the form:

$$L_P(\boldsymbol{\theta};\vec{d}) = L(\boldsymbol{\theta};\vec{d}) - \frac{1}{2} \cdot \lambda_a \cdot P_a(\boldsymbol{\theta}) - \frac{1}{2} \cdot \lambda_y \cdot P_y(\boldsymbol{\theta})\,, \tag{15}$$

where there are now two tuning constants: λ_a in age and λ_y in year.

As in the one-dimensional case, the regression coefficients are chosen by maximizing $L_P(\boldsymbol{\theta};\vec{d})$ for given joint values of tuning constants λ_a, λ_y.

The values of these tuning constants are chosen by minimizing *BIC*.

4 Results

In the previous section we set out the theory for extrapolating with *P*-splines and we used the age 60 data to illustrate the technique in one dimension. The main goal of this paper is the extrapolation of mortality tables and we now apply the method to data set (male in the Czech Republic). We use 1971-1996 (n_y = 26) data to predict the 1997-2011 rates (Figure 5.).

We set *B.deg* = 3, cubic *B*-splines, *P.ord* = 2, quadratic penalties, $ndx_a = \left[\frac{n_a}{5}\right] = \left[\frac{31}{5}\right] = 6$ and $ndx_y = \left[\frac{n_y}{5}\right] = \left[\frac{26}{5}\right] = 5$, this results in *L*= 9 and *K*=8.

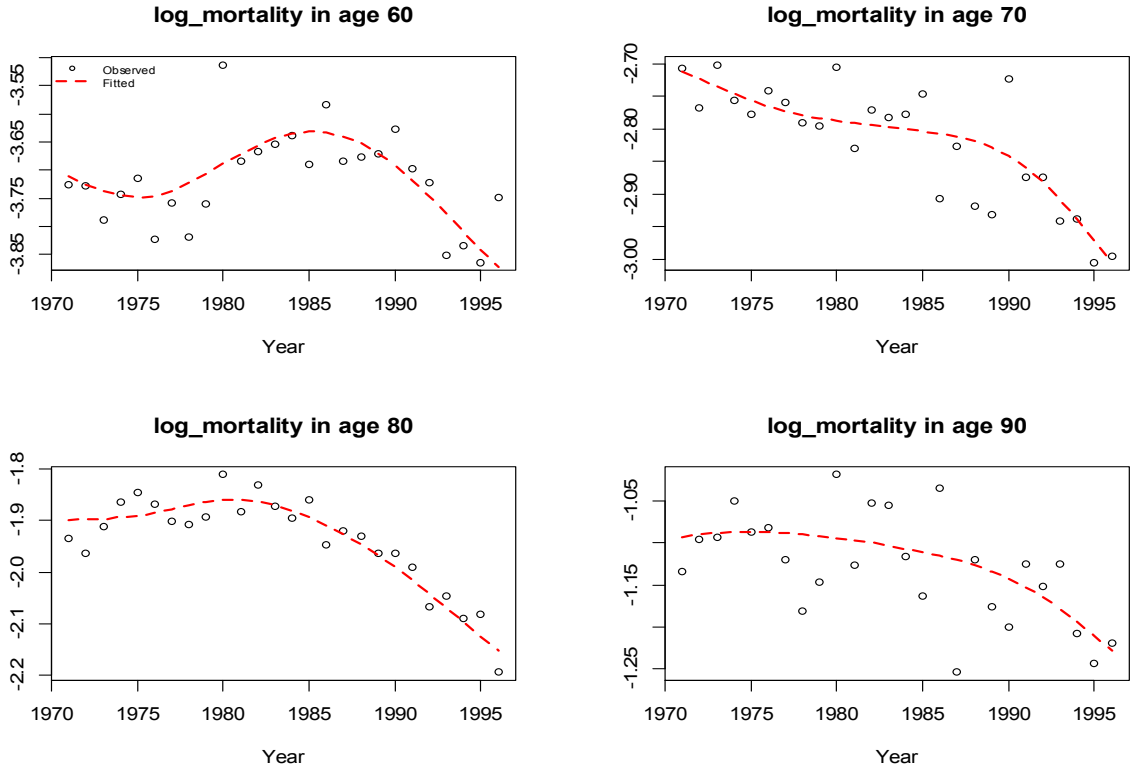
Figure 4 displays observed and fitted values of the force of mortality (in log scale) for ages 60-90.

The model used cubic *B*-splines and second-order difference penalties. The smoothing parameters λ_a = 316.23, λ_y = 100 were chosen by *BIC* (*BIC* = 2159.8).

The effective dimension of the model is 26.51 and the deviance is *dev* = 1982.355.

We can see decreasing of mortality from the middle of 80´s in all age categories.

Figure 4 Observed and fitted force of mortality for males over years 1971-1996 for selected ages

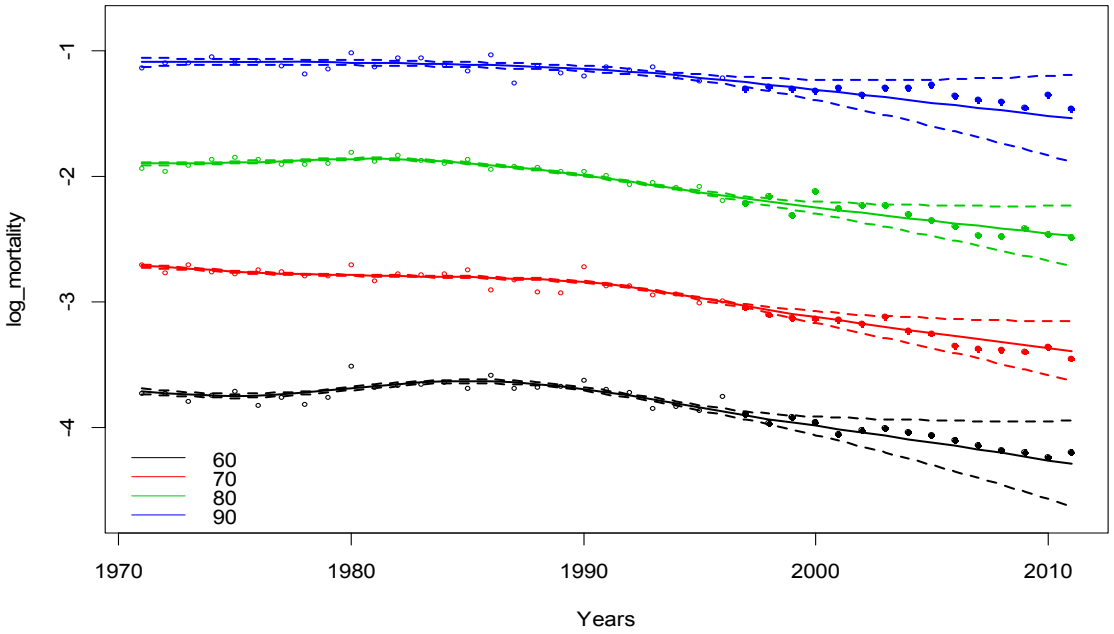


Source: Own processing

The observed values of the force of mortality do lie more or less within the 95% confidence interval. Few exceptions for age 80 around the year 2000 is caused with the cohort born around 1920.

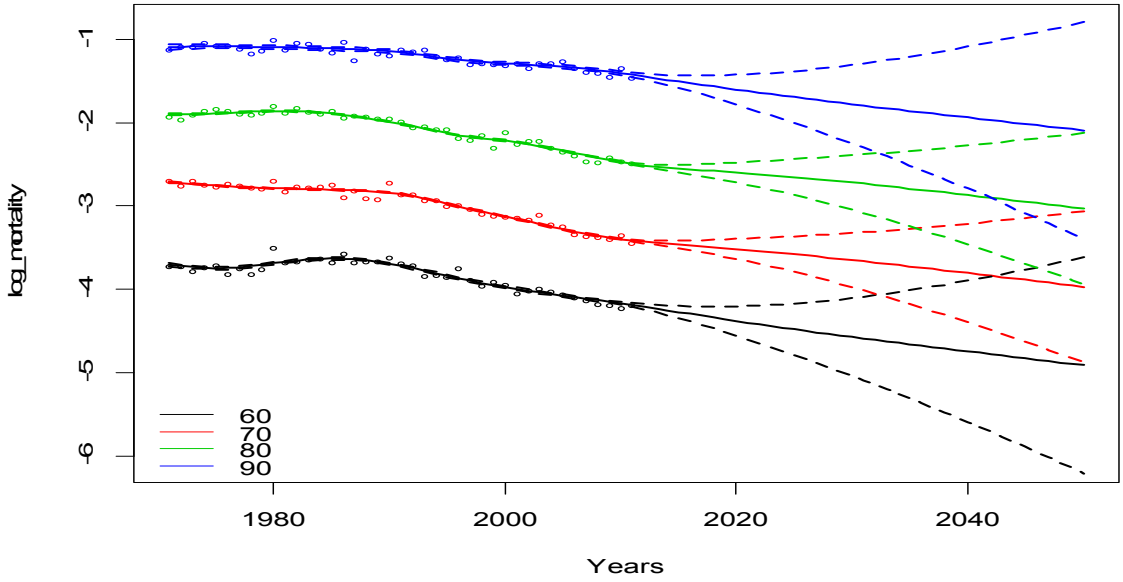
The forecasting (Figure 6) of the future mortality of the very old (over 80) is challenging since data can be poor at such ages. The width of the confidence intervals at age 90 indicates a high level of uncertainty in the future direction of mortality (part of the price of forecasting without wide data).

Figure 5 Observed, fitted and forecasting force of mortality for males in selected ages



Note: The 95% confidence intervals are included. The observed force of mortality is depicted with dots.
Source: Own processing

Figure 6 Forecasting force of mortality for males in selected ages.



Note: The 95% confidence intervals are included.
Source: Own Processing

5 Conclusion

We have presented a model for two-dimensional smoothing and shown how it may be fitted within the framework of a penalized generalized linear model. We have concentrated on the smoothing of mortality tables for which the Poisson distribution is appropriate.

Afterwards we can turn to the industry requirement for extrapolations up to year 2050. Similarly as in result section we could use newer data and predict future values. But forecasting of mortality should be approached with both caution and humility. Any prediction is unlikely to be correct. There is a need for awareness of model risk when assessing longevity-related liabilities, especially for annuities and pensions.

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Design Principles of Modified Discount Certificates

Zuzana Gordiaková, Monika Harčariková

Technical University of Košice
Faculty of Economics, Department of Finance
B. Němcovej 32, 040 01 Košice, Slovakia
E-mail: zuzana.gordiakova@tuke.sk, monika.harcarikova@tuke.sk

Abstract: *The paper analyses the structured financial products known as discount certificates and its modifications involving the particular conditions – expected rise/fall of underlying asset's price and barrier. By assuming this Discount Plus certificate, Reverse Discount certificate and Reverse Discount Plus certificate are presented in analytical form. We show that these certificates are engineered from a combination of traditional financial instrument and derivative products, especially vanilla and/or exotic options. We further develop formulas for their pricing and the conditions under which the issuer is profitable in the primary market and also the profitability for the investor at the maturity date are presented. Based on theoretical pricing models several certificates of all types on the Twitter stock with various parameters are designed and compared.*

Keywords: structured products, investment certificates, modifications of discount certificates, option pricing

JEL codes: G11, G13, G15, G24

1 Introduction

The financial crisis and the subsequent economic crisis have impacted all segments of financial markets, including the market of structured products. Nowadays, volumes of issued and offered structured products as well as the proportion of these products in investors´ portfolios are growing each year. Financial markets experience today a considerable growth again; however investors are still worried about unexpected market performance. Therefore issuers are creating new modified investment certificates belonging to the segment of modern structured products. These investment certificates contain always some option component - vanilla options, as well as barrier options. Due to the option components, issuers are able to create an investment certificates for every estimated situation of financial markets development (growth, stagnation, oscillation, or drop of markets). The situation is similar as for the attitude to risk. Both, conservative investors and risk-loving investors can choose. In the papers Younis and Rusnáková (2014), Hernández et al. (2013), Šoltés (2011), Šoltés (2010), Šoltés and Rusnáková (2010) deal with the analysis and creation of another types of investment certificates through the vanilla and more sophisticated exotic options.

The aim of this paper is to analyse classic Discount certificate, which can be modified by assuming certain particular conditions into three different types - Discount Plus, Reverse Discount and Reverse Discount Plus certificate. We explore how are applied the principles of financial engineering to the structured products creation. We show that, they are formed by using vanilla and/or barrier options; specifically down-and-out call or up-and-out put barrier options. A pricing formula is developed by using option pricing formulas. Then several certificates for all types of the Discount certificates on the Twitter stock with various parameters are designed and analysed followed by investigation of their profitability. Our findings help to raise the ability of retail investors to understand these sophisticated products constructions.

2 Characteristics of Discount Certificate and its Modifications

Issuers are constantly offering new modified investment certificates, which belong to the group of novel structured products.

The classic Discount Certificate, its issue and the basic characteristics of parameters is dealt in Šoltés (2007). Presented discount certificate and all its modifications belong to

the group of investment products with partial risk protection with common features. All of these certificates enable investors to acquire an underlying instrument at a discount to the direct investment which agrees with a limitation on the potential return cap level set at the beginning of the term. On the other hand, each type of this structured product is characterized by specific features, different scenario with its profit function and usage in particular estimated situation on financial market.

Both **Discount certificate and Discount Plus certificate,** a variation of classic discount certificates by assuming a predefined barrier, belong to the group of structured products suitable mainly when underlying is expected to move sideways or is slightly rising. In addition, for Discount Plus certificate is expected that the underlying will never touch the predetermined barrier level.

Discount certificates offer two possible payouts at maturity. If an underlying price is equal to or larger than the cap level, investors receive a cash amount equal to cap level at maturity. If an underlying price is smaller than the cap level, investors receive a cash amount equal to the underlying price at maturity. The profit function of Discount certificate with the starting price S_0, the valuation price S_T, the multiplier p, the cap level C at the expiration date T, and with k_0 a price of the certificate equal to $S_0 - D$, can be presented like:

$$P(S_T) = \begin{cases} p*(S_T - k_0) & if\ S_T < \mathrm{C}, \\ p*(C - k_0) & if\ S_T \geq C. \end{cases} \tag{1}$$

For **Discount Plus certificate** (Barrier Discount certificate) at maturity the maximum amount will only be paid out if the barrier has never been touched or undercut during the entire term. But if the barrier is so much as kissed, the discount plus certificate immediately converts into a normal discount certificate. The profit of a Discount Plus certificate with the starting price S_0, the valuation price S_T, the multiplier p, the cap level C, the barrier B, at the expiration date T, and with k_0 a price of the certificate equal to $S_0 - D$, is:

$$P(S_T) = \begin{cases} p*(S_T - k_0) & if\ \min\limits_{0 \leq t \leq T}(S_t) \leq \mathrm{B}, \\ p*(C - k_0) & if\ \min\limits_{0 \leq t \leq T}(S_t) > \mathrm{B} \wedge \mathrm{S_T} < C, \\ p*(C - k_0) & if\ \min\limits_{0 \leq t \leq T}(S_t) > \mathrm{B} \wedge \mathrm{S_T} \geq C. \end{cases} \tag{2}$$

Reverse Discount and **Reverse Discount Plus certificates,** a variation of Reverse Discount certificate by assuming a predefined barrier, are in contrast to the classic Discount certificate and Discount Plus certificate suitable when underlying is expected to move sideways or is slightly falling. In addition, for Reverse Discount Plus certificate is expected that the underlying will never touch the predetermined barrier level. Barrier level represents a partial risk protection, which is set above the starting price of the underlying. In this case cap level is set below the starting price of the underlying S_0 and investor can incur a total loss of invested capital, if the price of underlying rise above twice of the starting price the underlying $2S_0$. This type is suitable mainly when markets are moving sideways, slightly falling or slightly rising.

For **Reverse Discount certificate** are offered three possible payouts at maturity. If the price of the underlying is equal to or smaller than the cap level, investors receive a cash amount corresponding to the cap level at maturity. If an underlying price is larger than the cap level, investor receives a cash amount equal to the underlying price at maturity. But if the underlying price is larger than twice of the starting price of the underlying $2S_0$, investor incurs a total loss of their invested capital. The profit function of Reverse Discount certificate with the starting price S_0, the valuation price S_T, the multiplier p, the cap level C at the expiration date T, and with k_0 a price of the certificate equal to $S_0 - D$, is:

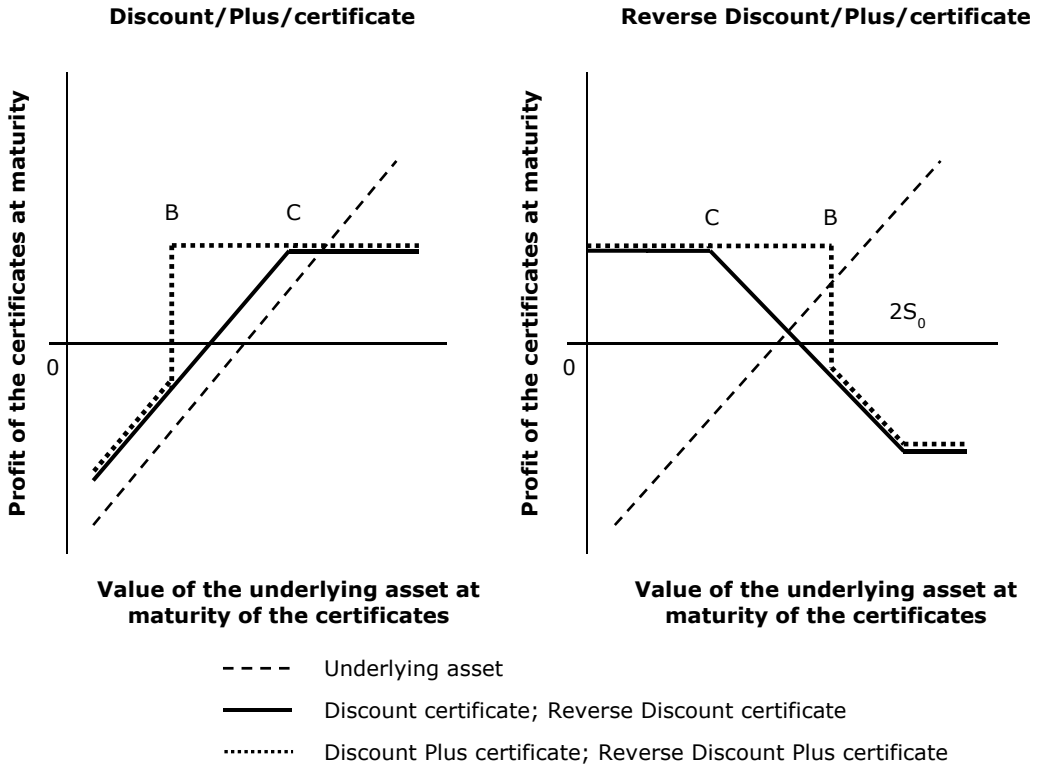
$$P(S_T)=\begin{cases} p*(S_0+(S_0-C)-k_0) & if\ S_T<\mathrm{C}, \\ p*(S_0+(S_0-S_T)-k_0) & if\ C\le \mathrm{S}_T<2S_0, \\ p*(S_0+(S_0-2S_0)-k_0) & if\ S_T\ge 2S_0. \end{cases} \quad (3)$$

At maturity, the maximum amount of **Reverse Discount Plus certificate** (Barrier Reverse Discount certificate) will only be paid out if the barrier has never been touched or undercut during the entire term. If, even for a moment, the barrier is reached, the partial protection is cancelled and the reverse discount plus certificate immediately converts into a normal Reverse Discount certificate. The profit of a Reverse Discount Plus certificate with the starting price S_0, the valuation price S_T, the multiplier p, the cap level C, the barrier B at the expiration date T, and with k_0 a price of the certificate equal to $S_0 - D$, is:

$$P(S_T)=\begin{cases} p*(S_0+(S_0-C)-k_0) & if\ S_T<\mathrm{C}, \\ p*(S_0+(S_0-C)-k_0) & if\ \max\limits_{0\le t\le T}(S_t)<B\wedge S_T\ge \mathrm{C}, \\ p*(S_0+(S_0-S_T)-k_0) & if\ \max\limits_{0\le t\le T}(S_t)\ge B\wedge S_T<2S_0, \\ p*(S_0+(S_0-2S_0)-k_0) & if\ S_T\ge 2S_0. \end{cases} \quad (4)$$

By assuming the characteristics and profit function mentioned above, in the Figure 1 the investment strategy graphical representations of Discount certificate and its modifications at maturity are presented.

Figure 1 Profit functions of different types of discount certificate



Source: own processing

3 Nature of the Creation

The same profit as the profit (1 of the **Discount certificate** is from holding following alternative portfolio: a long position in the number of p underlying assets with the starting price S_0

$$P_1(S_T)=p*(S_T-S_0) \quad (5)$$

a short position in the number of p call options on the underlying asset with the strike level referred to as the cap level C, the premium c_S for an option and the term to expiration of the option T, the same as the term to maturity of the certificate

$$P_2(S_T)=\begin{cases} p*c_S & if\ \mathrm{S_T} < C, \\ -p*(S_T - C - c_S) & if\ \mathrm{S_T} \geq C. \end{cases} \tag{6}$$

The profit function from the alternative investment portfolio expressed as a sum of the individual profit functions (5), (6) is as follows:

$$P(S_T)=\begin{cases} p*(S_T - (S_0 - c_S)) & if\ S_T < \mathrm{C}, \\ p*(C - (S_0 - c_S)) & if\ S_T \geq C. \end{cases} \tag{7}$$

The same profit as the profit of the **Discount Plus certificate** (2) is from holding following alternative portfolio (5), (6) together with a long position in the number of p down-and-out put options on the underlying asset with the starting price S_0, the strike level referred to as the cap C, the barrier level B, the premium p_{BDO} for an option and the term to maturity of the option T, the same as the term to maturity of the certificate

$$P_3(S_T)=\begin{cases} -p*p_{BDO} & if\ \min\limits_{0\leq t\leq T}(S_t) \leq \mathrm{B}, \\ -p*(S_T - C + p_{BDO}) & if\ \min\limits_{0\leq t\leq T}(S_t) > \mathrm{B} \wedge \mathrm{S_T} < C, \\ -p*p_{BDO} & if\ \min\limits_{0\leq t\leq T}(S_t) > \mathrm{B} \wedge \mathrm{S_T} \geq C. \end{cases} \tag{8}$$

Then, the profit function from the alternative investment portfolio expressed as a sum of individual profit functions (5), (6) and (8) has form:

$$P(S_T)=\begin{cases} p*(S_T - (S_0 + p_{BDO} - c_S)) & if\ \min\limits_{0\leq t\leq T}(S_t) \leq \mathrm{B}, \\ p*(C - (S_0 + p_{BDO} - c_S)) & if\ \min\limits_{0\leq t\leq T}(S_t) > \mathrm{B} \wedge \mathrm{S_T} < C, \\ p*(C - (S_0 + p_{BDO} - c_S)) & if\ \min\limits_{0\leq t\leq T}(S_t) > \mathrm{B} \wedge \mathrm{S_T} \geq C. \end{cases} \tag{9}$$

The profit of a **Reverse Discount certificate** due to the equation (3) is the same as the profit from holding following alternative portfolio: cash deposit in the amount of sold certificate $k_0 = S_0 - D$ (D-discount), while satisfying condition $(S_0 - D)(1 + r(1-d)t) = S_0$, (r-interest rate and d-tax rate), and at expiration time of certificate the purchase of the underlying at valuation price S_T, or a short position in the number of p underlying asset with starting price S_0 and valuation price S_T:

$$P_1(S_T) = p*(S_0 - S_T) \tag{10}$$

a short position in the number of p put options on the underlying asset with the strike level referred to as the cap level C, the premium p_S for an option and the term to expiration of the option T, the same as the term to maturity of the certificate

$$P_2(S_T)=\begin{cases} p*(S_T - C + p_S) & if\ \mathrm{S_T} < C, \\ p*p_S & if\ \mathrm{S_T} \geq C. \end{cases} \tag{11}$$

a long position in the number of p call options on the underlying asset with the strike level referred to as 2 the starting price $2S_0$, the premium c_B for an option and the term to expiration of the option T, the same as the term to maturity of the certificate

$$P_3(S_T)=\begin{cases} -p*c_B & if\ \mathrm{S_T} < 2S_0, \\ p*(S_T - 2S_0 - c_B) & if\ \mathrm{S_T} \geq 2S_0. \end{cases} \tag{12}$$

The profit function from the alternative investment portfolio expressed as a sum of individual profit functions (10)(11), (11) and (12) has following form:

$$P(S_T)=\begin{cases} p*(S_0-C+(p_s-c_B)) & if\ S_T<\mathrm{C}, \\ p*(-S_T+S_0+(p_s-c_B)) & if\ C\le \mathrm{S}_T<2S_0, \\ p*(-S_0+(p_s-c_B)) & if\ S_T\ge 2S_0. \end{cases} \tag{13}$$

The profit of a **Reverse Discount Plus certificate** (4) is the same as profit from holding alternative portfolio (10), (11), (12) and a long position in the number of *p* up-and-out call options on the underlying asset with the starting price S_0, the strike level referred to as the cap *C,* the barrier level *B*, the premium c_{BUO} for an option and the term to maturity of the option *T*, the same as the term to maturity of the certificate

$$P_4(S_T)=\begin{cases} -p*c_{BUO} & if\ \mathrm{S}_\mathrm{T}<C, \\ p*(S_T-C+c_{BUO}) & if\ \max\limits_{0\le t\le T}(S_t)<\mathrm{B}\wedge \mathrm{S}_\mathrm{T}\ge C, \\ -p*c_{BUO} & if\ \max\limits_{0\le t\le T}(S_t)\ge \mathrm{B}\wedge \mathrm{S}_\mathrm{T}\ge C. \end{cases} \tag{14}$$

The profit function from the alternative investment portfolio expressed as a sum of individual profit functions (10), (11), (12) and (14) has a form:

$$P(S_T)=\begin{cases} p*(S_0-C+(p_s-c_{BUO}-c_B)) & if\ S_T<\mathrm{C}, \\ p*(S_0-C+(p_s-c_{BUO}-c_B)) & if\ \max\limits_{0\le t\le T}(S_t)<B\wedge S_T\ge \mathrm{C}, \\ p*(-S_T+S_0+(p_s-c_{BUO}-c_B)) & if\ \max\limits_{0\le t\le T}(S_t)\ge B\wedge S_T<2S_0, \\ p*(-S_0+(p_s-c_{BUO}-c_B)) & if\ S_T\ge 2S_0. \end{cases} \tag{15}$$

The overview of the above mentioned certificates' construction is in the Table 1.

Table 1 Construction of modified discount certificates

Discount	Discount Plus	Reverse Discount	Reverse Discount Plus
Long Underlying asset	Long Underlying asset	Short Underlying asset	Short Underlying asset
Short Call	Short Call	Short Put	Short Put
	Long down-out put	Long Call	Long up-out call
			Long Call

Source: own design

If the formula $k_0=S_0-c_S$ of the equation (7), the formula $k_0=S_0+p_{BDO}-c_S$ of the equation (9), the formula $k_0=S_0-D$ where $D=p_s-c_B$ of the equation (13), and the formula $k_0=S_0-D$ where $D=p_s-c_{BUO}-c_B$ of the equation (15) is met, then the profit functions of the alternative portfolios are identical to the profit functions of presented certificates. Any selling price of the certificate above the fair value k_0 is the gain to the issuer of the certificate.

4 Pricing

The fair value of the certificates can be calculated based on the value of individual components, i.e. value of an alternative portfolio as combination of an underlying asset position and positions in options. For example Hernández (2013), (2010) deals with the problem of valuation of structured product. The fair value of the Discount certificate based on the value of the alternative portfolio is expressed by the equation (7), Discount Plus certificate is expressed by (9), Reverse Discount certificate is expressed by (13), and Reverse Discount Plus certificate by equation (15).

Consequently, we need to obtain values of the vanilla and barrier option positions. Theoretical price of European vanilla call and put option on the stock without dividend

can be calculated using Black-Scholes model, which is introduced in the work (Black & Scholes, 1973). However the original Black–Scholes model does not directly suit barrier options, due to the next factor – a barrier influences the height of option premium. Merton (1973) expanded the Black-Scholes model with dividends. Later, Rubinstein and Reiner (1991) applied Black-Sholes-Merton formula on eight basic types of barrier options and Haug (1998) on all sixteen single types of standard European barrier options. All derived relations we can find in paper Šturc and Žoldáková (2011). The volatility (σ) of the underlying is calculated as historical volatility according to Ambrož (2002) and the risk-free rate of interest is the yield of government bonds having the terms to maturity match those of the certificates. In order to simplify calculations, we have implemented the whole analysis in the statistical program R. (Iacus, 2001)

5 Design of the Innovative Discount Certificates

In this section, we propose discount certificate together with its three modifications on the Twitter stocks and perform the analysis of their profitability for to the investor at the time of maturity.

Twitter Inc. (TWTR) is a global platform for public self-expression and conversation in real time. The main aim of the company is to provide various social media products. In the last years, the company experiences rapid growth both through the new user registrations and acquisition of other social media companies. Together with Google, Facebook and similar; it is becoming one of the most important world social media enterprises. The price of stock has reached a value of 62.20 USD on 17th January 2014. The actual price of Twitter on 23th April 2014 is 45.95 USD. The common stylized data about the certificates is in Table 2.

Table 2 Stylized data about discount certificate and its modifications

Key data	
Underlying	Twitter, Inc. (TWTR)
Underlying price (S_0)	62.20 USD
Multiplier (p)	1:1
Issue data	17th January 2014
Maturity date (T)	17th January 2015
Dividends	-

Source: own design

In order to replicate the profit of these certificates, we create the replicating portfolio as a combination of investments due to the equations of alternative portfolios mentioned in the Section 3. Vanilla option prices on the stock Twitter with various strike prices and maturities are obtained from the web page of Yahoo Finance. In order to calculate down-and-out and up-and-out barrier option prices, we set the term to maturity to 17th January 2015. The strike prices at the cap level were selected by the authors at the level 110% of enter price of underlying for Discount and Discount Plus certificates, i.e. 68.42 USD and at the level 90% of enter price of underlying for Reverse Discount and Reverse Discount Plus certificates, i.e. 55.98 USD. The risk-free interest rates - the yields of government bonds with similar maturity as the options obtained from the Bloomberg is 0.12% and calculated historical volatility is 75.3%. The barrier levels were selected by authors at the level 80% of enter price of underlying for Discount and Discount Plus certificates, i.e. 49.76 USD and at the level 120% of enter price of underlying for Reverse Discount and Reverse Discount Plus certificates, i.e. 74.64 USD. The multiplier p is set to 1:1 to underlying asset.

The profit functions at maturity of the certificates are at given parameters for Discount certificate expressed by the equation (16) where the purchase price k_0 is 45.98 USD and discount is equal to 16.22 USD, for Discount Plus certificate (17) where the purchase price k_0 is 46.11 USD and discount is equal to 16.09 USD, for Reverse Discount certificate (18) where the purchase price k_0 is 54.00 USD and discount is equal to 8.20

USD, and for Reverse Discount Plus certificate (19) where the purchase price k_0 is 54.07 USD and discount is equal to 8.13 USD.

$$P(S_T) = \begin{cases} S_T - 45.98 & if\ S_T < 68.42, \\ 22.44 & if\ S_T \geq 68.42. \end{cases} \tag{16}$$

$$P(S_T) = \begin{cases} S_T - 46.11 & if\ \min\limits_{0 \leq t \leq T}(S_t) \leq 49.76, \\ 22.31 & if\ \min\limits_{0 \leq t \leq T}(S_t) > 49.76 \wedge \mathrm{S_T} < 68.42, \\ 22.31 & if\ \min\limits_{0 \leq t \leq T}(S_t) > 49.76 \wedge \mathrm{S_T} \geq 68.42. \end{cases} \tag{17}$$

$$P(S_T) = \begin{cases} 14.42 & if\ S_T < 55.98, \\ -S_T + 70.40 & if\ 55.98 \leq \mathrm{S_T} < 124.40, \\ -54.00 & if\ S_T \geq 124.40. \end{cases} \tag{18}$$

$$P(S_T) = \begin{cases} 14.35 & if\ S_T < 55.98, \\ 14.35 & if\ \max\limits_{0 \leq t \leq T}(S_t) < 74.64 \wedge S_T \geq 55.98, \\ -S_T + 70.33 & if\ \max\limits_{0 \leq t \leq T}(S_t) \geq 74.64 \wedge S_T < 124.40, \\ -54.07 & if\ S_T \geq 124.40. \end{cases} \tag{19}$$

The profit from the given certificates for the selected underlying price at the time of maturity is in Table 3.

Table 3 Comparison of the profitability (in USD) of the selected investment certificates

The underlying price at maturity	The profit of Discount certificate	The profit of Discount Plus certificate[1]	The profit of Discount Plus certificate[2]	The profit of Reverse Dicount certificate	The profit of Reverse Discount Plus certificate[1]	The profit of Reverse Discount Plus certificate[2]
34.21	-11.77	-	-11.90	14.42	14.35	14.35
43.54	-2.44	-	-2.57	14.42	14.35	14.35
45.98	0	-	-0.13	14.42	14.35	14.35
46.11	0.13	-	0	14.42	14.35	14.35
52.87	6.89	22.31	6.76	14.42	14.35	14.35
59.09	13.11	22.31	12.98	11.31	14.35	11.24
62.20	16.22	22.31	16.09	8.20	14.35	8.13
65.31	19.33	22.31	19.20	5.09	14.35	5.02
70.33	22.44	22.31	22.31	0.07	14.35	0
70.40	22.44	22.31	22.31	0	14.35	-0.07
71.53	22.44	22.31	22.31	-1.13	14.35	-1.20
80.86	22.44	22.31	22.31	-10.46	-	-10.53
90.19	22.44	22.31	22.31	-19.79	-	-19.86
124.40	22.44	22.31	22.31	-54.00	-	-54.07

Source: own design

It can be seen, that Discount certificate makes a profit for investor if the underlying price at the maturity is from interval (45.98; ∞), in other case the investor makes a loss. The profit of Discount Plus certificate is 22.31 USD if the underlying price has never touched the barrier. If the pre-defined barrier was touched or undercut at least once during the

[1] The barrier has never been touched or undercut during the entire term.
[2] The barrier has been touched or undercut at least once during the entire term.

entire term and the price of underlying is (46.11; ∞) then the investor is profitable. The profit of Reverse Discount certificate is possible for the price of underlying at the maturity form interval (0; 70.40). If the price will be higher the investor makes a loss. The profit of Reverse Plus Discount certificate, if the underlying price has never touched the barrier, is 14.35 USD. If the barrier was touched or undercut during the lifetime of certificate at least once, the investor makes a profit for possible underlying prices from the interval (0; 70.33) at maturity.

6 Conclusions

This paper oriented on the segment of modern structured products, which has been gaining in popularity and is going through a continuous boom again, presents a proposal of classic Discount certificate and its selected modifications – Discount Plus, Reverse Discount and Reverse Discount Plus certificates. Based on the analytical approach and profit functions of vanilla and/or exotic options together with the position in underlying has been derived the profit functions of these certificates. Assuming certain conditions for alternative portfolios it has been shown that the profit functions of these investment opportunities are equal to the profit functions of proposed certificates. The practical application of these newly designed certificates has been performed on the stocks of Twitter Inc. and the analysis of profitability to the investor in Discount certificates and its modifications at different possible future scenarios of underlying price development at maturity of the certificates is been carried out. The outcomes of analysis have allowed quantifying price intervals resulting in profit or loss of potential investor.

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Efficiency of Insurance Lines in the Slovak Republic

Eva Grmanová

Alexander Dubcek University of Trencin
Faculty of Social and Economic Relations
Studentska 3, 911 50 Trencín, Slovak Republic
E-mail: eva.grmanova@tnuni.sk

Abstract: *The study is focused on the efficiency of non-life insurance lines and life insurance lines of commercial insurance companies in the Slovak Republic in the times of global financial and economic crisis. It compares the efficiency scores of insurance lines on the Slovak insurance market. Data envelopment analysis (DEA) was used in order to reflect the efficiency scores. The following characteristics are taking into account in our analysis – premium, claims and administrative costs. The analysis will also review the differences in relative efficiency in different years and relative differences of specific subgroups of insurance lines. The result will determine the specifics of non-life and life insurance. This will provide information which can contribute to spread of knowledge of the insurance market in Slovakia.*

Keywords: insurance, non-life insurance lines, life insurance lines, efficiency, data envelopment analysis

JEL codes: G22, C52

1 Introduction

The insurance industry is a promising area of the national economy each developed a modern economy. (Koišová, 2010) It focuses on insurance and reinsurance business and on the provision of insurance and reinsurance. One of the fundamental entities of insurance is commercial insurance companies. The insurance companies are special financial companies. Their activity is joined on assumption of client´s risks. (Ducháčková, 2007) They offer products aimed at protecting their clients. The insurance that they offer has influence on the elimination of risk. In case of citizens they are designed to maintain their standard of living, in case of corporate entities they are designed to stabilize their economic situation.

According to the Act no. 8/2008 Coll. on Insurance and on amendments to certain acts, insurance is divided into life insurance and non-life insurance. (NR SR, 2007) Within the scope of life insurance, the National Bank of Slovakia (NBS, 2008-2012) which exercises supervision over the insurance industry, recognizes five insurance lines. They are Death insurance; Traditional life insurance annuities; Annuities; Unit-Linked; Supplementary non-life insurance. Within the scope of non-life insurance, it recognizes twelve insurance lines. They are Accident and health insurance without Individual health insurance; Individual health insurance; Motor Third Part Liability; Motor other classes; Marine, aviation and transport; Carrier´s liability insurance; Fire and other damage to property; Third party liability; Credit, suretyship and other financial losses insurance; Legal expenses insurance; Assistance insurance; Active reinsurance.

In our article we focused on analyzing the efficiency of life and non-life insurance lines during 2008-2012. During the period analyzed, the impact of the financial and economic crisis was manifested in different sectors of the national economy, affecting also the insurance market. The economic income of commercial insurance companies worsened during the economic crisis (NBS, 2012), although deterioration occurred at a slower pace than in the case of banks.

Insurance market, its scope, efficiency and importance can be monitored of multiple indicators. (Koišová and Masárová, 2010) In this article, we analyzed the development of the indicators of premium, claims, administrative costs for all insurance lines. Our aim was to determine the efficiency scale of insurance lines in the Slovak insurance market in each year of the period analyzed, compare them and assess their relative changes that

occurred in the period analyzed. We built on the fact that the economic crisis has had a different effect on the efficiency of various insurance products. Life insurance is considered to be less affected by the external environment then non-life insurance. This follows from the nature of life insurance products. That is why we assumed that specifications would be apparent in the changes of relative efficiency among life insurance lines and non-life insurance lines.

2 Methodology and Data

The analyzed values of indicators of insurance lines were collected from the website of the National Bank of Slovakia. For the analysis of time series we used the growth coefficient k_m, which is expressed as

$$k_m = \frac{y_m}{y_{m-1}}, \tag{1}$$

where y_m is the value in the m-th period in the time series,

y_{m-1} is the value in the $m-1$ period in the time series.

The average growth coefficient was quantified using the geometric mean, which is expressed as

$$\bar{x}_g = \sqrt[n]{x_1 x_2 \ldots x_n} = \sqrt[n]{\prod_{i=1}^{n} x_i}, \tag{2}$$

where x_i is the growth coefficient in the i-th period. (Pacáková, 2003)

Model Specification

To compare the efficiency of insurance lines, we used Data envelopment analysis models (DEA models). DEA models enable us to analyze the efficiency of transformation of multiple inputs to multiple outputs. These models are based on non-parametric approach. They use linear programming methods to construct non-parametric envelopment of data. (Grmanová and Jablonský, 2009) They assess efficiency using the efficiency score. Efficiency scores are calculated as relative values to the envelopment of data.

In our analysis we used BCC models that are based on variable returns to scale. BCC efficient units comprise the convex envelopment of data. The convex envelopment is the border of efficiency in variable returns to scale. The units that lie on the border of efficiency have an efficiency scale equal to one and are considered effective.

We assume that we have n homogeneous entities, for which we monitor the outputs r and inputs m. The inputs matrix will be marked $\mathbf{X} = [x_{jk}, j = 1\ldots, m, \quad k = 1, \ldots, n]$, the outputs matrix will be marked $\mathbf{Y} = [y_{ik}, i = 1, \ldots, r, \quad k = 1, \ldots, n]$.

The efficiency score θ_q in the input oriented model is expressed in the matrix form

$$\min \quad z = \theta_q - \varepsilon\left(\mathbf{e}^T \mathbf{s}^+ + \mathbf{e}^T \mathbf{s}^-\right), \tag{3}$$

subject to

$$\mathbf{X}\boldsymbol{\lambda} + \mathbf{s}^- = \theta_q \mathbf{x}_q,$$
$$\mathbf{Y}\boldsymbol{\lambda} - \mathbf{s}^+ = \mathbf{y}_q$$
$$\mathbf{e}^T \boldsymbol{\lambda} = 1,$$
$$\boldsymbol{\lambda}, \mathbf{s}^+, \mathbf{s}^- \geq \mathbf{0},$$

where $\mathbf{s}^+, \mathbf{s}^-$ are matrix of slack variables, $\boldsymbol{\lambda}$ is matrix of weights, $\mathbf{e}^T = (1, 1.., 1)$ and ε is infinitesimal constant. (Jablonský and Dlouhý, 2004)

3 Results and Discussion

At the beginning of the analysis, we assessed trends in the premium, the costs of insurance claim and administrative costs in life and non-life insurance. We expressed the growth coefficient and the average growth coefficient using the geometric mean.

There was a growing trend of premium in life insurance since 2009. The biggest increase was from 2009 to 2010. The average growth coefficient in life insurance was 100.28%. In life insurance, however, there was also a growing trend in the cost of insurance claims. In each year of the period analyzed the growth was bigger than the growth of premium. The average growth coefficient of costs of insurance claims in life insurance was 111.86%. The average growth coefficient of administrative costs in life insurance was 99.48%. Thus, the greatest average growth coefficient in life insurance was in the insurance claim. This should be considered as a negative aspect of life insurance.

In non-life insurance, insurance premium increased only from 2010 to 2011. The average growth coefficient of premium in non-life insurance was 98.03%. In non-life insurance the cost of insurance claims increased only from 2009 to 2010. The average growth coefficient of insurance claims in non-life insurance was 97.45%. The average growth coefficient of administrative expenses in non-life insurance was 99.14%. Thus, the greatest average decrease in non-life insurance was in the volume of insurance claims.

Table 1 Mean of premium, claims and administrative costs in life insurance lines

	2008	**2009**	**2010**	**2011**	**2012**
Premium (EUR)	219799828	205797725	215868634	218810587	222315239
Growth coefficient (%)	-	93.63	104.89	101.36	101.60
Cost of insurance claims (EUR)	92610280	110304137	121782437.6	131780063	144987787
Growth coefficient (%)	-	119.11	110.41	108.21	110.02
Administrative costs (EUR)	53987838	51217015	49100236	49610690	52864743
Growth coefficient (%)	-	94.87	95.87	101.04	106.56

Source: own processing according to NBS (2008-2012)

We concluded that in case of life insurance, insurance premiums had a growing trend during the economic crisis. In case of non-life insurance, there was a downward trend of the premiums, except for the year 2011. In life insurance, the cost of insurance claims increased every year. Their average growth coefficient was greater than the average growth coefficient of premiums. In non-life insurance, the cost of insurance claims decreased, with the exception of 2010. The mean of premium, claims and administrative costs in life insurance lines is shown in Table 1. Mean of premium, claims and administrative costs in non-life insurance lines is shown in Table 2.

Table 2 Mean of premium, claims and administrative costs in non-life insurance lines

	2008	**2009**	**2010**	**2011**	**2012**
Premium (EUR)	83426271	79699583	77958060	78846275	77065745
Growth coefficient (%)	-	95.53	97.81	101.14	97.74
Cost of insurance claims (EUR)	41721080	40216504	43587954	43139351	37630004
Growth coefficient (%)	-	96.39	108.38	98.97	87.23
Administrative costs (EUR)	26310307	24138828	24809292	25595552	25417464
Growth coefficient (%)	-	91.75	102.78	103.17	99.30

Source: own processing according to NBS (2008-2012)

In the next step of our analysis we focused on individual insurance lines. We monitored their efficiency and relative changes of efficiency that occurred in the period analyzed. The efficiency score was expressed in the BCC input-oriented model with two inputs and one output. The inputs in the model were the claims and administrative costs, the output was the premium. The efficiency score is shown in Table 3. Effective units were compared on basis of the superefficiency score, which was expressed in the EMS program.

Table 3 Efficiency of life insurance lines and non-life insurance lines

	2008	2009	2010	2011	2012
Death insurance	1	1	1	1	1
Traditional life insurance annuities	1	1	1	1	1
Annuities	1	1	1	1	1
Unit-Linked	1	1	1	1	1
Supplementary non-life insurance	1	1	0.939	0.994	1
Accident and health insurance without individual health insurance	0.684	0.750	0.805	0.710	0.560
Individual health insurance	1	1	1	1	1
Motor Third Part Liability	0.706	0.749	0.664	0.693	0.789
Motor other classes	0.575	0.708	0.608	0.593	0.642
Marine, aviation and transport	0.770	1	1	0.995	0.876
Carrier´s liability insurance	0.793	0.823	0.880	0.838	0.735
Fire and other damage to property	0.742	0.949	0.556	0.640	0.966
Third party liability	0.845	0.863	0.954	1	0.991
Credit, suretyship and other financial losses insurance	0.598	0.513	0.597	0.583	0.493
Legal expenses insurance	0.655	0.619	0.756	0.759	0.836
Assistance insurance	0.543	0.629	0.650	0.687	0.503
Active rainsurance	1	0.932	0.671	0.767	1
Mean	0.818	0.855	0.828	0.839	0.847

Source: own processing in EMS according to NBS (2008-2012)

Life insurance products mostly belong to long-term insurance. Statistical and mathematical methods are usually used in determining the level of premiums. Life insurance products are considered to be less affected by the external environment than non-life insurance products. From the perspective of insurance companies they are low-risk insurances for death. Our aim was to compare the relative change of efficiency of life insurance lines and the relative change of efficiency of non-life insurance lines and determine in which insurance lines there were significant changes in relative comparison (in relation to other insurance lines).

In all the years of the period analyzed the life insurance lines Death insurance; Traditional life insurance annuities; Annuities; Unit-Linked had an efficiency score equal to one and were effective. Regarding non-life insurance lines, the line Individual health insurance remained effective throughout the whole period. Hence, four out of the five life insurance lines were effective and only one group out of the twelve non-life insurance lines remained effective during the entire period.

The largest share of premiums in each year of the period analyzed had the insurance line Traditional life insurance annuities. Its share of the premiums, however, decreased from 56.01% in 2009 to 50.18% in 2012. This insurance line had high superefficiency throughout the period analyzed. In 2008, it reached a premium greater than the amount for claims and administrative expenses. However, since 2009, the amount of costs for insurance claims and administrative expenses was greater than premiums. This was mainly caused by the increasing cost of insurance claims.

The insurance line Death insurance had a share of the premium in an interval from 2.6% to 3.2% throughout the period analyzed. Since 2010, its share of premiums increased. Throughout the whole period analyzed, this insurance line reached a premium greater than the amount of costs of insurance claims and administrative costs.

Relative changes when comparing insurance lines in terms of superefficiency occurred in case of the insurance line Unit-Linked, in which the share of premium grew from 27.61% in 2009 to 32.3% in 2012. When monitoring superefficiency, its relative position in 2012 worsened. This was influenced by the increase in insurance claims in 2012, which was due to repurchase and survival to the contractually agreed age. The superefficiency scale is shown in Table 4.

Table 4 Supperefficiency of life insurance lines

	2008	**2009**	**2010**	**2011**	**2012**
Death insurance (%)	135.45	114.09	124.35	144.15	133.58
Traditional life insurance annuities (%)	big	big	big	big	big
Annuities (%)	134.84	138.81	143.54	143.76	162.57
Unit-Linked (%)	238.33	301.08	354.61	274.49	145.32
Supplementary non-life insurance (%)	101.99	119.37	93.86	99.38	121.28

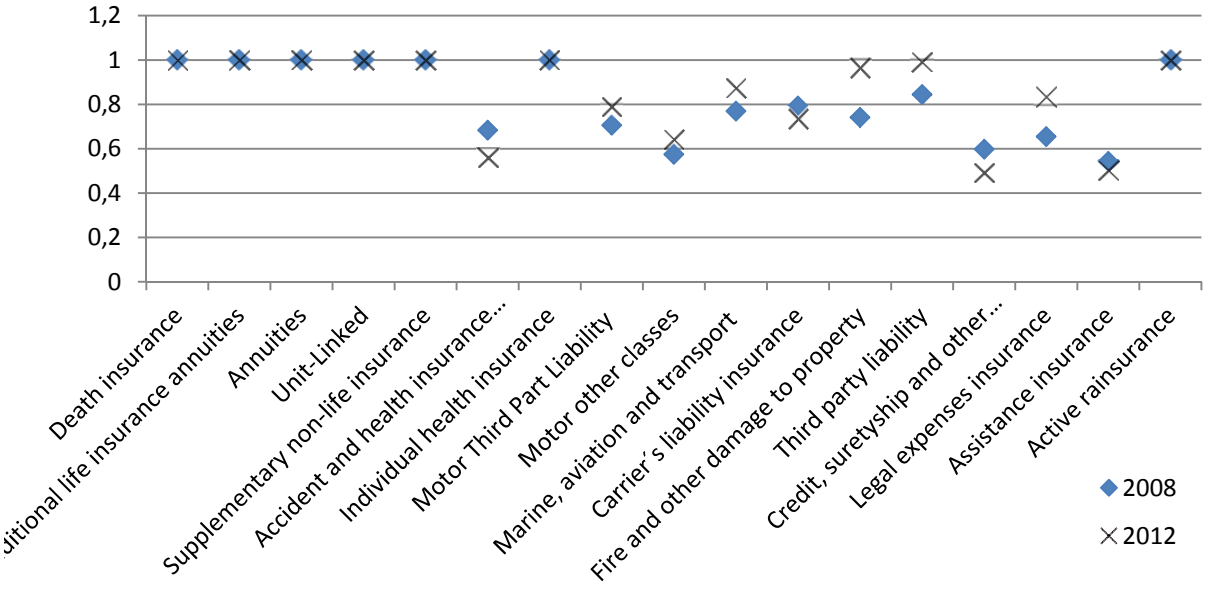
Source: own processing in EMS according to NBS (2008-2012)

In case of non-life insurance lines, the insurance line Individual health insurance had the greatest efficiency score throughout the period analyzed and it was effective. However, the share of this insurance line on non-life insurance premiums was the smallest for the whole period. It ranged from 0.2% to 0.3%. Regarding non-life insurance lines, the largest share of premiums had the insurance lines Motor Third Part Liability, Motor other classes, Fire and other damage to property. Among these lines, the insurance line Motor other classes had the smallest efficiency scale, with the exception of 2010. In this insurance line the premium declined, with the exception of 2011. Also in 2011-12, its premium was smaller than the amount of costs of insurance claims and administrative expenses.

Fire and other damage to property reached the highest efficiency scale in the years 2008-2009 and 2012, and in the line of three non-life insurance lines it had the largest share of premium. On contrary, in 2010 it had the lowest efficiency scale. Its relative position is unstable.

In case of non-life insurance lines, the lines Credit, suretyship and other financial losses insurance and Assistance insurance. had the worst relative ranking since 2010. The share of premium of these insurance lines was small. In case of Credit, suretyship and other financial losses insurance it does not exceed 2% and in case of Assistance insurance it does not exceed 3%. The efficiency scale of insurance lines in 2008 and 2012 is shown in Figure 1.

Figure 1 Efficiency of life insurance lines and non-life insurance lines



Source: own processing

4 Conclusions

Several specifics were manifested in life and non-life insurance during the economic crisis. Premium had an upward trend in life insurance. At the same time, costs of insurance claims increased too. The average premium growth coefficient was less than the average growth coefficient of insurance claims. In non-life insurance, the premium had a downward trend, except for 2011. At the same time the costs of insurance claims decreased too, except for 2010. Concerning life insurance, the line Traditional life insurance annuities. has the largest share of premium. This line was effective and it achieved the greatest superefficiency scale. However, the share of premium for this line decreased.

The share of premium of the insurance line Unit-Linked grew. This insurance line was effective. It had the second greatest superefficiency scale in 2008. However, in 2012 its relative ranking in relation to the efficiency scale worsened.

In case of non-life insurance, only the insurance line Individual health insurance was effective throughout the period analyzed. However, the share of premium of this line was very small. In non-life insurance the largest share of premium accounted for the Motor Third Part Liability, Motor other classes, Fire and other damage to property. There were fluctuations in the efficiency scale during the reporting period. Its relative position in relation to the efficiency scale was very unstable.

In non-life insurance, Credit, suretyship and other financial losses insurance and Assistance insurance. had the lowest efficiency scale from the year 2010. However, these insurance lines had a small share.

Acknowledgement

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Cartel Formation in the Financial Sector during Different Stages of Business Cycle

Andrius Guzavicius

Kaunas University of Technology
School of Economics and Business, Department of Finance
Laisves al. 55, LT-44029 Kaunas, Lithuania
E-mail: andrius.guzavicius@ktu.lt

Abstract: *Today's research on cyclical fluctuation in economy is one of the main topic in scientific debate in the field of many different approaches. The current stage of business cycle affects both the financial institution and consumer behavior, so the established cartel stability within the changing business cycle phases depends on the members' flexibility and speed of reaction to changes within the market. Financial institutions, having collusive agreement, are more orientated to gain benefit from collective action when there is economic boom. During a decline period of business cycle, which makes benefit of this collusive agreement less certain, cartels could break down. Depression collusive institutions are most unstable because of the high level of competition among companies, during a depression benefit of this action becomes less certain, cartels could break down. Cartels stability over recovery phase of business cycle mostly depends on flexibility of these organizations to predicts success and stability of collective action. The research object of this article is modeling process of cartel formation in the financial sector during different stages of business cycle.*

Keywords: cartel, business cycle, behavioral finance

JEL codes: G02, G14, G28

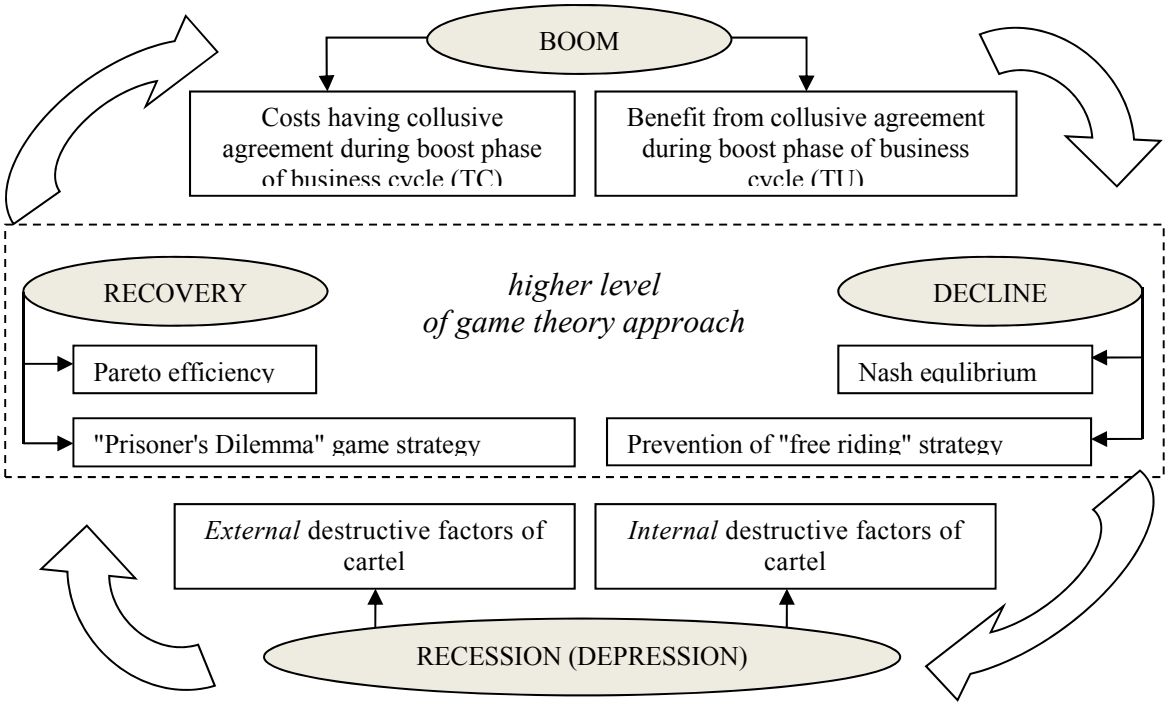
Cartels Stability over Different Stages of Business Cycle

Today's relationship between cyclical fluctuation in economy is one of the main topic in scientific debate in the field of many different approaches. It is difficult to separate economics science from others disciplines, like psychology, human behaviour, philosophy, ethic. Cyclical fluctuation in economy making the situation even more complicated. Expansive monetary policy might increasing liquidity in economy and provide efficient recourse allocation, on the other hand, such intensive policy could lead to misallocation of recourses, high cyclical fluctuations. Very important is appropriate balance between free market competition and government control and intervention. There are scientifically opinions, that in the long run period free market economy could be self adjustable, but in short run period we faces financial and economical crises and even social instability and insecurity. It is very important to analyze different market actions, affected be risk seeking, imperfect competition, transactions costs and systemic risk. The main factors determining the supply and demand ratio in the market are directly dependent on the business cycle. The current stage of business cycle affects both the consumer behaviour and habits, so the established cartel stability within the changing business cycle phases depends on the members' flexibility and speed of reaction to changes within the market.

During the recent years the influence made collective action on the country's economy has been in the focus of attention. In the 6-th decade the formation collective action was analysed (Olson, 1965; Buchanan, Tullock, 1962), in the eighth decade rent seeking theories made their influence on the analysis of interest representation effectiveness and resource distribution (Colander, 1984; Moe, 1980). In the 9 th decade research included the influence collective action on nation growth and recession (Olson, 1982; Elster, 1989; Holmstorm, Tirole, 1989; Morris, 1999; Basso, Ross, 2010; Budzinksi, Ruhmer, 2010). There are some studies about interaction of business cycle and interest groups activity, effects of the business cycle in oligopoly market (Gallet, Schroeter, 1995), (Bagwell, Staiger, 1995).

Business cycles often have four stages of length and amplitude: boom, decline, recession, recovery. Cartels in financial sector participants are more guaranteed sure benefit from collective action when there is economic boom, during a decline, which makes benefit of this action less certain, cartels could break down. Financial institutions during the economy boom period are more indented to participate in collective action, especially having collusive agreements. An economic boom, associated with high profit would lead to higher benefit of cartel. During boom stage there are less destructive factors for collusive agreement except determinants as characteristics of large and small institution participation in collective actions (see figure 1).

Figure 1 Differential behaviour of financial institutions regarding collusive agreement during different stages of business cycle.



During the transition periods (recovery and decline periods of business cycle) companies reacting to each other decisions using models from the game theory approach.

Cartels Stability over Boom Phase of Business Cycle

The game theory models argue that cartel agreements are usually stable and tend to integrate at the boom phase of a business cycle, because a high price level and high corporate profitability encourages companies follow the agreements.

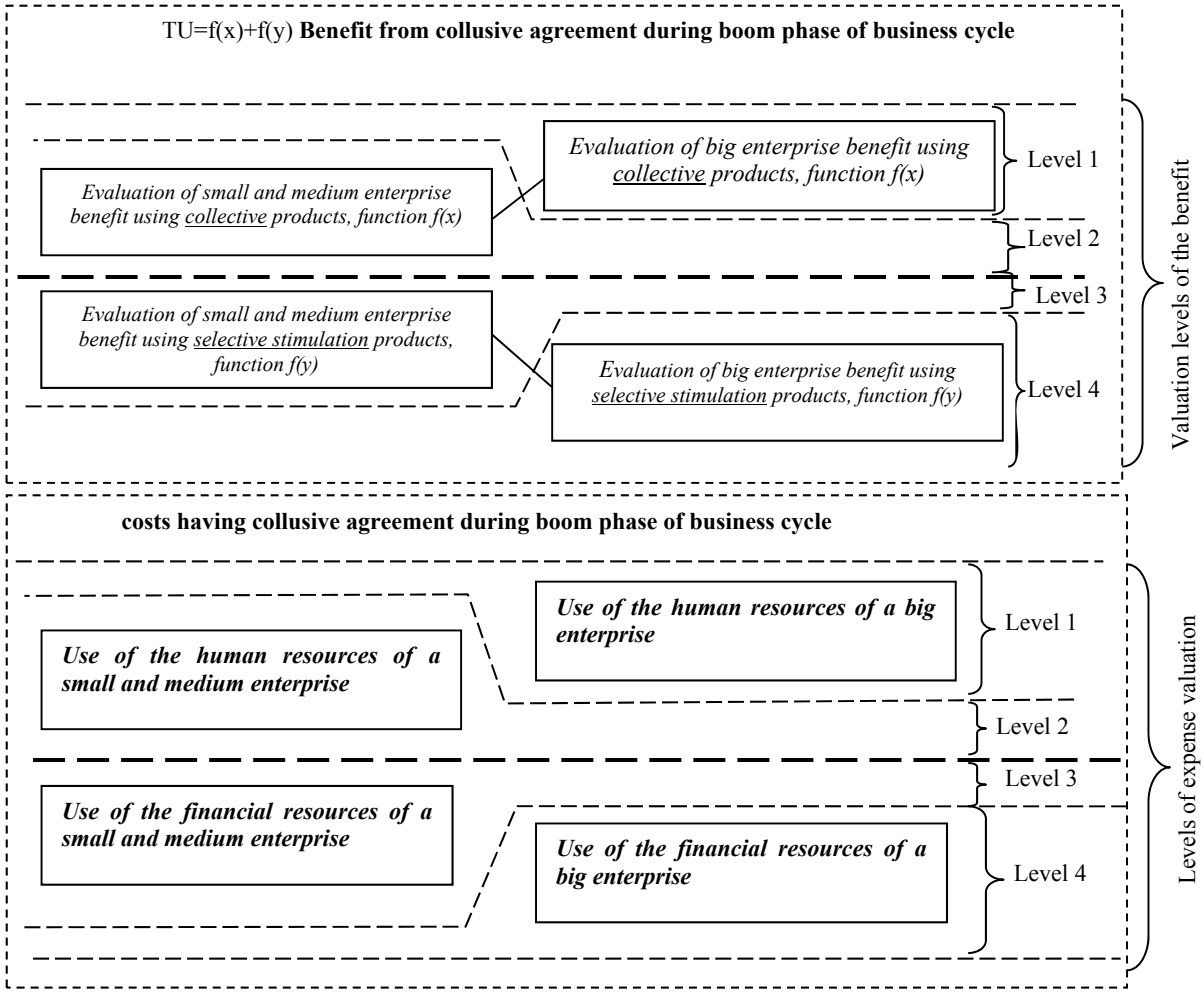
Economic companies differ in size, manufactured products and manufacturing process (mass production, unit production), market power and production customers, dislocation in the market (the domestic market and foreign market), the rate of production growth, profitability, financial resources, internal organizational structure, organizational culture, internal company code of ethics, etc. Due to such differences the interests of economic agents often differ, and different interests determine the diversity in perception of benefits gained by an economic agent. Following the collective action theory introduced by Olson, the greatest diversity of economic interests within collective action is determined by sorting its members into companies possessing more or less economic power.

One can distinguish the following characteristics of large and small businesses' participation in collective actions: due to its large-scale production a large company is better able to distribute costs related to collective actions to consumers than small companies; large companies-members allocate more time and human resources for collective work than small companies-members. Large companies dispose information

related to the current and future situation in the market provided by hired consultants, so they are more autonomous and independent than small companies.

The benefit obtained by an economic subject while participating in the collective activity is difficult to define. The advantage received could be defined and classified according to certain criteria, however, it is difficult to express it in terms of quantity units (e. g., it is rather difficult to present in monetary units some addition to a certain law influenced by an economic interest group and to evaluate its advantage and disadvantage for an enterprise). Subjects' economic capacity has influence on benefit apprehension while distributing enterprises into big, small and medium business agents (Offe, Wiesenthal, 1979, Diamantoudi, 2005).

Figure 2 Differential valuation of cots and benefit from cartel during boom phase



The supply of a collective product makes up the biggest part of the activity of collective action (see Figure 2). Economic subjects with a higher economic capacity value the benefit obtained from using collective products much more than the subjects with less economic power. (Figure 2, Level 1, Level 2). Presenting much higher evaluation of benefit, the subjects of bigger economic power want to take part in the collective activity and agree to assign more productive resources for the creation of a collective product. This condition increase the growth of a collective product supply. The subjects of less economic power value much higher the benefit obtained from using the necessary selective stimulation products (Figure 2, Level 3). They perceive the product of a selective stimulation as a supply of a specialized information about market conditions.

Cartels Stability over Decline and Recovery Phase of Business Cycle

The key challenge for collusive institution is to sustain collective action. They have to develop organization form, that continuously adapt to changing circumstances, flexibility of these organizations predicts success and stability of collective action. Competition among companies is greater during periods associated with significant negative shocks to demand, lower observed demand, lower expected future industry profit.

The volume of production resources allocated for creating an individual industrial product of actors involved in cartel actions depends on resources which remain after the contribution for conspiracy product development is made. This raises the question of conditions under which a cartel should be created, what the production resources distribution scheme should be so that the welfare of all economic agents involved in the cartel would rise, compared to the welfare when a cartel is not established; that is, under which conditions Pareto improvement is achieved.

In the case of private products, a competitive market facilitates implementation of an efficient distribution by Pareto. Each economic agent, when making a decision regarding how many different private products to consume, forms an efficient consumption structure based on Pareto.

The principal assumption of this analysis – economic agents' consumption of private products does not affect the benefits gained by other agents. In this case the public optimality is sufficiently achieved by optimization of each consumer's private product consumption. Another situation occurs with the collective product consumption. In such a case the benefit of each economic agent is inextricably linked. In this case, by providing a collective product under the market conditions, efficient supply volumes based on Pareto are difficult to achieve.

Actions of individual economic agents can impair the outcomes of a rational collective behaviour. On the other hand, the two players' non-zero sum games are not completely identical to the collective behaviour problem. "Free riding" strategy of the rational economic agents is prevailing, n – individuals' "Prisoner's Dilemma" game is not favourable with respect to participation in collective actions (Conybeare, 1984) (Hardin, 1971, Beck, Cherkaoui, Minoia, Ernst, 2007). Although in this case, the resulting Nash equilibrium of the game is achieved, but this concept is not entirely accurate, if the evaluation includes other participants' of the game actions. "Free riding" strategy will not be dominant if the economic agent thinks (or knows) that other economic agents do not cooperate. "The mechanism operates only when it is headed, if not - the collective action problem becomes a "Prisoner's Dilemma" type.

In the above example, the players play only once, but in reality they often repeat the game. In dynamics the player can influence the current decision by considering the outcomes of the previous period. According to Kurnia - Nash equilibrium, "Each economic agent responds to other agents' actions, suggesting that other economic agents react to his actions" (Taylor, 1987, Kühn, 2008). This case is known as a zero-sum game of economic agents, where the winning amount is equal to zero.

In the case of repeated games, achieving Nash equilibrium depends upon the actors' involved in the game patience; thus, every rational strategy of an economic agent is considered to be in balance.

Business enterprises, participating in cartel collective action, having costs:

w1 – A economic subject's available recourses,
w2 – B economic subject's available recourses,
g1 – A economic subject's available recourses for activity participating in collusion,
g2 – B economic subject's available recourses for activity participating in collusion,
x1 – A economic subject's available recourses for other activity (private goods),
x2 – B economic subject's available recourses for other activity (private goods).

Regarding to the rule of limited resources:

x1 + g1 = w1 x2 + g2 = w2

c – costs of cartel (if cartel members only are A and B economic subjects)

A and B economic subjects will participate in collusive activity, if:

g1 + g2 >= c

A economic subject's utility function u1(x1, G) will be regarding economic subject's available recourses for private goods x1 and collusive activity G (G = 0, when there isn't collusive agreement and G = 1, when cartel exist). A economic subject's utility function u1(x1, G), and B economic subject's utility function u2(x2, G).

It is very important, to be able recognise a marginal recourses, available for collusive activity r1. For private goods available recourses will be w1 - r1. If economic subject doesn't participating in collusive activity, then recourses available for private good will be w1.

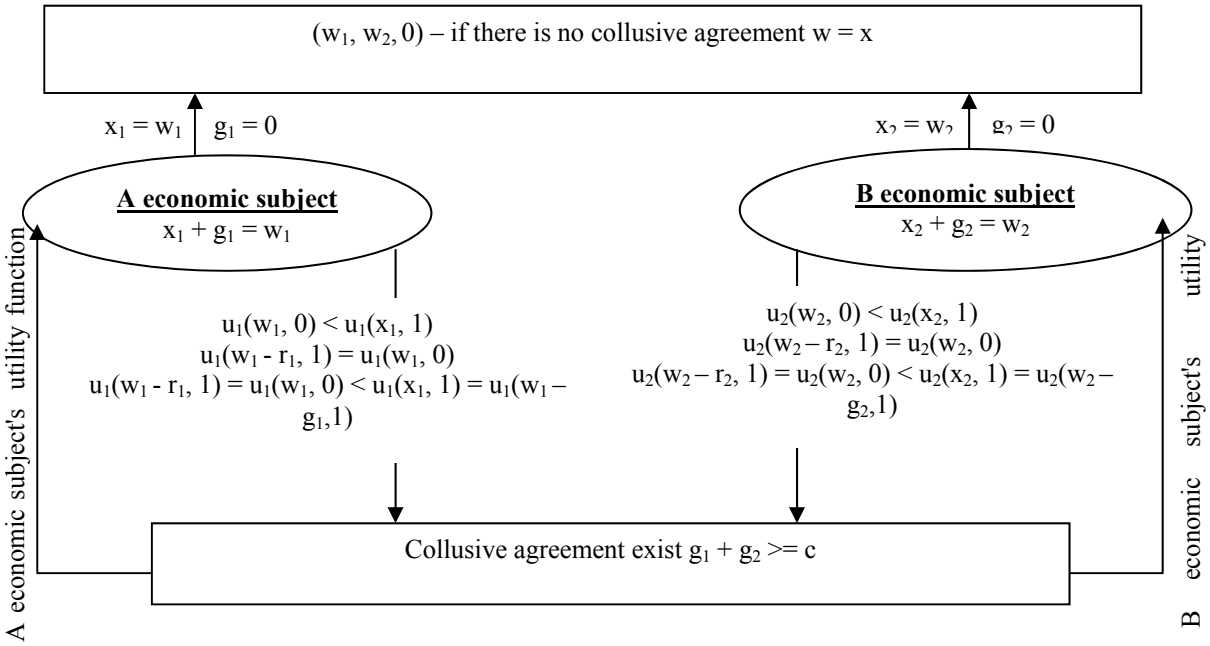
u1(w1 - r1, 1) = u1(w1, 0).

for A economic subject x1 = w1 - g1; for B economic subject x2 = w2 - g2.

According to Pareto optimal principle,

for A economic subject u1(w1, 0) < u1(x1, 1);
for B economic subject u2(w2, 0) < u2(x2, 1).
for A economic subject u1(w1 - r1, 1) = u1(w1, 0) < u1(x1, 1) = u1(w1 – g1,1),
for B economic subject u2(w2 - r2, 1) = u2(w2, 0) < u2(x2, 1) = u2(w2 - g2, 1).

Figure 3 process of creation collusive agreement during recovery



The strategy that maximizes the sum of players' usefulness involves each player making the same choice (see figure 3). In terms of a rational economic agent, the strategy that maximizes the sum of usefulness is to provide a collective product to one of the players, and for both the players to consume it. An even bigger problem arises with a game involving more economic agents. In this case, there is a higher possibility of gaining benefits by consuming the collective product at other economic agents' expense.

Cartels Stability over Depression Phase of Business Cycle

Depression collusive institutions have been permitted in industries requiring price and production stability and to permit rationalization of industry structure and excess capacity. Crisis collusive institutions have also been organized by governments for various industries or products in different countries in order to fix prices and ration production and distribution in periods of declines.

For some collusive institutions the government may establish support relating to prices or output. Competition policy distinguishes between various types of collective action. Many countries implicitly or explicitly support the activities of export orientated collective action, allowing practices considered to be anti-competitive

The operational efficiency of economic interest groups is determined by interactions between the group consolidating factors and destructive internal and external factors. The most important efficiency-enhancing factor is a positive size of ratio between the benefits of collective actions and costs of participation in collective actions. The economic agent who focuses more on benefits gained from the collective product consumption rather than on costs associated with collective actions, will get involved in the economic interest group actions. The efficiency of economic interest group actions is increased through a mutual support between economic agents when providing collective and selective promotion products.

Conclusions

1. Financial institutions, having collusive agreement, are more orientated to gain benefit from collective action when there is economic boom. An economic boom, associated with high profit would lead to higher benefit of collective action, including formation of cartel. During boom stage there are less internal and external destructive factors for collusive agreement except determinants as characteristics of large and small businesses participation in collective actions
2. During a decline period of business cycle, which makes benefit of this collusive agreement less certain, cartels could break down. In this period key challenge for collusive agreement is to sustain collective action. Participants of collective action have to develop organization form, that continuously adapt to changing circumstances. Competition among companies is increasing during periods associated with significant negative shocks to demand, like in the decline stage of business cycle. Decision making on the development of collective goods can be explained by the initial algorithm on game theory approach.
3. Depression collusive institutions are most unstable because of the high level of competition among companies, during a depression benefit of this action becomes less certain, cartels could break down. The operational efficiency of collusive institution during this phase is determined by interactions between the group consolidating factors and destructive internal and external factors. The most important efficiency-enhancing factor is a positive size of ratio between the benefits of collective actions and costs of participation in cartel.
4. Cartels stability over recovery phase of business cycle mostly depends on flexibility of these organizations to predict success and stability of collective action. The volume of resources allocated for creating an individual product cartel members depends on resources which remain after the contribution for conspiracy product development is made. Cartel might be created, when production resources distribution scheme will be so, that the welfare of all economic agents involved in the cartel would rise, compared to the welfare when a cartel is not established.

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The Assessment of Impact of Value Added Tax on the Cash Flow of Chosen Business Entities

Norbert Gyurián[1], Angelika Kútna[2]

[1] Selye J. University
Faculty of Economics, Department of Management
Bratislavská cesta 3322, 945 01 Komárno, Slovak Republic
E-mail: gyurian.norbert@ujs.sk

[2] Financial Directorate of Slovak Republic
Tax Office in Nitra
Damborského 5, 949 01 Nitra, Slovak Republic
E-mail: angelika.kutna@financnasprava.sk

Abstract: *Taxes are an important part of income of each country's budget. Their administration and collecting conditions should be also taken into consideration as factor affecting the business environment. In this context, the value added tax is one of the taxes that directly do not affect the economic situation of business entities. On the other hand, it affects in significant extent to their cash flow. The paper is focused on the impact assessment of value added tax to the cash flows of chosen business entities. The analysis is based on the given terms by the law for settling of the assessed taxes, which are subsequently reflected to the influence of cash flow figures of those entities.*

Keywords: value added tax, cash flow, business entity

JEL codes: H22, H25

1 Introduction

National budgets are an important regulation tool of national economies. State budget revenues consist primarily of tax revenues, by which State ensures the performance of its basic functions. Taxes are compulsory payments determined by State, which taxpayers have to pay to the State budget in a specific amount and in predetermined due date. Currently prevailing trend of fulfilling the state budget revenues primarily from indirect taxes, i.e. through value added tax and selective excise taxes (Sopková-Raškovská, 2013).

Value added tax is a general-purpose tax, which affects the supply of almost all goods and services. The issue of input tax credits (aliable for deduction), excessive deduction and their subsequent control by tax authorities are considered as the potentially largest source of tax evasion (Bojňanský, 2010).

Tax evasion generates billions of dollars of losses in government revenue and creates large distortions, especially in developing countries. Claims that the VAT facilitates tax enforcement by generating paper trails on transactions between firms have contributed to widespread VAT adoption worldwide, but there is little empirical evidence about this mechanism (Pomeranz, 2013).

Tax evasion is reality in modern economies, which cannot be underestimated. Value added tax by their general consumption taxation regime and the growing volume of international movement of goods, services, people and capital affects more and more citizens and companies. A particular tax system of the country is an important variable in making economic decisions of taxpayers in the field of direction of their business plans, location of business, investment decisions, and of course the fulfilment of tax obligations. (Sopková, 2011).

Value added tax represents one of the major income channel of public budget in countries, in which it was implemented. It follows from its general character (Bánociová, 2009).

Value added tax under that belongs to taxes, at which the tax liability is frequently disallowed. It is therefore important, that countries try to enforce value added tax in such a way, in which is the motivation of tax payers to declare and pay tax least unmotivated.

The main objective of this paper is to assess the impact of paying VAT on the effectiveness of selected agricultural companies and food producing enterprises of Nitra region in Slovakia.

Our analysis is based on the following assumptions:

- paying of VAT in greatly affects the cash flow of assessed companies,
- paying of VAT is necessary to pay more attention by companies,
- return of VAT excess deduction by state is too long.

2 Methodology and Data

The paper focuses on the assessment to the value added tax impact on the Slovak agricultural enterprises or cooperatives cash flows. The analysis assumes following basic assumptions:

- Data were obtained from the financial statements and from the annual reports of the agricultural and food producing enterprises or cooperatives,
- There are ten enterprises or cooperatives included in this analysis, five of them are agricultural cooperatives and five others are food processing enterprises – the assessed sample is not statistically significant. We are focused on 10 relevant companies in the evaluated sectors and we take into consideration the maximum prescribed allowance range of pages.
- The enterprises and cooperatives which are analysed in this paper were included in database according following standards:
    - We focus on the agricultural cooperatives and food producing enterprises,
    - Enterprises and cooperatives (in the next only "entities") are registered at Slovak Commercial and Trade Register, they shall be required to keep accounts and prepare financial statements in monetary units of the Euro, with the presumption of annual profit aim,
    - Entities are registered at the Tax Office of the Slovak Republic to be a value added tax- payers (in the next only "VAT payer"). All analyzed entities are monthly value added taxpayers,
    - Their economic activity („business") from which an income is accrued includes the activities of producers, traders and persons supplying services in agricultural sector.
    - The entities are from the region Nitra.

Model Specification

Not only definition of criteria for the selection of entities to database but also the methodological approach for assessment entities and method of their evaluation was necessary and important. We used following methodological approach at this paper:

- The data for analysis were selected from tax return, monthly submitted within 25 days of the end of each tax period at Slovak tax office,
- Data were converted to the tabs and schedules,
- The „time shift interval" consist of following days: first day is the day when taxpayer becomes entitled to an excess deduction and the last day of this interval is the day when tax office shall return the non-deducted excessive deduction or its non-deducted part to the taxpayer, it means the taxpayer has his money available at bank account.
- Definition of "notional interest" based on financial mathematic expression:

  "Notional interest of time shift interval" = principal x interest rate x 60/365

Where:

- principal: an excess deduction for taxpayer becomes entitled expressed in monetary terms (EURO),
- the time shift interval was sixty days in average,
- Interest rate: average nominal interest rate of commercial credits or loans provided for business companies by financial institutions (banks) in the years of analysis. The data were calculated from the National bank of Slovak Republic and they were officially published at WEB side of NBS,
- The average interest rate was calculating as following:
  - year 2011 rate 3,74 p. a.,
  - year 2012 rate 3,57 p. a.,
  - year 2013 rate 3,96 p. a.,
- „60" = the period consists of the days beginning with the day when taxpayer becomes entitled to an excess deduction and ending with the last day of this interval is the day when tax office shall return the non-deducted excessive deduction or its non-deducted part to the taxpayer, of excess VAT is not being paid to the bank account of the enterprise,
- „365" number of days in the year.

o Assessment of the achieved and founded results of the analysis and their presentation in the tables and charts forms in the conclusion of the paper.

3 Results and Discussion

Not only in economic theory but also in real business life as well, value added tax as the type of indirect tax, is not a tax directly affecting the costs. In general we cannot claim that the value added tax does not influence the economic profit of each business company. The agricultural enterprises are not exceptions. VAT influences enterprises in three main ways:

- As the part of the selling price, VAT directly increases this price for final consumers and affects the selling ability of the goods and services,
- The tax due day (obligation for payment) and the day of returning excess deduction (from the tax Office to the taxpayer bank account) both affect the cash flows of each company,
- Entity is obliged to keep detailed records by individual tax periods on supplies of goods and services – its accounting is extended on monthly VAT tax evidence which is connected with more additional costs, personal and technical costs as well.

All three ways of affecting the entities (agricultural cooperatives and food producing companies as well) are important. As for the cash flows, the second way is the most important of all these three affecting ways. This is reason why, this paper focuses on it.

Agriculture is commonly rated the hardest to tax of all hard-to-tax sectors. This is universally the case, due to the small scale and spatial spread of the activity. Agriculturalproductioniscloselyconnectedwiththebiologicalprocesses. The possibilities of agricultural production are limited with 12 month period of agricultural production. This one year period is important and in evitable mostly in a crop production. During the whole producing year the agricultural companies have to pay for the agricultural inputs. These inputs are direct and indirect costs during majority of months and the final effect is only during one month at the end of the agricultural process (the harvesting e.g.).

As for food processing enterprises, we can also consider their production to have a seasonal character. This is because they are closely connected with the agriculture and their production follows agricultural activities as well (fruit and vegetables products production e.g.).

The analysis is based on the article of Act No. 222/2004 Coll. On Value Added Tax as amended. According this Act the right to deduct the tax on goods or service shall accrue

to the tax payer on the day when a tax liability in respect of these goods or service arises (§49). If the deducted tax (if there is the right to deduct it according the Act) exceeds the tax on supplies of goods and services (§8 and §9) taxpayer becomes to be entitled to an excess deduction. To put it simply VAT on inputs exceeds VAT on outputs.

Analysis is based on the next basic assumptions:

- The tax which the taxpayer shall be obliged to pay shall be payable within 25 days of the end of the tax period in which the tax became chargeable on a taxable transaction, with the exemption of the tax imposed by a customs authority on the importation of goods, which shall be payable within the deadline applicable to customs duties pursuant to customs regulations.
- Tax return shall be submitted within 25 days of the end of each tax period by each taxpayer. The taxpayer shall be obliged to pay the tax charged within 25 days of the end of the tax period.
- If the taxpayer has no due to pay, as the second possibility he becomes entitled to the excess deduction. Then he shall deduct the excess amount from the due tax in the next tax period. If the tax payer cannot deduct excessive deduction from its own tax obligation in the following tax period the tax office shall return the non-deducted part no later than 30 days after filing the tax return for the taxation period following the taxation period in which the excessive deduction was created (section 79 paragraph 1).

As it is written above the taxpayers shall be obliged to pay within 25 days after the end of the tax period in which the tax became chargeable. If tax payer becomes entitled to an excess deduction the problem is more complicated. Then he shall deduct the excess amount from the due tax in the next tax period.

In this second case, if the taxpayer cannot deduct excessive deduction from its own due tax in the next tax period, the tax office shall return the non-deducted excessive deduction or its non-deducted part no later than 30 days after filing the tax return for the taxation period following the taxation period, in which the excessive deduction was created. The period of returning can be counted 60 days. This fact influences the cash flows of taxpayer, because this is the indirect way by which a taxpayer credits the state budget with its owns cash resources.

Table 1 Analysis of the time shift between the entitling excessive deduction and its return to the taxpayers according to the periods in 2011

Month	Agricultural companies			Food producing enterprises		
	Origin of ED-/DT+	Return of ED	Pay of DT	Origin of ED-/DT+	Return of ED	Pay of DT
1	-5412.21	0	5412.21	426.652	0	0
2	19978.28	0	0	-18996.4	0	18569.748
3	18802.706	19978.28	0	32814.27	0	0
4	27025.248	18802.706	0	29855.37	32814.27	0
5	11218.226	27025.248	0	23080.952	29855.37	0
6	-9102.434	2115.792	0	6115.868	23080.952	0
7	-79026.43	0	79026.432	-40613.3	0	34497.436
8	-17384.45	0	17384.446	-38974.5	0	38974.504
9	-12374.83	0	12374.828	-23979.88	0	23979.884
10	-20793.16	0	20793.16	-30333.23	0	30333.23
11	-36411.77	0	36411.768	-14150.96	0	14150.962
12	-22169.42	0	22169.422	-40886.16	0	40886.164

Source: individual processing

The legend: DT – due tax, ED – excess deduction

Also the third case is possible. This is the case, the taxpayer shall be obliged to pay due tax and in previous tax period he became entitled to an excess deduction. Amount of due tax is not equal to the deducted excess The tax office shall return only non-deducted part

no later than 30 days after filing the tax return for the taxation period following the taxation period, in which the excessive deduction was created.

To summarize the listed data in table 1 is it possible to define the "notional interest of time shift interval", using the financial mathematic model defined in the part "model specification".

Monetarized shift interval in EURO currency is in the Table 2. There are some information assuming from this table:

- Each agricultural company in our analysis "credits" money to the tax office, average sum of lended money was about 74 489,48 EUR per taxpayer. The period of this credit was 60 days, average interest rate 3,74 % p.a. According this „notional interest" it was 457,95EUR of interest per one agricultural company.
- Variability of analyzed data was spread, the reason for this was probably in the different activities of analyzed entities.

Table 2 Analyses of returning excess deduction of agricultural entities in 2011

Subject	1	2	3	4	5	Average
Value of ED	13508.42	29303.28	38515.08	106143.91	184976.71	74489.48
Interest for 60 days	83.049026	180.15496	236.7886	652.56694	1137.2267	457.95724

Source: individual processing

Monetarized shift interval of food businesses is presented in Table 3. There is also high variability of values in this table. The crediting of the state budget by food businesses is higher than by agricultural companies. It represents 104727,17 EUR in average in 2011. The given value is about 71.13% higher than in the case of agricultural companies. The analyzed difference is reflected in value of interest, which in case food producing enterprises constitute 643,86 EUR in an average.

Table 3 Analyses of returning excess deduction of food producing enterprises in 2011

Subject	1	2	3	4	5	Average
Value of ED	46687.95	50805.48	104481.77	130552.29	191108.36	104727.17
Interest for 60 days	287.03496	312.34931	642.3482	802.62833	1174.9237	643.8569

Source: individual processing

Another analyzed year is 2012. In that year came to decrease of average nominal interest rate of operational loans from 3,74% p.a. to 3,57% p.a.. Average data of analyzed items are presented in tables 4 to 6.

Table 4 Analysis of the time shift between the entitling excessive deduction and its return to the tax payers according to the periods in 2012

Month	Agricultural companies			Food producing enterprises		
	Origin of ED-/DT+	Return of ED	Pay of DT	Origin of ED-/DT+	Return of ED	Pay of DT
1	-4408	0	4407.998	-23974	0	23973.96
2	-15188.9	0	15188.88	11836.83	0	0
3	2603.496	0	0	38960.3	11836.83	0
4	22968.75	2603.496	0	36185.86	38960.3	0
5	11943.56	22968.75	0	26613.59	36185.86	0
6	-3658.13	8285.428	0	15369.63	26613.59	0
7	-63770.6	0	63770.62	2629.988	15369.63	0
8	-8871.61	0	8871.61	-22337.2	0	19707.21
9	-57132	0	57131.96	-28439.1	0	28439.08
10	-46557	0	46557.01	-44590.3	0	44590.27
11	-24976.5	0	24976.5	-33910.9	0	33910.94
12	-14150	0	14150.02	-18570.6	0	18570.59

Source: individual processing

From table 5 means that agricultural companies in average loaned state budget (resp. other payers of this tax) by amount of 64938,78 EUR. Comparing with year 2011 is possible to state decrease of figure by 9550,70 EUR. Interest amount of mentioned time difference is 381,09 EUR.

Table 5 Analyses of returning excess deduction of agricultural companies in 2012

Subject	1	2	3	4	5	Average
Value of ED	0	13642.55	26697.12	56839.41	227514.8	64938.78
Interest for 60 days	0	80.06121	156.6719	333.5617	1335.169	381.0928

Source: individual processing

In table 6 we evaluate food producing enterprises, in which also in year 2011 is possible to record higher figures in calculation by enterprise. Mentioned difference is in average 75561,22 EUR. For food producing enterprises in total it means figure 140500 EUR and in interest coming out from time difference amount of 824,52 EUR. Even due to decrease of interest rate is possible to record higher figures in comparation with previous year.

Table 6 Analyses of returning excess deduction of food producing enterprises in 2012

Subject	1	2	3	4	5	Average
Value of ED	22112.41	31776.64	178267.4	190247	280096.4	140500
Interest for 60 days	1116.46	186.481	1046.16	1643.74	129.767	824.523

Source: individual processing

Last evaluated year is year 2013. Time shift between start of oversized deduction and his payment by state side displays table 7.

Table 7 Analysis of the time shift between the entitling excessive deduction and its return to the tax payers according to the periods in 2013

Month	Agricultural companies			Food producing enterprises		
	Origin of ED-/DT+	Return of ED	Pay of DT	Origin of ED-/DT+	Return of ED	Pay of DT
1	-12033	0	12032.97	-27250.8	0	27250.75
2	-20669.2	0	20669.18	-26522.9	0	26522.85
3	20386.76	0	0	40037.45	0	0
4	55001.29	20386.76	0	8848.122	40037.45	0
5	17238.63	55001.29	0	16941.98	8848.122	0
6	6811.818	17238.63	0	29267.37	16941.98	0
7	-57220.8	0	50408.96	-4084.68	25182.69	0
8	-33194.7	0	33194.74	-36801.7	0	36801.69
9	-19290.2	0	19290.17	-21803.2	0	21803.24
10	-32907.7	0	32907.71	-18072.7	0	18072.69
11	-17722	0	17721.96	-5171.35	0	5171.348
12	-32372.4	0	32372.42	-28721.4	0	28721.41

Source: individual processing

Average figures of analyzed data for year 2013 are displayed in tables 8 and 9. From table 8 we can see that in average every agricultural company for year 2013 loaned state budget (resp. other registered payers) by amount 93252,02 EUR. With average interest rate 3,96% it means interest in average for one agricultural company at figure 607,03 EUR.

Table 8 Analyses of returning excess deduction of agricultural companies in 2013

Subject	1	2	3	4	5	Average
Value of ED	1822.4	32186.98	46489.84	132668.8	253092.1	93252.02
Interest for 60 days	11.86308	209.524	302.6298	863.6195	1647.525	607.0323

Source: individual processing

Figures of indicator time shift for food producing enterprises we show in table 9. In comparation with agricultural companies we can see very small differences. Variability of loan figures in case of food producing companies is lower as of figures of agricultural companies.

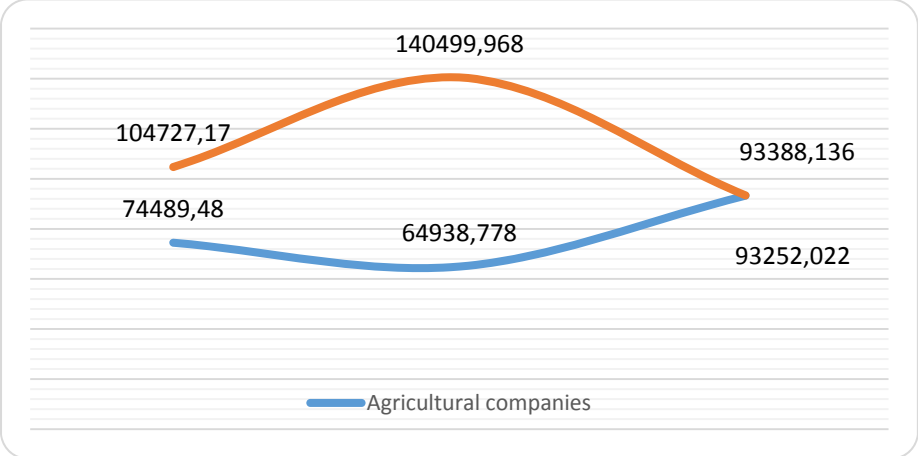
Table 9 Analyses of returning excess deduction of food producing enterprises in 2013

Subject	1	2	3	4	5	Average
Value of ED	45729.76	46705.48	56213.61	145010.5	173281.3	93388.14
Interest for 60 days	297.6819	304.0335	365.9275	943.959	1127.99	607.9184

Source: individual processing

Better explanation of total progress of time shift figure provides Figure 1. From this figure we can see that total progress of figure in case of analyzed agricultural and food processing companies is opposite. In case of food producing companies is possible to record rapid increase and following significant decrease of figures. In case of agricultural companies start with slow decrease and continue with slow increase of figures. In year 2013 figures of indicator are almost same in case of both groups of analyzed companies.

Figure 1 Development of value of the time shift between origin of ED and its encashment during period 2011-2013



Source: individual processing

4 Conclusions

In analysis we wanted to point out the impact of clearance value added tax to cash flows of agricultural and food processing companies of Nitra region. As the result of the analysis is possible to make following outcome:

- By food producing companies we have recorded in every year higher values of loan of state budget as for agricultural companies.
- In case of agricultural companies were recorded in every year lower figures. On the other side is necessary to count with fact that their count is several times higher as of food processing companies.
- Concerning the bad finance, economical and property situation as well as situation of agricultural enterprises on Slovak market, significantly would effect to

improve their economic situation shortening of time of clearance of redundant deduction. Mentioned fact is necessary to solve on legislative level, what would be seen mostly in improvement of their ability to pay their debts to other enterprises.

- It is clear from our analysis, that paying VAT has own specifics. It is visible, that paying VAT greatly affects the cash flow of analysed companies. Therefore we recommend, that companies should pay more attention to tax planning. This should be taken into consideration by the most of business s transaction and the companies should develop a plan of received transactions of higher value.

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The Issue of Indebtedness of Czech Hospitals

Tana Hajdikova[1], Lenka Komarkova[2], Petr Pirozek[3]

[1, 2] University of Economics, Prague
Faculty of Management
Jarosovska 1117/II, Jindrichuv Hradec, Czech Republic
E-mail: hajdikova@fm.vse.cz, komarkol@fm.vse.cz

[3] Masaryk University
Faculty of Economics and Administration
Lipova 41a, 602 00 Brno, Czech Republic
E-mail: pirozek@econ.muni.cz

Abstract: *The paper represents the current state of indebtedness of Czech hospitals in dependence on the selected financial indicators and parameters. It responds to the current challenges related to adjustments of the health care financing system which not only EU countries are facing. It also points to the problem of financial reporting and accounting processes of organizations providing health care. The research was based on analysis of secondary data, which were selected from annual reports and internal documents of hospitals in the year 2012. In the research the following financial indicators were used - revenues, subsidies, personnel costs, depreciation, liabilities. The legal form of the hospital is also taken in account. Statistical analysis of dependencies was performed on the obtained data. The period of 2012 was chosen because it is the last known year for which hospitals submitted their annual reports. The presented research provides objective evidence of indebtedness of hospitals in the area of the Czech Republic and discusses the currently performed estimate that says a third of hospitals are facing the danger of extinction due to their high indebtedness. The achieved results of the research indicate the current state of indebtedness of hospitals in terms of cost structure (depreciation, personnel costs) and their relation to achieved revenues, net of subsidies received.*

Keywords: hospitals, revenues, subsidies, indebtedness, personnel costs

JEL codes: H2

1 Introduction

The issue of health-care financing is associated with the interaction of public and private providers with the impact on the financial structure of stakeholder organizations (Kalouda, 2013). Financing related to the legal form of the hospital is currently under discussion (Albreht and Klazinga, 2009), (Mishtal, 2010) and as such should result in the establishment of basic financial parameters to demonstrate a responsible financial management. In addition, in connection with the financing of medical facilities, it requires maintaining of the provision of quality and efficient health care. The first important impulse which intervened in the financing of health care facilities was the change of legal form as a transition from public and subsidized legal forms towards the legal form of the business company. This had such an effect , that currently there are several legal forms of health care facilities in the private and public ownership in the Czech Republic (Stritecky and Pirozek, 2003). Most often we meet the legal form of a company (limited liability company, Joint-stock Company) or in the form of subsidized organizations. In most cases, the founder is the appropriate county or municipality or city. Large, so called university hospitals are managed by the Ministry of Health. Minority owners are private individuals or religious organizations.

In connection with the transformation of legal form it was expected that this will stabilize the management of hospitals while maintaining the availability and quality of health care services (Hajdikova et al., 2014). Regarding the legal form, there are also opinions that a greater autonomy of hospitals will provide flexibility to solve specific issues through management at the hospital level (Jakab et al., 2002). Alternatively stated, on the one hand, there are benefits associated with higher motivation, income, flexibility,

accountability and efficiency, and on the other hand, the disadvantages in terms of risks and fragmentation of hospital autonomy (Maxwell, 1997).

On the basis of the ongoing transformation of the legal form and related financing of healthcare facilities, the issue of financial management and evaluation of the corresponding financial indicators comes to the forefront (Votapkova and Stastna, 2013). Based on the experience from the private sector it is successfully implemented in the public sector (Hrůza and Valouch, 2013).

Indebtedness is an economic term which indicates the fact that the company is using liabilities to finance its assets (Synek, 1999). The use of liabilities affects the level of risk of realized activities. However, when financing assets only from equity, the overall profitability may be reduced (Synek, 1996). The assets are financed, depending on the size of the company, through a combination of equity and debt (Wöhe and Kislingerová, 2007). The associated debt issue also applies to health care facilities. State-run hospitals (university hospitals) have overdue liabilities in total of more than five thousand million crowns. Actual financial results show that the fastest indebted were the university hospitals. In this situation, the crisis management committee of hospitals, unions and patients warned that, due to this issue, a third of hospitals are threatened by extinction. In addition, half of the university hospitals and institutes managed by the Ministry of Health ended in the first half of 2013 at a loss (ÚZIS, 2014).

In this context, one may question whether the university hospitals are the most indebted when comparing the economy with various types of legal forms of health care facilities. Part of the costs of health care facilities and approach of their effects is the segmentation on variable and fixed costs (Pappas and Hirschney, 1990). Fixed costs are significantly represented in the functioning of hospitals and the largest share is made up of the depreciation and personnel costs - staff salaries (Pirožek and Střítecký, 2002).

For an objective evaluation of financial indicators of all represented types of legal forms, it was needed to obtain achieved revenues of organizations and purify them of subsidies received. Given the importance of the operation costs and its management, the indicator of selected costs associated with the operation of the hospital was also included in the subject of examination. Indebtedness in the form of liabilities is being put in connection with the search for mutual dependence for different types of legal forms of hospitals.

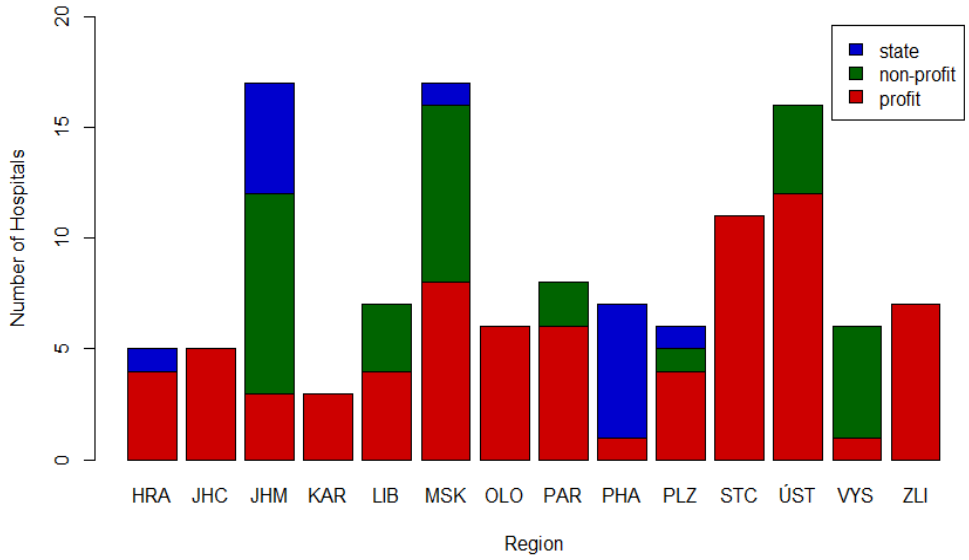
The research question, that is the subject of this paper, is whether there is a significant difference between the level of indebtedness in relation to financial indicators represented by achieved revenues and major operating costs in represented legal forms of hospitals.

2 Methodology and Data

For the description and analysis of indebtedness of hospitals in relation to selected indicators, the data from 186 hospitals has been used. 121 hospitals (65.1% of the overall sample) were analyzed, for which all of the examined variables (liabilities, revenues, subsidies, personnel costs and depreciation) were available. Regarding the legal form of hospitals, there were 75 business companies (53 joint-stock companies, 22 limited liability companies), 32 subsidized organizations (30 subsidized organizations, 2 charitable trusts) and 14 state hospitals (all in the legal forms of subsidized organization, 12 of these are founded by the Ministry of Health, 2 by central authorities). All of these 3 types of hospitals were together represented only in the region of South Moravia, Moravian-Silesian region and Plzen region (Figure 1).

At first, for the individual financial indicators a descriptive statistics (characteristics of location, boxplots) with regard to the type of legal form has been performed. Subsequently, the research problem has been analyzed using a regression model. Statistical data processing was performed in the statistical software R version 3.0.1

Figure 3 Distribution of types of hospitals across regions



Source: author's own research

3 Results and discussion

Regarding the aim of this paper, following indicators have been observed: liabilities, revenues net of subsidies (revenues - subsidies) and operating costs (personnel costs + depreciation). These indicators are reported in the financial statements for the observed period in obligatory annual reports.

The liabilities indicator is a value from the balance sheet statement, which is part of the financial statements in accordance with the current accounting rules. Liabilities represent a debt owed to creditors and as such are expected to be settled within the agreed period of time and will not bear interest.

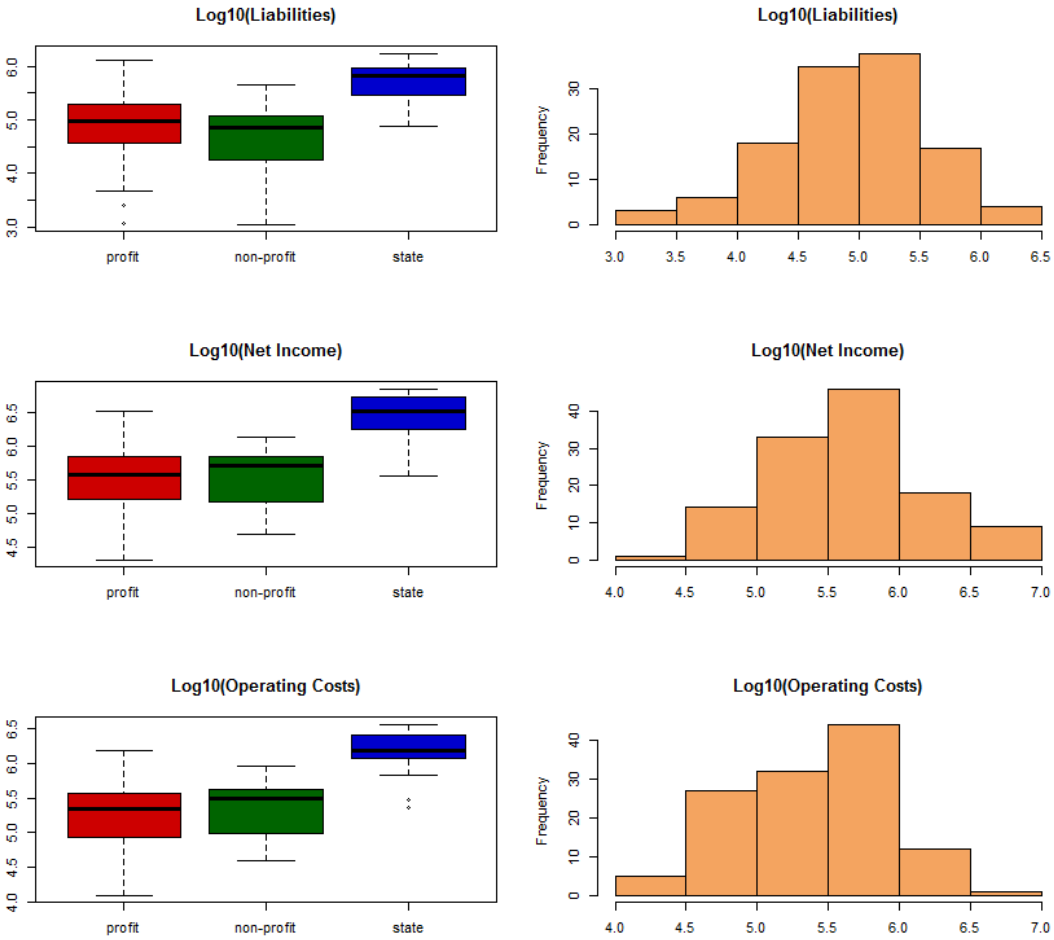
The results show that liabilities are used mostly by the state hospitals, which have the highest net income and operating costs (Table 4, Figure 4). With respect to the asymmetric shape of the distribution of financial indicators with a large number of outliers, the decimal logarithm has been used for transformation (given that financial indicators are presented in thousands of CZK, the logarithm value of 1 means 10 000 CZK, the value of 3 means 103 000 CZK, i. e. CZK million). The explanation is that the state hospitals are, compared with other types of hospitals, very large.

Table 4 Summary statistics (mean, median, lower and upper quartile) for the financial variables

Financial Variable	Type of Hospital	Mean	Median	LowerQ	UpperQ
Liabilities (thousand CZK)	profit	150947	94725	37287	196830
	non-profit	90719	72032	18620	119974
	state	701998	654205	308966	888132
	Total	198777	94725	36857	199477
Net Income (thousand CZK)	profit	521983	367041	158310	685718
	non-profit	485072	519596	152710	689902
	state	3659294	3340059	2091597	5278317
	Total	875216	466200	163077	841922
Operating Costs (thousand CZK)	profit	286348	223570	87320	375042
	non-profit	295333	316254	100338	403759
	state	1729959	1550890	1201073	2468884
	Total	455754	288335	94949	474641

Source: author's own research

Figure 4 Distribution of the financial variables after the log10-transformation (boxplots, histograms)



Source: author's own research

The indebtedness represented in the form of liabilities was investigated in relation to net income and the operating costs with regard to the use of legal form by the general regression model (GRM) with one quantitative (net income, respectively operating costs) and one qualitative explanatory variable (legal form of the hospital). With regard to the shape of the distribution of financial indicators, the log-log model without interaction has been used (interaction was not statistically significant; p=0.520, respectively p=0.585).

$$E log_{10} Y = \beta_0 + \beta_1 u_1 + \beta_2 u_2 + \beta_3 log_{10} x, \quad (1)$$

where *Y* represents liabilities, *x* represents net income (respectively operation costs), u_1, u_2 are 0-1 variables, where u_1 indicates a state hospital and u_2 indicates the business company (if $u_1 = u_2 = 0$, it is then subsidized company). The result of the analysis in the form of point and interval estimates of regression parameters β_0, β_1, β_2, β_3 including the statistical significance render the Table 5 a Table 6. Fidelity of both models (according to *determination coefficient* R^2) was 76 %.

Table 5 Results of regression analysis (Liabilities vs. Net Income)

	Estimate	Std. Error	Conf. Interval	P-value
Intercept	-1.080	0.356	(-1.784, -0.376)	0.003
Form: State	0.027	0.115	(-0.201, 0.254)	0.817
Form: Profit	0.222	0.065	(0.093, 0.352)	< 0.001
Log10(Net Income)	1.045	0.064	(0.919, 1.170)	< 0.001

Source: author's own research

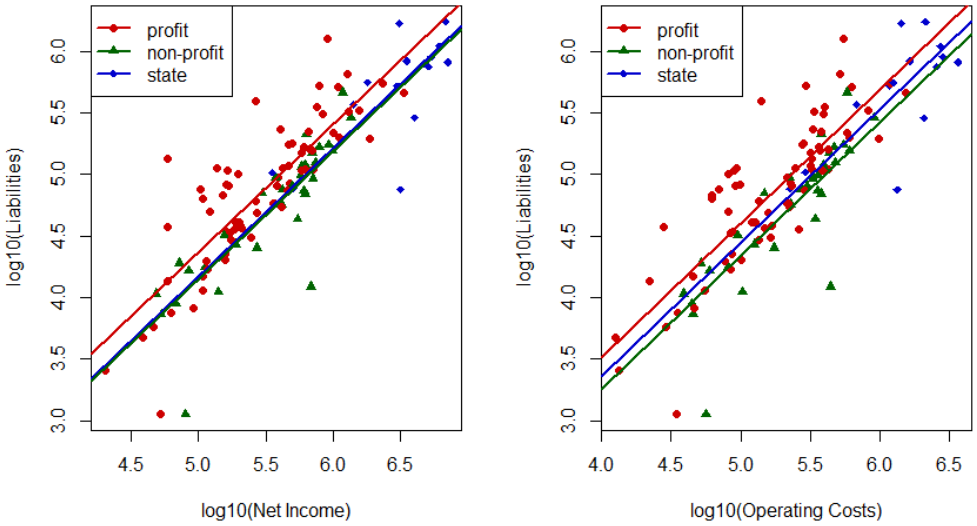
Table 6 Results of regression analysis (Liabilities vs. Operating Costs)

	Estimate	Std. Error	Conf. Interval	P-value
Intercept	-1.094	0.361	(-1.808, -0.380)	0.003
Form: State	0.106	0.114	(-0.119, 0.331)	0.352
Form: Profit	0.264	0.066	(0.134, 0.395)	< 0.001
Log10(Operating Costs)	1.086	0.067	(0.954, 1.219)	< 0.001

Source: author's own research

The analysis shows that with the same net income or operating costs, the average liabilities statistically significantly differ between the legal form of business company and subsidized organization (visual idea is shown in Figure 5). In the case of hospitals in the legal form of business company, the liabilities are used more, on average by 67 %, respectively by 84 % ($10^{0.222}$=1.667, respectively $10^{0.264}$=1.837). Between state and subsidized hospitals no statistically significant difference can be proved (both financial indicators, net income and operating costs, could not be included in the model at the same time due to the high multicollinearity of the model. The correlation coefficient between these indicators in the logarithmic transformation amounted to 0.97).

Figure 5 Log-log regression models for liabilities



Source: author's own research

4 Conclusions

The paper shows some new facts regarding the observed period and indebtedness of Czech hospitals in dependence on the selected indicators. The research was conducted on analysis of secondary data, which were selected from the statements and internal documents of hospitals in the observed year of 2012. Among certain limitations belong the results of reporting of hospitals, that were either incomplete or did not match their carrying amounts reported in the financial statements. Among hardly observable data belong mainly amounts of the operating subsidy received. In addition, it turns out that subsidies have a very significant impact on the total amount of net profit.

The results obtained do not indicate a significant mismatch between the number of observed indicators in different types of legal forms. Despite some differences in state hospitals (run by the Ministry of Health and local authorities), no significant difference in performance can be stated. This type of legal form, despite its higher indebtedness, reaches higher revenues net of subsidies and a greater representation of the most significant operating costs.

From a statistical processing there is a noticeable relationship between selected legal form and a greater use of external resources. The higher value of liabilities can be found

at hospitals with the legal form of business company in contrary to the legal form of subsidized organizations. This is mainly due to the possibility to use liabilities in the legal form of the business company, which are in the hands of private owners.

From the comparison of the presented legal types of hospitals, a more cautious use of liabilities can be recommended for the legal form of business company (with respect to net income or operating expenses). By comparison, hospitals with the legal form of subsidized organizations have almost the same elements of behavior as those of state type in the use of liabilities in relation to total revenues.

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Longitudinal Design as an Extension to Standard Banking Approaches to Companies' Financial Performance Assessment and Prediction

Lubor Homolka[1], Jiří Doležal[2], Petr Novák[3]

[1] Tomas Bata University in Zlín
Faculty of Management and Economics, Department of Statistics and Quantitative Methods
Mostní 5139, 760 01 Zlín, Czech Republic
E-mail: homolka@fame.utb.cz,

[2] Tomas Bata University in Zlín
Faculty of Management and Economics, Student of Master's program Finance
Mostní 5139, 760 01 Zlín, Czech Republic
E-mail: j2_dolezal@fame.utb.cz

[3] Tomas Bata University in Zlín
Faculty of Management and Economics, Department of Enterprise Economics
Mostní 5139, 760 01 Zlín, Czech Republic
E-mail: pnovak@fame.utb.cz

Abstract: *Financial distress modelling used for loan-approval decision making has received a lot of attention from both practitioners in commercial banks and academics over the last decades. Several modelling techniques accepted by both sides have emerged from the literature review. Surprisingly, such models are usually developed on cross-sectional data with lagged variables. This study extends traditional cross-sectional framework by employing longitudinal design in connection with generalised linear mixed models (logistic regression). Results are summarised by receiver operating characteristic curves. This approach allows direct comparison of techniques with different complexity and can incorporate different cost of misclassification (granted loan to defaulted company and loan rejection to healthy company). Our results obtained on sample of 278 companies suggest that longitudinal approach allows identification of company-specific behaviour. As analysis of receiver operation characteristic shows, this turns in high predictive power of bankruptcy classification on one year predictive horizon.*

Keywords: longitudinal design, GLMM, bankruptcy

JEL codes: C51, G17, G32

1 Introduction

The importance of financial models oriented towards lending processes has received large attention as a result from financial crises of 2008 and consequent credit crunch. This development points to several aspect of credit risk modelling.

There are two contending aims of entrepreneurs (these are not restricted to banks and smaller financial institutions only). Companies undertake risks to receive rewards (projected in cash flows). According to economic theory association between risk and reward is positive. Generous lending or investments to risky counterparts can result in higher rewards but can jeopardize the whole business. On the other hand, stakeholders consider capital returns as an investment decision making tool. Strict lending and investing policies can result in economical default as well. The importance of rules which correctly assess risks and rewards is therefore crucial today. Economic environment is highly competitive and focus only on cost-cut strategies cannot govern profit margin large enough to survive.

Scope of studied problem, i.e. counterpart's risk assessment, spans from company-level trading decisions to bank supervisors and other institutional policy makers. Recent development in the field of credit risk modelling was driven mainly by banking sector. Basel II allowed banks (after fulfilling requirements) to use their own internal rating system in IRB regime to assess obligor's risk-profile. But, this approach brought a lot of

controversy (Herring, 2011; Cipovová, 2012a). There is ongoing dispute over banks' conflicting role in valuation of its own assets and liabilities which is magnified by methodological deficiencies in credit-risk models (such as absence of robust methods in estimating Value at Risk (Rossignolo, 2011) or weak validation conditions (Belás, 2012) of credit portfolio). Moreover, according to Belás (2011) these changes fuelled macro-economic instability which results in deeper pro-cyclical behaviour of overall economy.

The objective of this study is to introduce two-stage model with high predictive accuracy and assess its performance by ROC tools. We do not present model's parameters and corresponding inferential statistics as this model serves only for prediction. The remainder of this paper is organized as follows. Next section reviews studies with similar objective with accent on analytical methods and selected variables. In section methods and data we introduce our time-varying sample and data-cleaning approaches Description of two-stage modelling procedure consisting of generalised linear mixed model (GLMM) and linear regression follows. In the last section we present results obtained from our model using receiver operational characteristic curve and confusion matrix. Last, caveats to practical implementation and other limitation of our study are considered.

Related Studies

Analytical models constructed for predicting bankruptcy, default or other form of financial distress are relatively similar in terms of used methods and selected variables. However, there are differences across authors in the definitions (e.g., distress, default), researchers' aims and interpretation of variables in feature space (Ravi, 2007).

Next paragraph introduces standard analytical methods. Second paragraph discusses pitfalls resulting from impropriate data scheme and suggests survival model and auto-correlated models as a solution. Third paragraph highlights different definitions of "distress" situation used in literature. In the last paragraph we review most common indicators used for distress modelling which also set basis for our study. We've restricted our review only to early warning systems and bankruptcy prediction models used for small and medium companies (except from the most important Altman's paper). Models describing start-ups, large financial institutions or large multinational companies were not considered.

The era of default modelling with more sophisticated methods than financial-ratios started by publishing seminal works of Beaver (1966) and Altman (1968). Both authors used linear discriminant analysis (LDA) to find classification rule for dichotomous output. Later, LDA was extended to handle non-linear decision boundaries by developing Quadratic discriminant analysis (QDA). With rise of computational power logistic regression become preferable statistical method for default modelling. Apart from statistical techniques other methods were used. As the most important classification algorithms can be named multi-layer perception neural network (MLP), self-organizing map (SOM), and support vector machines (SVM). For more depth-in historical review we refer reader to Ravi (2007).

Surprisingly, majority of these models are created on cross-sectional data and can be therefore considered only as a single-period classification models. These "static models" can be extended by time-varying covariates, as Shumway (2001) has shown when he introduced hazard model for bankruptcy forecasting. His paper points to theoretical flaws of standard approaches and recommended class of survival models as a remedy. His major reproof states: *"By ignoring the fact that firms change through time, static models produce bankruptcy probabilities that are biased and inconsistent estimates of the probabilities that they approximate."* As a class of static models Shumway considered those which do not incorporate historical development of economical characteristics. If the last two years (in form of lagged variables) are considered, research design does not allow distinguishing healthy companies which go bankrupt next year and therefore cannot correctly describe bankruptcy trajectory. Second problem is the arbitrary time setting when companies are identified as either bankrupted or healthy. This results in

selection bias. Adjustments allowing time dynamics using lagged values cannot be considered as proper multi-period models, because they do not properly describe auto-correlation structure resulting from repeating observations on one sample. Nam et al. (2008) highlight methodological difficulties with standard cross-sectional design and suggest duration models (survival analysis) and mentions joined models (implicitly). He points to deficiency of standard classification methods (such a LDA) which assume two groups from distinctive populations. These populations should differ in feature space values (such as mean values of variables) to ensure good separability by some threshold (border in form of single number in simple cases to hyper-planes in sophisticated cases). Duration models do not state this assumption and consider all subjects to belong to one population. To our knowledge use of GLMM for bankruptcy prediction is not considered under standard frequentist statistics as it is usually replaced by previously mentioned survival models. There is at least one attempt from Bayesian perspective (Mcneil, 2007) but is not followed by other authors. We devote more space to auto-correlated models in Model specification section.

Financial distress models must set clearly what is meant by "distress" or default. Beaver (1966) defines default as a situation when company announces its bankruptcy, inability to repay bonds and preferred stock dividends or when over draw bank account. Tinoco reviews financial distress conditions by other authors and emphasises Wruck's, Asquith's, Andrades' and Whitaker's definitions. Wruck (1990) considers company as defaulted when company fails to meet its financial obligations. Asquith (1994) tightens default with interest coverage ratio assuming that company close to bankruptcy issues junk-bonds with higher interest rate. Company is considered as defaulted when EBITDA is less than 80% of its interest expense. Andrade (1998) supports Asquith and considers company as defaulted in the first year when EBITDA is less than financial expenses. Whitaker takes value standpoint to default and argue that financial distress can be detected before the default even by analysing a proportion of the loss in company's value. Whitaker considers company defaulted when cash flows is less than current maturities of long-term debt, but this have to be supported with either negative rate of growth in market value or negative growth in market values adjusted to market specifics.

The domain of predictors used in our analysis was based on literature review of Ravi (2007), Tinoco (2013), Lin (2011) and Nam et al. (2008). Ravi reviews 124 papers published during 1968 - 2005 period. He emphasises the importance of used analytical technique (statistical or artificial-intelligence driven models) on feature selection. All reviewed papers focus on bankruptcy and default predictions, but with different definition of default. From the quantitative perspective (ratios with highest occurrences irrespectively to default definition) the majority of papers use 4-6 dimensions to predict default behaviour which were used in Beaver (1966), Altman (1968) and Deakin (1972). Nam et.al (2008) extends this feature space by including dimensions of: *growth* (he finds differences in Growth rate of net worth and Growth of added value per employee in classes by employing Wilcoxon test), *safety* (Cash flow to total assets and Operating profit to financial cost), *productivity* (Added value per employee and Ordinary profit per employee). He also considers log of relative firm size and operating Cash flow to liabilities as *others*.

Table 1 Summarizes variables selected to our model with economic justification.

Code	Dimension	Formulae	Multiple name
X1	Leverage	Total debt to Assets	Debt ratio
X2	Liquidity	Cash to Liabilities	Cash ratio
X3	Efficiency	Sales to assets	Assets turnover
X4	Profitability	Net Earnings to Equity	Return on Equity

Source: Own processing

2 Methodology and Data

Our initial sample consists of 278 companies from the Czech Republic. These were analysed during the period of 2007-2012. To mitigate industry specifics, we restrict our sample to plastics producers with 221 and 222 NACE code and NACE 25 - metal manufacturing companies only. Some companies were not present during the whole period, as it is shown in Table 2. Companies were selected by random from those with available accounting information. We understand that this sampling scheme introduces selection bias, which is in our economic environment extremely hard to avoid.

We consider default as a situation when bankruptcy proposal is announced. This predates court decision about bankruptcy proposal and is earliest publicly available official warning information. Although the purpose of such an announcement might be only a way to solve negligible litigation, it sends negative signal to market partners and can be viewed as a management failure.

Our default definition makes default prediction and identification more difficult. It can be expected that initials signals are less apparent and harder to detect from financial statements, which objects to discretional decisions from management side.

Table 2 Overview of our data sample

Year	Non-problematic	Announced for listings	No. companies
2007	108	0	108
2008	244	2	246
2009	223	11	234
2010	206	10	216
2011	183	9	192
2012	167	6	173

Source: Own processing

To fulfil aim of this research paper, ROC performance measures were used to evaluate models. We define accuracy as the percentage of records that are correctly predicted by the model. Sensitivity (also known as recall) is the ability of the model to predict a financial distress event correctly. It is computed as a true positive (defaulted companies assigned as defaulted) to all positives (all assigned defaults with those, which are actually non-defaulted). False positive rate (fallout) is the rate of well-performing companies but assigned as defaulted to all companies assigned as defaulted. 1-fallout is known as specificity. Finally, AUROC value summarises performance by computing area under ROC curve. If this statistics takes value 0.5 or lower, model is not better than random guess. Higher values indicate better classification performance.

Table 3 Cost matrix

		Reality	
		Default	Non-default
Predicted	Default	5	-10
	Non-default	-40	5

Own processing

As stated in introduction, dimensions of risk and reward must be considered in the process of default modelling. Our cost matrix (Table 3) brings both explicit costs, which are induced when the loan is granted to to-be defaulted company and implicit costs in form of opportunity costs. We also reward model when defaulted company is correctly recognised and loan is not granted.

Model Specification

We employ logistic regression on longitudinal data. This adjustment for time variation allows for correct treatment of auto-correlated variables. Our model uses both fixed and

random effects hence the mixed model terminology. We have employed both random intercepts and slopes (depicting time domain) and fixed covariates (financial indicators). This settings lead to GLMM model. Nam et al. (2008) show that predictions arising from this method are very similar to results from hazard models.

In our research design companies are considered either defaulted $(y = 1)$ or healthy $(y = 0)$. We index time domain by j where maximum value is 6 (stands for year 2012) and individual by $i = (1,2,...n)$. Our model utilizes 4 variables coded as x_k, briefly described in Table 1. Variables were winsorized (trimmed at 5th and 95th quintiles) to soften influence of outliers. Ranges of variables given companies pertinence to class is shown in Table 4.

Table 4 Ranges of variables given companies pertinence to class

	leverage	liquidity	efficiency	profitability
Min.	-1.204	-0.529	0.000	-0.427
1st Qu.	0.102	0.368	0.850	-0.026
Median	0.342	1.367	1.392	0.039
Mean	0.272	3.618	1.528	0.028
3rd Qu.	0.629	4.215	2.132	0.117
Max.	0.917	19.949	3.790	0.321
NA's	1	157	0	13

Source: Own processing

We used statistical package R 3.0.1. For the purpose of Generalized linear mixed models (GLMM) modelling library lme4 (Bates, 2014) was used. Although some difficulties in presence of missing values (NA in Table 4) can occur, random effects (both intercepts and slopes) can be estimated if at least two observations (complete year figures) are present. However, some observation was omitted from computation. As a model identification procedure was used maximum likelihood (Laplace Approximation) estimator. Set of linear predictors was linked to conditional mean of the y through the inverse link function. In our settings we use *logit* function and corresponding binomial family. We propose two step procedure. In the first step we employ GLMM written as:

$$Y_{ij} \sim \text{Binomial}\left(n_{\text{ij}}, p_{ij}\right) \tag{1}$$

where Y_{ij} is a vector of zeros and ones indicating whether individual i in times $j = j_i,\ldots,J_i$ (it's necessary to use subscript in j_i to allow different time company entered/leaved sample) was announced for bankruptcy or not. We model p_{ij}, probability of individual being classified as announced $y = 1$ given covariates as:

$$\log\left(\frac{p_{ij}}{1-p_{ij}}\right) = X_{ij}\beta + Z_{ij}b_i \tag{2}$$

assuming random b_i coefficients of individual i to follow $N(0, D)$ with covariance matrix D. Vector β is a vector of fixed-effect parameters. Data matrix X_{ij} stores covariates of individuals in across available times. We have only one observation for every *i* in particular *j* so $n_{ij} = 1$ or zero when missing.

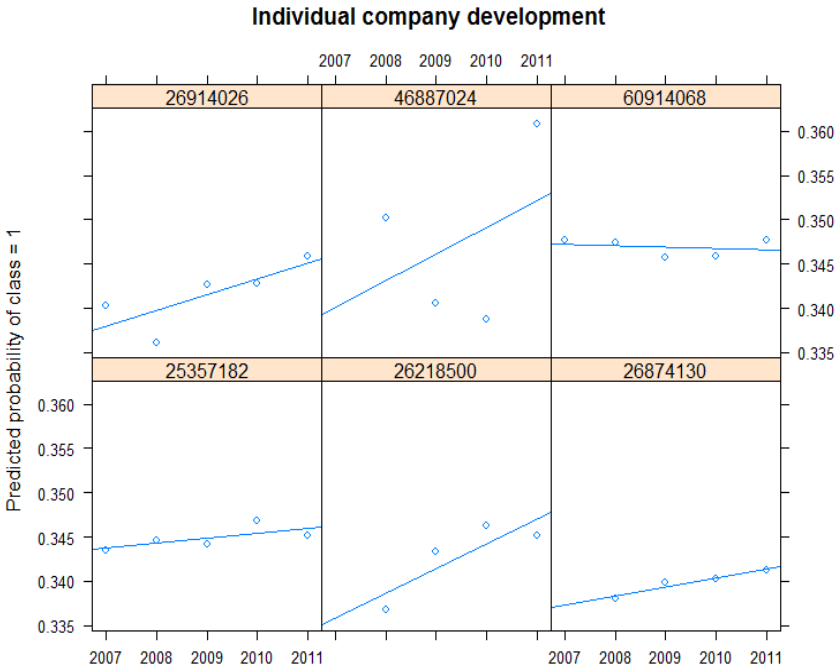
In the second step we utilize semi-results from GLMM. Although estimates of Y_{ij} are known, we continue with estimates of p_{ij} to track development of each company in vector h_i. Based on the history of p_{ij} we predict behaviour in 2012. History is analysed by simple linear model, because no significant improvement was achieved by employing higher polynomial function or splines. This linear model is written as $h_{ij} = \text{N}\left(\mu_{\text{i}}, \sigma^2\right)$

where $\mu_i = \alpha T_i$. Matrix T_i is a matrix of years for which track history of company i and can be written for particular period j as $T_{ij} = \left[1, t_{ij}\right]^{\mathrm{T}}$.

3 Results and Discussion

We will demonstrate our results in Figure 1. Each frame in the figure represents a history of particular company whose identification number is written at the top of the frame. Points in each frame represent p_{ij} estimates from the first stage (employing GLMM model which reflects four dimensions (see Table 1) of studied problem and time dimension). As the future values of financial ratios are unknown in advance, we predict future probability of default by simple linear regression (second step). In this paper we limit ourselves only to comparison of absolute values of probabilities to selected threshold. Analysis of default probabilities development seems promising but requires different analytical methods not considered in this paper (such a cluster analysis or self-organising maps).

Figure 1 Trajectory of probabilities of "default" class membership for



Source: Own processing

After the probabilities are set it's important to find suitable threshold for further classification. This decision is visualized at left side of Figure 2. We set threshold value as a value for which the overall cost function becomes flatter. It can be viewed as point where marginal increase in costs (here after profit ~ 480) becomes small enough to cover possible problems arising from higher rate of false negatives. We set threshold on the value of 0.3515 for classification decisions in both years 2011 and 2012. If h_{ij} exceeds 0.3515 we assign company as defaulted ($y = 1$).

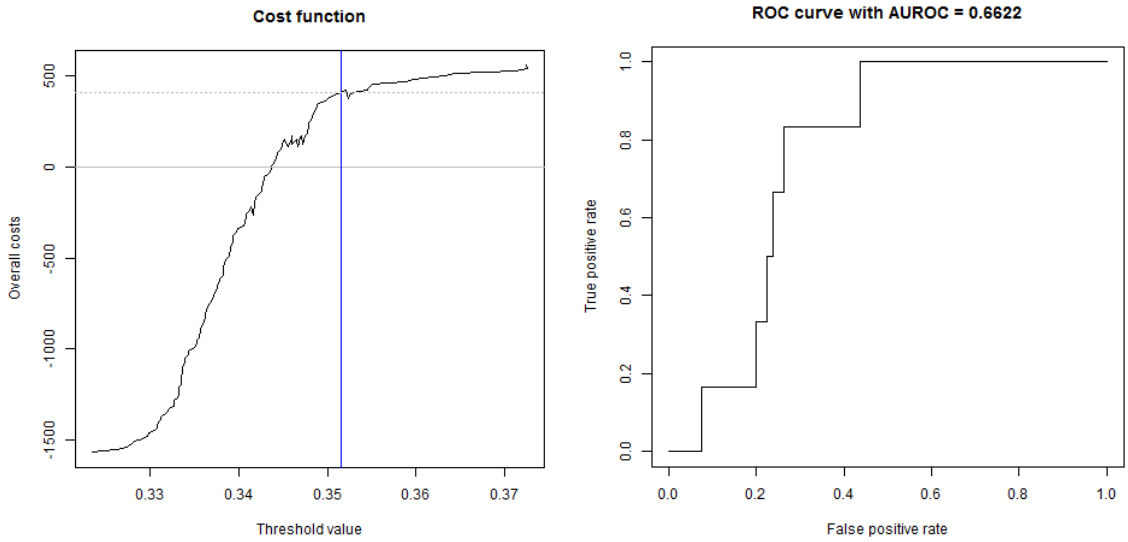
As we set cost matrix our classifier do not return best results in terms of accuracy (which in 2011 equals to 89.15% and in 2012 to 90.96 %), but minimises misclassification costs. Presented results are, therefore, only illustration of one particular situation corresponding to settings in Table 3. These good results are not surprising because of the size of majority class.

Table 5 Cost matrix

		Reality in 2011 and 2012			
		Default	Non-default	Default	Non-default
Predicted	Default	147	13	139	10
	Non-default	5	1	4	2

Source: Own processing

Figure 2 On the left panel classification cost function shows possible thresholds and corresponding costs/profits. Right panel refers to ROC curve of achieved results in 2012 with AUROC value.



Source: Own processing

Left window of Figure 2 shows our threshold in solid vertical line and corresponding profit by dashed line.

4 Conclusions

In this paper we have introduced two-stage model for predicting bankruptcy announcement on the sample of Czech industrial companies. In the Czech economic environment an absence of quality data inevitably brings selection bias to those analysts who do not possess internal data and who must rely only on publicly available data. In our opinion once the low quality data burden is removed our model can be successfully applied as our results suggest on highly sparse test sample.

Future extension of this paper should cover better data cleaning, such as missing values imputation and outlier detection. Also, the proportion of minority class (defaulted companies) might be increased over the long-term proportion of 3-5 % to all companies by some artificial intelligence based method (such a SMOTE) to allow better pattern identification of these companies while adjusting for this increase in final model.

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Impact of Interest Rates and Credit Structure on Liquidity and Stability of Banking Sector of the Euro Area

Eva Horvátová[1], Ján Horvát[2]

[1] University of Economics in Bratislava
Faculty of National Economy
Dolnozemská 1, 852 35 Bratislava
E-mail: eva.horvatova@euba.sk

Masaryk University in Brno
Faculty of Business Administration
Lipová 41a, 602 00 Brno
E-mail: eva.horvatova@econ.muni.cz

[2] University of Economics in Bratislava
Faculty of National Economy
Dolnozemská 1, 85235 Bratislava
E-mail: jan.horvat3@gmail.com

Abstract: *Analysis of bank liquidity has several aspects of the investigation. The problems of bank liquidity reflect the major internal factors of the Bank, as well as external conditions of economic development, in particular interest rates and the state of the economic cycle. Therefore, possible effects on liquidity are varied. The Bank's liquidity is a pillar of stability in the banking sector and at this context is very closely linked with the issue of solvency and regulation of the banking sector. The issue of bank liquidity has therefore become an important indicator pursued even under Basel III document, as well as in analyzes of several experts. Liquidity of the banking sector is linked to the risk and profitability of the banking sector. In this relationship it is possible to analyze the possible development scenarios as part of stress tests as a dependent variable in relation to the structure of assets and liabilities. The Bank's liquidity indirectly relates the evolution of market interest rates and the cross-correlation between different groups of assets held by banks. The Bank's liquidity is also related to the theoretical concept of the net value of the bank.*

Key words: bank liquidity, portfolio of loans, interest rates, optimal structure of loans in euro area

JEL classification: G11, G21, G28, G01

1 Introduction

Traditional aspects of the investigation of bank liquidity relate the sufficiency of reserves and influence of market interest rates. The need for sufficient reserves is associated with the probability of liquidity shortage and with opportunity costs of holding reserves. „The optimal amount of reserves is the amount for which the marginal opportunity costs of holding reserves equals the expected cost of liquidity shortage" (Freixas and Rochet, 2008, p. 276-277).

Other authors also take into account the alternative, "that the assets will need to be sold at a low price, or that the funding will have to be done at the higher rate that the forward rate as the result of the illiquidity in the short-term funding market"(Dermine, 2009, p. 336).

Mishkin, F. studied sensitivity of assets and liabilities to changes in interest rates combined with maturity of assets and liabilities to changes in market prices of assets and liabilities.
Introduced the concept of net value of the bank, which comprises the following (Mishkin, 2005):

$$NVB = d\,V_A - d\,V_L \quad (1)$$

*d V_A = - (in case of increasing interest rates in %) or +(in case of decreasing interest rates in %) * Maturity of Assets* (2)

*d V_L = - (in case of increasing interest rates in %) or +(in case of decreasing interest rates in %) * Maturity of Liabilities* (3)

Where: NVB = net value of the bank, d V_A = the change of value of assets and d V_L = the change of the value of liabilities.

The concept of the net value of the bank points out that the value of the bank may change under the influence of external circumstances, due to particular structure of assets and liabilities and due to their maturity structure. Structure of assets or liabilities combined with interest rates creates the conditions for growth or decline in the net value of the bank without having to carry out an operation. It is therefore very important to pay attention to the structure of assets and liabilities, whether in their mutual binding, as well as the structure of individual assets or liabilities.

This is applied in standard methods of measurement and management of interest rate risk, such as:

1. Gap management method and
2. Duration gap analysis (or portfolio immunization).

The essence of the method of gap management lies in the fact that banks dealing compile groups by maturities of assets and liabilities, for example. 1-90 days, 91-180 days, 181-365 days, and more and assigns them different amounts of assets and liabilities along with interest rates. Gap management method enables expressing the net interest income as the difference between interest income on assets and interest expense on liabilities. The actual mismatch "Gap" can be described as the difference between sensitive assets to interest rate and liabilities sensitive on interest rate.

Taking into account the role of market interest rates within the liquidity of banks Freixas, X. and Rochet, J. Ch. Consider the banks as Market Maker, they mentioned works Ho and Stoll (1980), and Ho and Saunders (1981). They had interesting idea that bank as a market maker will hold illiquid assets and therefore consider risk of the portfolio with two positions: 1st: long – if the bank has granted more loans then desired, or 2nd: short – if the bank has taken too many deposits. The bank has a portfolio γ of marketable assets and a Money market position M to fund loans or to invest excess of liquidity. The bank sets margin (a and b) for deposits and for loans, which means that the bank sells securities (collects deposits) at a bid price and buys securities at the ask price (gives the loans). On this basis, the authors define the total wealth on end of the period as (Freixas and Rochet, 2008):

$$W = \gamma(1 + \tilde{r}_\gamma) + M(1 + r) + I(1 + r_I) \tag{4}$$

Where: $\tilde{r}_\gamma$ = the random return of the portfolio, r = the Money market interest rate and I is difference between loans and deposits, r_I = the return of the loans activity.

Similar views, in particular in the relationship between deposits and loans presented in their research many authors, for example Lileikiene, A., Aurimas, L. (2011), Lakstutiene, A., Breiteryte, A., Rumsaite, D. (2009), Water, P. (2013), Belás and Polách (2012), Cipovová and Belás (2012).

This perspective allows us to look at loans as the bank's investment portfolio designed by bank management.

2 Methodology and Data

The aim of this paper is on the basis of analysis of the structure, volume and lending rates in the euro area to assess the conditions on which loans should be oriented banks

to improve liquidity in the banking sector. The recommendations will be based on two methodological principles:

- 1st: Markowitz modern portfolio theory,
- 2nd: Prediction of interest rates and their confrontation with the theory of liquidity of commercial banks.

The contribution is based on theoretical assumptions liquidity of commercial banks and links the issue of bank liquidity management with portfolio theory and risk management issues in banking. It is a comparison of the recommendations of modern portfolio theory with recommendations based on expectations of interest rates development. To predict trends in interest rates, we have applied modeling using SPSS.

In the prediction of trends in interest rates, we focused on the analysis of time series, published on the website of the European Central Bank. We obtained data on interest rates and the volume of loans for different types of loan maturities. We have focused on finding the best model to predict trends in interest rates, up to 31.12.2014. In particular, we focused on whether the interest rate shows a tendency to rise or to drop. These trends we associate with the theoretical expressions of growth or decline in value of assets due to interest rate developments. In defining the potential gain or loss we follow reasoning: if the bank currently provide loans with lower interest rates and future interest rates rise, the bank will potentially lose, they could provide loans with a higher interest rate compared to other thus loses.

Table 1 Relationship between maturity and interest rate movements

	increase in interest rates	**decrease in interest rates**
Short-term credit (ST)	increase of profit	decrease of profit
Long-term credit (LT)	decrease of profit	increase of profit

Source: own processing

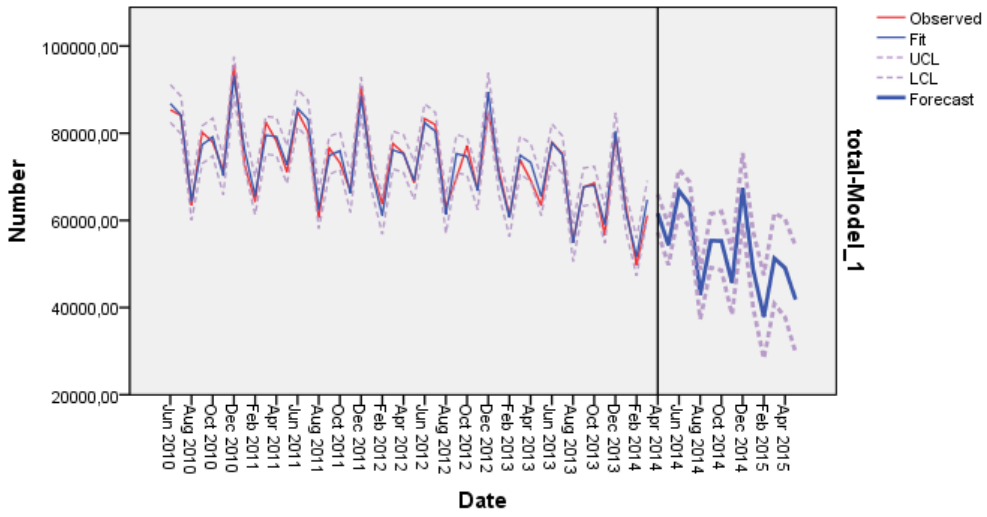
Using Markowitz modern portfolio theory we find such a composition of credits, which contributes to optimizing the portfolio of loans. Values with a minus sign, we excluded from the portfolio as inappropriate for creating the optimal portfolio and to the positive values we determined their new potential weights in the portfolio. So we create the optimum portfolio of loans in the banking sector of the euro area. We compared the recommended values with real shares of each type of loans in the current euro area banking sector.

Then we prepared estimates of interest rates based on expert finding best fitting models. We evaluated the development trend of the interest rate and related potential gains or losses from the loans. Finally, we compared the recommendations based on portfolio theory and recommendations based on expert estimate of interest rates. We assume that in those cases in which both types of recommendations are identical, they are significant and can be an indicator for the decision-making in the real practice of commercial banks in the euro area.

3 Results and Discussion

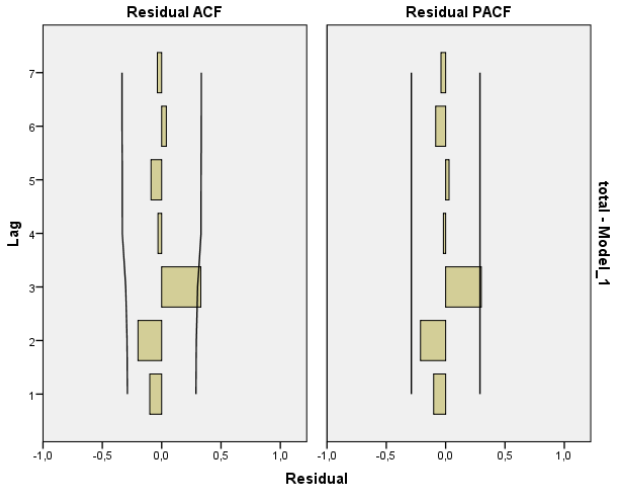
Development of loans in the euro area at present is very unfavorable. It has significantly declining tendency, what could be important barriers to economic growth in the future. In connection with this development can hardly be expected rise in interest rates in the short term, and therefore we can define the potential direction of interest rates downwards, even now interest rates are low.

Graph 1 forecast for total credits volume to May 2015 (mil. EUR)



Source: own processing using IBM SPSS software
Data www.ecb.int; http://sdw.ecb.europa.eu/browse.do?node=bbn2883

Graph 2 Residual autocorrelation function (ACF) and residual partial ACF



Source: own processing using programe IBM SPSS. Data www.ecb.int

Chart of residual autocorrelation function and partial autocorrelation function indicate a relatively good quality of human judgement on the basis Winter's additive model. Comparison of the observed and predicted values gives satisfactory results.

In addition to the volume of loans is ahead the question whether the structure of loans will ensure a stable development of the banking sector. Even if needs to be increased the amount of loans, equally important is the structure of credits which has to contribute to long-term stability of the banking sector. To the structure of loans are going to look on basis of portfolio theory, because modern portfolio theory takes into account income on loans, the volatility of returns and mutual correlations between yields. Then we will compare, as the recommendations for the loan portfolio structure are consistent with other groups of recommendations.

According to Markowitz modern portfolio theory portfolio expected return is a weighted average of the expected return of its individual components. To the expected return of the portfolio contributes each component (in our case a loan) by its expected return and its share of the initial market value of the loan portfolio (Sharpe and Alexander, 1994, p. 113).

$$r_P = \sum_{i=1}^{N} X_i * r_i = X_1 * r_1 + X_2 * r_2 + \cdots + X_N * r_N \quad (5)$$

Where: r_p = expected portfolio profitability; r_i = expected profitability of component (credit) i; N = number of components (credits) in portfolio; X_i = weight of component „i" in initial value of the portfolio.

The Markowitz modern portfolio theory is based on the normal probability distribution of income portfolio. For a portfolio composed of N kinds of loans we apply the following formula for the standard deviation (Sharpe and Alexander, 1994, p. 113-115):

$$\sigma_P = \left[\sum_{i=1}^{N} * \sum_{j=1}^{N} X_i X_j \sigma_{ij}\right]^{1/2} \quad (6)$$

Where: X_i = weight of component „i"in initial value of the portfolio; X_j = = weight of component „j"in initial value of the portfolio; σ_{ij} = covariance between credits „i"and „j".

Covariance is calculated according to the formula:

$$\sigma_P = \rho_{ij} * \sigma_i * \sigma_j \quad (7)$$

Where: ρ_{ij} = The correlation coefficient between loans i and j; σ_i = standard deviation of the yield of credit „i"; σ_j = standard deviation of the yield of credit „j".

3.1 Forecasting of Interest Rates

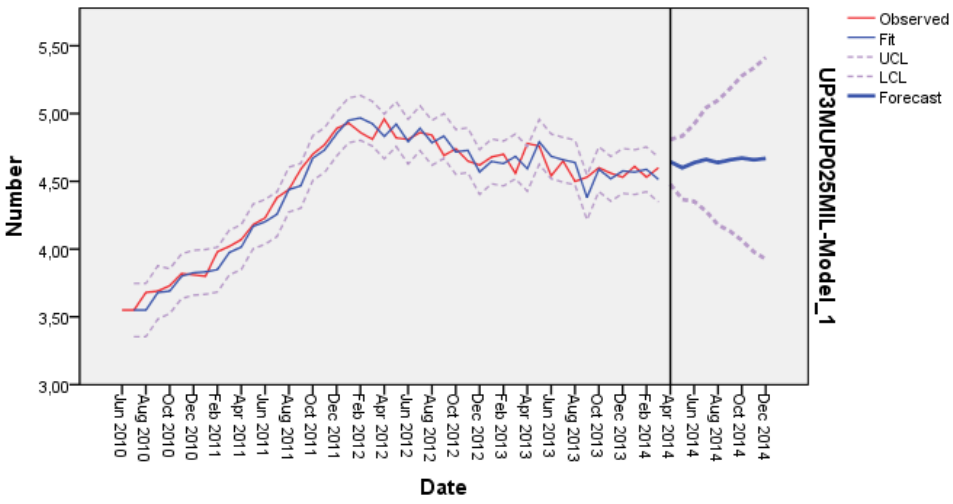
Calculation of forecasts of interest rates is based on expert modeling in SPSS. We have focused primarily on the interest rates, which represent the highest share of loans in the adjusted portfolio.

Prognosis of interest rate development (on a loan with the maturity up to three months to 0.25 million EUR - UP3MUP025MIL):

Graph 3 Model type and forecast for total credits volume to Dec 2014 (mil. EUR)

Model Description

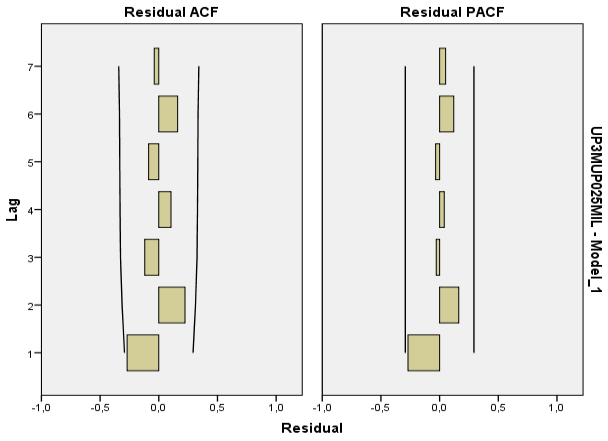
			Model Type
Model ID	UP3MUP025MIL	Model_1	ARIMA(3,1,0)(0,0,0)



Source: own processing

To verify the correctness of the model is used autocorrelation function (ACF) and partial autocorrelation function (PACF). The graphs ACF and PACF show that the model adequately describes all the influences on the development of time series. ACF and PACF were created to all models for various types of loans analogically.

Graph 4 Residual autocorrelation function (ACF) and residual partial ACF



Source: own processing

The graph and modeling of interest rate prediction show that even under the influence of seasonal effects are not expected towards significantly increasing interest rates. Observable fluctuations caused by seasonal ingredients interest rate. We assume that there are certain relation between the interest rate and maturity of loans that can be summarized in the table:

Table 2 Impact of predicted interest rates and maturity of loans to the expectations of gains and losses on loans

Case nr.	Type of loan	Weight the initial proposal of the portfolio	Weight in the adjusted portfolio	Recommended weight in %	Weight of credit in the real banking sector of the euro area in 2014	Recommendation	IR Apr. 2014 and predicted IR Dec 2014 (%)	Expected vol. of credits (mil. EUR) APR / DEC	Impact of combination between IR and maturity of credits = ↓ or ↑
1	UP3MOVER1MIL	-0.5736			47.312	↓	2.31 /2.37	29391.8 27675.5	ST+↑ IR= ↑ PROFIT
2	**UP3MUP025MIL**	0.95973	0.1993	**19.93**	5.892	↑	4.64 / 4.67	3678.2 3711.5	**ST+↑ IR= ↑ PROFIT**
3	UP3M025MILUP1MIL	0.24131	0.0501	5.01	10.122	↓	2.86 / 2.93	6395.2 5591.6	ST+↑ IR= ↑ PROFIT
4	TO1YTO1MIL	-0.8577			2.695	↓	3.88 / 3.78	1589.4 1776.4	ST+↓IR= ↓ PROFIT
5	**TO1YOVER1MIL**	0.61993	0.1287	**12.87**	4.798	↑	2.39 / 2.46	3007.3 3608.0	**ST+↑ IR= ↑ PROFIT**
6	ONETO5UP1MIL	-0.6351			0.542	↓	3.92 / 3.77	296.7 278.5	ST+↓IR= ↓ PROFIT
7	ONETO5YOVER1MIL	0.29957	0.0622	**6.22**	0.972	↑	3.30 / 2.74	635.4 1656.0	ST+↓IR= ↓ PROFIT
8	OVER5YTO1MIL	-0.9131			0.949	↓	3.92 / 3.77	502.9 667.1	LT+↓IR= ↑ PROFIT
9	**OVER5YOVER1MIL**	0.32370	0.0673	**6.72**	0.950	↑	3.29 / 2.97	1677.4 2344.0	**LT+↓IR= ↑ PROFIT**
10	FIVETOTENOVER1MIL	-0.1641			0.054	↓	3.25 / 2.84	1677.4 2344.1	LT+↓IR= ↑ PROFIT
11	FIVETOTENUP025	0.07187	0.0149	1.49	1.137	↑	3.61 / 3.35	719.7 656.7	LT+↓IR= ↑ PROFIT
12	FIVETOTENY025TO1MIL	0.02261	0.0047	0.46	0.949	↓	2.86 / 2.35	502.9 667.5	LT+↓IR= ↑ PROFIT
13	OVERTENYOVER1MIL	-0.1239			1.559	↓	3.36 / 3.14	1236.0 2135.4	LT+↓IR= ↑ PROFIT
14	OVERTENUP025	0.08394	0.0174	1.74	1.137	↑	3.66 / 3.35	416.6 599.4	LT+↓IR= ↑ PROFIT

15	**OVERTEN025TO1MIL**	**0.4030**	**0.0837**	**8.36**	1.084	↑	3.52 / 3.20	605.4 900.5	**LT+↓IR= ↑ PROFIT**
16	OVER3MTO1YOVER1MIL	-0.1962			9.778	↓	2.84 / 2.70	4834.7 8991.3	ST+↓IR= ↓ PROFIT
17	OVER3MTO1YUP025	0.22833	0.0474	4.74	0.693	↑	4.53 / 4.10	2320.1 2184.2	ST+↓IR= ↓ PROFIT
18	OVER3MTO1Y025TO1MI	0.17329	0.0360	3.59	3.770	↓	3.58 / 3.41	1792.8 2288.2	ST+↓IR= ↓ PROFIT
19	ONETO3YOVER1MIL	-0.1746			0.972	↓	3.25 / 2.72	4834.7 8991.7	ST+↓IR= ↓ PROFIT
20	ONETO3YUP025	0.14940	0.0310	3.10	0.542	↑	4.33 / 4.29	660.6 731.8	ST+↓IR= ↓ PROFIT
21	ONETO3Y025TO1MIL	0.13928	0.0289	2.89	0.970	↑	3.41 / 2.77	296.7 278.5	ST+↓IR= ↓ PROFIT
22	OVER3TO5YOVER1MIL	-0.17707			1.290	↓	3.29 / 2.79	837.0 1395.3	ST+↓IR= ↓ PROFIT
23	OVER3TO5YUP025	**0.6338**	**0.1316**	**13.16**	1.078	↑	4.11 4.02	660.6 731.8	ST+↓IR= ↓ PROFIT
24	OVER3TO5Y025TO1MIL	0.46571	0.0967	9.67	0.522	↑	3.25 / 2.35	319.0 392.2	ST+↓IR= ↓ PROFIT

Source: own processing

4 Conclusions

Based on the analysis, we concluded that these groups of credits have the profit potential:

1) UP3MUP025MIL loan with a maturity of up to three months, to 0.25 million. Eur;
2) TO1YOVER1MIL loan with a maturity of up to 1 year over 1 million. EUR;
3) OVER5YOVER1MIL loan with a maturity of over 5 years, over 1 million. EUR;
4) OVERTEN025TO1MIL loan with a maturity of over 10 years, os 0.25 to1 million. EUR.

Results suggested on the basis of portfolio theory take in account the risk, return and covariance between loans. The results based on the analysis of yield and maturity takes into account return and maturity.

In summary, there is a great likelihood that the types of loans confirmed by both analyses are potentially profitable and useful to compile an optimal portfolio in the practice.

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Impact of High Frequency Trading on Volatilities of Securities on German Market

Juraj Hruška

Masaryk University
Faculty of Economics and Administration, Department of Finance
Lipová 41a, 602 00 Brno, Czech Republic
E-mail: 206887@econ.muni.cz

Abstract: *Algorithmic trading has become the crucial part of trading on world equity markets. Almost every big stock exchange undertook process of hybridization and allowed automated order submission. This led to many manipulative strategies which could have impact on market volatility. This paper is focused on these strategies and their impact on volatility. Furthermore, the reduction of the volatility is tested as a result of implemented regulations. Econometrical methods are used to determine relationship between high-frequency trading activity and volatility of chosen securities. Their selection is based on volume of trading, number of trades and especially number of orders and cancelled orders, which are the main indicator of manipulation activity. Explained variable in the models is the implied volatility of securities and explaining variables are derived from trading activity and dummy variables of events of hybridization and regulation of markets. Results of this paper confirm that unregulated high frequency trading can cause increase in the volatility of market prices on Eurex exchange and are presented and discussed in this paper.*

Keywords: high frequency trading, volatility, linear regression, algorithmic trading, trading volume

JEL codes: G140, G120, G150

1 Introduction

Algorithmic trading has become the most used realization of trading on world equity as well as derivative markets. In most of world largest exchange markets electronic order submission replaced the floor trading. The aim of this paper is to examine an impact of increasing number of trades generated by algorithmic trading and high frequency trading (HFT) on volatilities of securities on German derivative market. Secondly we will test efficiency of regulation of German market in reducing volatility of returns. The volatility of securities is defined by fluctuations of derivative or stock prices which can be estimated by the variance or the standard deviation of stock returns (Benouda Sioud and Mezzez Hmaied, 2000). HFT can be defined as a subset of algorithmic trading, or the use of computer programs for entering trading orders, with the computer algorithm deciding such aspects of the order as the timing, price, and order volume. However, HFT is distinguished from general algorithmic trading in terms of holding periods and trading purposes (Zhang, 2010). Deep analysis of algorithmic trading impact on stability and liquidity of U.S. equity markets were conducted, confirming positive relationship between these two aspects (Hendershott, Jones, & Menkveld, 2011). Readers can refer to (McGowan, 2012) for deeper background of HFT. In the first part of the paper the basic theory of used methods is presented. Afterwards the methods are applied to data from Bloomberg database and statistical reports from EUREX. Obtained results are presented and discussed in the end.

The main question which is addressed here is whether HFT has impact on volatility of securities traded on EUREX. We are testing whether the German act regulating HFT and especially some market manipulation techniques, which came into force in May 2013, were successful in reducing volatility on the derivative markets. Mentioned strategies were layering, spoofing and quote stuffing. Quote stuffing is based on submitting large number of orders, which are cancelled in very short time creating short term jump in price. Manipulator uses this situation to buy at lower price or to sell at higher, depending

on the direction of the jump. Layering and spoofing are similar processes using directed jumps. For example, manipulator opens short position above market price, and then submits larger long order with price much higher than market price. This order attracts other investors which are anticipating growth of price and so manipulator can close his short position. Immediately after short position is closed, manipulator cancels the long order. This process is then repeated vice versa. Hence, these short term jumps create additional volatility of prices and consequently of all the products derived from them.

It was determined (Zhang, 2010) that HFT is positively correlated with stock price volatility on U.S. capital market. When most of trades are based on statistical correlations in stock returns and investors do not hold assets as investments (HFT traders usually do not keep any investments overnight) efficient pricing becomes questionable. Theoretical models show (Froot, Scharfstein and Stein, 1992) that markets with short--horizon trades have worse performance then those with long--term investors. An increase of volatility and liquidity was noted in (Naidu and Rozeff, 1994) as well as an improvement in efficiency following the automation of the Singapore stock exchange. These implications are tested on EUREX exchange in this paper. For all models open source statistical software R was used. The paper is structured as follows. Section 2 describes available data and methodology of paper. Section 3 shows main results of the paper and section 4 presents a conclusion derived from the results.

2 Methodology and Data

The analysis presented in this paper focuses on a sample of firms from the EUREX exchange during 2000–2014. The data were exported from Bloomberg and eurexchange.com. Exported data are in daily form from 2000 or 2003 (in one case from 2007) to 2014 depending on availability for different companies. The list of explanatory variables can be found in Table 1.

Table 1 Variables in datasets

Variable	Description
Date	Date
volatility_30d	30-day volatility of the stock price
volatility_90d	90-day volatility of the stock price
vwap_num_trades	The number of trades during the day
vwap_automated_volume	The volume of trades that were submitted by automatic traders
algo.start	Time period with significant role of algorithmic trading
hft.act	The date when HFT act come into force in Germany

Source: Author

There are two dummy variables in the datasets: *algo.start* and *hft.act*. *Algo.start* identifies those trading days when algorithmic trading had a significant role in price development. More specifically, more than 30% of daily traded volume was created by orders submitted by automated traders. Hft.act represents observations after May 2013 when High Frequency trading Act (*Entwurf eines Gesetzes zur Vermeidung von Gefahren und Missbräuchen im Hochfrequenzhandel*) came into force. Remaining variables are continuous. In this phase new variables were computed with following formula,

$$volatility\_30t_i = volatility\_30d_i - volatility\_30d_{i-1}, \quad (1)$$

to represent the changes in the volatility between next days and avoid autocorrelation of residuals. The same transformation was done for 90-days volatility.

Linear regression was used for estimating influences of chosen variables on 30-days, 90-days, 180-days volatility and volatility for call and put options. ANOVA was used for confirmation of results from previous regressions.

Model Specification

The linear regression was used to answer the proposed question. Regression coefficients were estimated using following formula

$$y_i = \beta_1 x_{i1} + \cdots + \beta_p x_{ip} + \varepsilon_i, \tag{2}$$

where y_i is called response (dependent) variable, β is a p-dimensional parameter vector, x_{ip} are called explanatory (independent) variables and ε is the error. Readers who want to read more about background of linear regression can refer to (Verbeek, 2012).

Data for ten companies were used and two regressions were computed for every company, one for 30-day volatility and one for 90-day volatility as response variables. Remaining variables were used as explanatory ones. Afterwards, multicolinearity and heteroscedasticity were tested and if needed transformations to predictors have been done. To measure multicolinearity the variance inflation factors (VIF) were used. Everything important about VIF can be found in paper (O'Brien, 2007). To check heteroscedasticity the Breusch–Pagan test was used. When heteroscedasticity was found then heteroscedasticity-corrected covariance matrix was computed. This matrix can be computed using following formula

$$V(b) = inv(X'X)X'diag(e^2)Xinv(X'X)_i, \tag{3}$$

where e^2 are the squared residuals, X is the model matrix and $V(b)$ is heteroscedasticity corrected covariance matrix. Afterwards β coefficients in formula (2) were recalculated using the matrix $V(b)$ (David Garson, 2012).

The process was repeated with new target variables that were derived from 30-days volatility and 90-days volatility by formula (1). By these regressions we tried to examine the impact of number of trades and algorithmic trading on changes in volatilities.

For comparing volatilities before and after implementation of High frequency trading act ANOVA method was used. These statistics were conducted also for the 180-days volatility and for the separate volatility of call and put options. The same approach was used for comparing volatilities on days with high ratio of algorithmic trades on daily volume to those with low ratio. Additional statistics were also calculated where it was possible.

3 Results and Discussion

In first stage, altogether twenty linear regressions were computed. 30-days volatility and 90-days volatility were used as explained variables for every option. Simple summary of results can be found in Table 2 and Table 3 for volatility_30d and volatility_90d respectively.

Table 2 Summary of computed results for variable volatility_30d

Explanatory variable	No. of models	***	**	*	.	No significant
vwap_num_trades	10	7	0	1	0	2
vwap_automated_volume	10	4	2	0	1	3
algo.start	5	3	1	0	0	1
hft.act	10	7	1	1	1	0
date	10	8	0	0	1	1

Source: Author's calculation

Note: Created based on results computed in software R. Number of stars determines significance of impact of the variable on explained one.

Table 3 Summary of computed results for variable volatility_90d

Explanatory variable	No. of models	***	**	*	.	No significant
vwap_num_trades	10	7	0	0	0	3
vwap_automated_volume	10	2	0	4	1	3
algo.start	5	4	0	0	0	1
hft.act	10	10	0	0	0	0
Date	10	8	1	0	0	1

Source: Author's calculation

Note: Created based on results computed in software R. Number of stars determines significance of impact of the variable on explained one.

*** - p-value of variable is less than 0.001
** - p-value of variable is between 0.001 and 0.01
* - p-value of variable is between 0.01 and 0.05
. – p-value of variable is between 0.05 and 0.1

If there is a low p-value, the hypothesis that β coefficient is equal to 0 (no effect) is rejected. Therefore there is a significant relationship between explanatory and explained variable. It can be observed from Table 2 and 3 that every variable had a significant relationship in at least 70% of models. Now we can take a look at every variable separately.

If variable *algo.start* had a significant relationship with target variable, the coefficient was always positive. That means if *algo.start* is equaled to 1 (HFT had significant role in trading), either 30-days volatility or 90-days volatility is bigger. This confirms the hypothesis that rising application of HFT increased volatility of derivative markets. The results were exactly opposite with the variable *hft.act*. The strong negative correlation was shown by all models. Furthermore the average of the coefficient for this variable was around -6, so if *hft.act* is equaled to 1 (actions against some practices in HFT were taken) then the volatility is 6 points smaller. That proves that large amount of volatility of prices had been caused by manipulative trading strategies that were banned by HFT Act in 2013.

In other variables the relationships were not so clear, but trend can be still visible there. The variable *vwap_num_trades* showed significant relationship with target variable fifteen times. Out of these fifteen times the coefficient was negative three times. Other twelve times the coefficient was positive. This means that the variable *vwap_num_trades* has positive influence on volatility in 80% of models. It was a similar case with time trend. The coefficient was negative in 70% of models, therefore the volatility have been usually decreasing during the time. The relationship of the last variable *vwap_automated_volume* with explained variable cannot be determined using our models. Although the significant relationship was shown fourteen times, only eight times out of fourteen was the coefficient positive and six times was negative. It means that the percentage of either positive or negative coefficients is closed to 50%. Therefore the conclusion is that variable *vwap_automated_volume* has significant relationship neither with 30-days volatility nor 90-days volatility.

In second stage twenty linear regressions were computed again using target variables that were computed by formula (1). These regressions show impact of explanatory variables on changes in volatilities. In this case the variable *date* did not show any significant relationship with target variable. Variable *vwap_num_trades* showed significant relationship in 70% of models and in every of those models the coefficient was positive. This means that the number of trades in one day is positively correlated with changes of volatility. The variable *vwap_automated_volume* had a similar result. A significant relationship was proven in 90% of models and the coefficient was bigger than zero in all but two. Therefore it can be said that the volume of automated trades, in contrast to volatility, is positively correlated with daily changes of volatility. The results of two remaining variables were completely opposite to models in the first stage. Variables

algo.start and *hft.act* showed negative and positive correlations with target variable respectively. This means that daily changes in volatilities can be reduced by automated trading.

Table 3 Summary of results from ANOVA for selected volatilities

Explanatory variable	No. of models	30d	90d	180d	Call	Put	No significant
algo.start	7	6	7	7	5	5	1
hft.act	15	14	14	15	7	6	0

Source: Author's calculation

Note: Created based on results computed in software SAS. Number of stars determines significance of impact of the variable on explained one

Results from the regressions were confirmed by the outcomes of 22 ANOVA models. Data in Table 3 show number of securities, where the null hypothesis of equal mean volatility was rejected (each time p-value was lower than 0.001). Which lead us to conclusion that high activity of algorithmic trading and regulation prohibiting manipulative techniques changes volatility of selected securities. Separate volatilities for call a put options were available only for 5 models testing *algo.start* and 7 models testing *hft.act*.

These analysis confirmed generally accepted hypothesis that algorithmic and more specifically HFT is increasing volatility on financial markets. Some of our results suggests opposite character of tested variables, however these effects can be explained by different character of explained variable. One of the explanation can be, that algorithmic trading is increasing market volatility in long run, but after effective regulation and implemented safety measures it can reduce price shocks in short run. We were testing only options on shares of companies in automobile and financial sector. More observations on more options would be beneficial for the trustworthiness of these conclusion. Same analysis could be also applied on the futures market to compare effects on these two types of market traded derivatives. In our analysis we were taking into account only derivatives with high volume of trade and especially with high number of trades. Options with low number of trades can be used for verification of hypothesis concerning algorithmic trading and its impact on market volatility.

4 Conclusions

In this paper we examined the effect of algorithmic trading and HFT on the volatility of securities of sample of firms from EUREX exchange. The data shows that algorithmic trading has become a dominant force in trading including about 98% percent of overall trading volume for every firm in 2014 compared to approximately 20-30% in early 2000s. More importantly this paper confirms our hypothesis that algorithmic trading is positive correlated with volatility of securities even in cases where volatility has been decreasing during the time. These effects were firstly caused by errors in algorithms and later by practices that were manipulating market and causing artificially increased volatility. Variables *algo.start* and *vwap_num_trades* in most of the models were positive correlated with either 30-days volatility or 90-days volatility. On the other hand variables *date* and *hft.act* were negative correlated. The results show that when restrictions were applied on HFT, the volatility of securities decreased. The negative effect of time can be explained by overall improvement of algorithms, which are now less likely to cause unintentional shocks in market movements. These results also confirm the hypothesis presented in this paper. Based on (Zhang, 2010) the HFT causes stock prices to over-react to news about fundamentals, and that this over-reaction is subsequently corrected, represents direct evidence supporting the hypothesis that HFT creates volatility. In second stage the influence of explanatory variables on daily changes of volatility was measured. It was observed that algorithmic trading, even it is positive correlated with volatility of securities, can lower the daily changes in the volatility. This can lead to improvement in market efficiency. The research paper (Benouda Sioud and Mezzez Hmaied, 2000) showed that, in addition, the HFT improve also liquidity and that it can restructure and restore the stock market after period of anarchy.

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Selected Determinants of Lifelong Learning of Population in the Slovak Republic

Kristína Hudoková, Anna Schultzová, Marcela Rabatinová

University of Economics in Bratislava
Faculty of National Economy, Department of Finance
Dolnozemská cesta 1, 852 35 Bratislava, Slovak Republic
E-mail: kristina.hudokoval@euba.sk, anna.schultzova@euba.sk, marcela.rabatinova@euba.sk

Abstract: *The contribution is focused on the analysis of lifelong learning and training programs aimed at the residents of the Slovak Republic. The main reason for the examination of this issue is the fact that sustainable development, competitiveness and dynamically developing economy is nowadays almost unachievable without increasing the educational level of human capital. The aim of this paper is to explore dependencies and the impact of selected determinants of lifelong learning at higher population's ability to assert themselves in the labor market. We will examine this dependency through the econometric method - regression analysis. In this paper statistical data will be used to evaluate the most probable regression model of selected determinants of lifelong learning in the Slovak Republic. The output will be the assessment of the extent of importance of selected indicators on the lifelong learning of population.*

Keywords: determinants of further adult education, regression analysis, lifelong learning, Gretl

JEL codes: I20, I25, H52

1 Introduction

Lifelong learning is increasingly becoming the dominant theme of education and vocational training policies in all developed industrialized countries. Increasing the educational level of human capital is necessary for achieving a sustainable development, competitiveness and dynamically developing economy. For governments, the concept of lifelong learning is an overarching policy framework which offers solutions to a number of common economic and social problems (Rubenson, 2011). Despite the fact that lifelong learning relates to all levels and forms of education, in the context of the development of the knowledge-based society, a specific interest is put on the education of the adult population. Support of further education of the adult population is perceived, in the context of global changes and their consequences such are, for example, the labor market changes, technological changes, demographic changes or economic crisis.

Education and vocational training belong among the highest political priorities of all the Member States in the European Union, not just the Slovak Republic. Obtaining the new knowledge, skills and abilities as well as their continuous updating is considered to be the assumption of personal development of all citizens and their active participation in all aspects of society through integration into the labor market. Education of the adult population is more important nowadays because we are in an era of globalization characterized by rapid changes, technological progress and integration. Learning provides to adults new knowledge and skills, which does not only improve the quality of their own lives, but also leads to the benefit of their families, community and society. Lifelong adult education also plays an important role in reducing poverty, promoting sustainable procedures in the field of environment and not least in improving the level of health and nutrition.

More than one third of the EU population in the age range between 25 and 64 years participate in formal or non-formal education or vocational training. In general, young people participate more in further education, and there are only minor differences between men and women. Non-formal education and vocational training, in contrast to formal education, is characterized by less time-intensive courses. This is probably the main reason for higher participation of adult population in non-formal education. The

majority of non-formal education and vocational training activities is related on the work of adult learners (i.e. job-related learning activities). In the Slovak Republic, in 2011 (the latest figure available from Eurostat), the proportion of job-related activities of non-formal education and vocational training was 90.5%. However, there are difficulties related to participation in further education and vocational training, such as work schedule or family responsibilities.

2 Methodology and Data

Our contribution is focused on the compilation of the most probable regression model of selected determinants of lifelong learning in the Slovak Republic. For examining the dependencies and impact of selected determinants of lifelong learning we have used the multiple regression model in the econometric program Gretl *(Gnu Regression, Econometrics and Time-series Library)*. The analyzed data are obtained mainly from Eurostat. The period of years monitored is from 2004 to 2013. We have chosen the time series as a dataset structure in the Gretl program. When using the time series for the estimation of the regression function, it is necessary to calculate with the existence of the apparent correlation, which is caused by the identical or similar trend of the time trajectories of the non-stationary variables (Budayová, Bolek, Šupšák, 2013).

Model Specification

The multiple regression model works with more than one explanatory variable. The general form of this model is as follows:

$$y_i = \beta_0 + \beta_1 x_{i1} + \cdots + \beta_K x_{iK} \quad \text{i=1, 2, …, N} \tag{1}$$

where index *i* represents the individual observations,
index $k = 1, 2, ..., K$ represents the individual explanatory variables and
$\beta_0, \beta_1, ..., \beta_K$ are the parameters to estimate (Bil, Němec, Pospiš, 2009).

To estimate the unknown model parameters we have used the estimation method *Ordinary Least Squares*, so-called OLS model. To assess the quality of the model we have used the *coefficient of determination* R^2, which shows what proportion of the variability of dependent variable we managed to explain with the considered regression dependence. Coefficient of determination R^2 is defined as the ratio of *Explained Sum of Squares (ESS)* and *Total Sum of Squares (TSS)* (Lukáčik, Lukáčiková, Szomolányi, 2011):

$$R^2 = \frac{ESS}{TSS} \tag{2}$$

The coefficient of determination can take values between 0 (weak fit) and 1 (good fit), ($0 \leq R^2 \leq 1$), respectively in percentage terms from 0% to 100%:

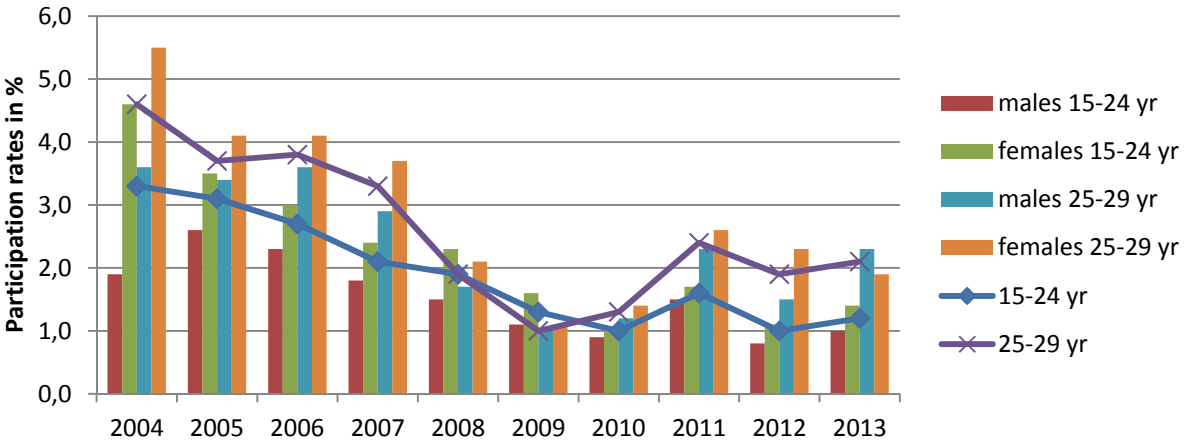
- value of the coefficient of determination $R^2 = 0$, i.e. estimated econometric model does not explain any part of the variability of selected dependent variable;
- value of the coefficient of determination $R^2 = 1$, i.e. estimated econometric model explains 100% of the variability of selected dependent variable (Soukiazis, 2013).

Lifelong Learning Participation

In the introduction we have mentioned that mainly young people are participating in further, respectively lifelong learning. To gain a better overview, we have considered that it is necessary to give a more detailed view of the development on the amount of participants in the lifelong learning, namely the non-formal education and vocational training in the Slovak Republic for the years 2004 - 2013 (see Figure 1). The monitored group, in this case, were the adults in two age groups, namely 15-24 years and 25-29 years, simultaneously with breakdown by sex.

As is apparent from *Figure 1*, there are clear signs of improvement in the reduction of differences between men and women. Participation of young adults in non-formal education and vocational training is starting to have an increasing tendency again, after a period of economic crisis.

Figure 1 Participation in non-formal education and training by sex and age



Source: own processing based on data from Eurostat available at www.epp.eurostat.ec.europa.eu

3 Results and Discussion

OLS Model with Multiple Selected Variables

Before estimating the parameters of a linear model with multiple variables we have verified the suitability of selected variables by using a statistical correlation coefficient extent - we have done an analysis of correlation between variables.

Table 1 Correlation Coefficients, using the observations 2004 – 2013
5% critical value (two-tailed) = 0.6319 for n = 10

FED_NFE	**ACT**	**UNE**	**INAC**	
1.0000	0.9291	0.9239	0.9595	**FED_NFE**
	1.0000	0.7820	0.8105	**ACT**
		1.0000	0.9021	**UNE**
			1.0000	**INAC**

Source: own processing in Gretl based on data from Eurostat available at www.epp.eurostat.ec.europa.eu

The highest calculated value 0,9595 of correlation coefficient between a pair of variables INAC and FED_NFE (the explanatory note below) confirms that among these variables there is a strong direct linear correlation. The lowest calculated value of the correlation coefficient between variables UNE and ACT, equal to the value 0,7820, this shows that between the given variables there is a linear dependence (correlation), but weaker than between INAC and FED_NFE.

Then we have specified the dependent variable FED_NFE (overall participation in formal and non-formal education and vocational training) and independent variables:

- *ACT* - economically active population - comprises all persons of either sex who represent the labor supply for the production of economic goods and services,
- *UNE* - unemployed - the proportion of the labor force that is without work, but is available and looking for a job,
- *INAC* - inactive persons - people who are not classified as employed or unemployed are defined as inactive (http://stats.oecd.org/glossary/, 2014).

After that we have done a linear model estimation of parameters in the Gretl program using the *Ordinary Least Squares estimator*, so-called OLS model.

Model 1 OLS, using observations 2004-2013 (T = 10)
Dependent variable: FED_NFE
HAC standard errors, bandwidth 1 (Bartlett kernel)

	Coefficient	*Std. Error*	*t-ratio*	*p-value*	
const	2.37193	0.321272	7.3829	0.00032	***
ACT	0.72395	0.0594227	12.1831	0.00002	***
UNE	0.718061	0.198928	3.6097	0.01124	**
INAC	0.205256	0.0195498	10.4991	0.00004	***

Mean dependent var	14.65000	S.D. dependent var	1.641984
Sum squared resid	0.129668	S.E. of regression	0.147008
R-squared	0.994656	Adjusted R-squared	0.991984
F(3, 6)	1566.167	P-value(F)	4.54e-09
Log-likelihood	7.537420	Akaike criterion	-7.074841
Schwarz criterion	-5.864500	Hannan-Quinn	-8.402581
rho	0.484833	Durbin-Watson	0.994101

Source: own processing in Gretl based on data from Eurostat available at www.epp.eurostat.ec.europa.eu

At the beginning it is necessary to perform verification of the econometric model. Statistical verification includes testing the significance of individual parameters, testing the significance of the model as a whole, evaluation of the coefficient of determination and testing the fulfillment of linear model assumptions (eg. heteroscedasticity test, autocorrelation test, multicollinearity test). First we have tested the significance of individual parameters using the Student's *t*-statistics. We have formulated a pair of hypotheses:

$$H_0: \beta_0 = 0 \qquad \text{against} \qquad H_1: \beta_0 \neq 0,$$

We have found, that the calculated *t*-statistic parameter β_0 in absolute value (|7,3829|) is greater than the critical value $t_{0,025}(6) = 2,44691$, so we can reject the null hypothesis and conclude that the parameter β_0 is on the 5% significance level statistically significant. For all other parameters, result of the comparison is the same - we reject the null hypothesis, i.e. on the 5% significance level the parameters are statistically significant:

Table 2 Comparison of t-statistics and critical value

Parameter	*t*-statistics	Comparison	Critical value	Result
ACT	|12.1831|	>	2.44691	reject H_0
UNE	|3.6097|	>	2.44691	reject H_0
INAC	|10.4991|	>	2.44691	reject H_0

Source: own processing; results from Gretl based on data from Eurostat available at www.epp.eurostat.ec.europa.eu

Subsequently, we have tested the significance of the model as a whole using the *F*-statistics by comparing the calculated *F*-statistics with the critical value $F_{0,05}(3,6)$. First we have formulated a pair of hypotheses:

$$H_0: \beta_1 = \beta_2 = \beta_3 = 0 \qquad \text{against} \qquad H_1: \exists\, \beta_1 \neq 0, \text{ pre } i = 1, \ldots, 3$$

Thereafter, using the program Gretl, we have found the critical value of *F*-statistics at significance level $\alpha = 0,05$ and degrees of freedom 3 and 6. The searched critical value was 4,75706. By comparing of both obtained values we have found, that the calculated *F*-statistic is greater than the critical value $F_{0,05}(3,6)$:

$$F = 1566.167 > 4.75706 = F_{0,05}(3,6).$$

Therefore, we can reject the null hypothesis and conclude that the model as a whole (at 5% significance level) is statistically significant. This conclusion is confirmed by the probabilistic value P-value (F), because its value of $4{,}54e^{-09}$ is less than 0,05 and therefore we can reject the null hypothesis at 5% significance level.

For the reason to avoid the heteroskedasticity problem, we have used the method of the HAC estimator in *Model 1* (robust standard errors).

Table 3 Results from White's test for heteroskedasticity

	Hypotheses	Reject H_0 if	Results from Gretl	Result
Hetero-skedasticity	H_0: $\beta_1 = \beta_2 = \beta_3 = 0$ (homoskedasticity) H_1: β_1 or β_2 or $\beta_3 \neq 0$ (heteroskedasticity)	$TR^2 > \chi^2(p)$ *or* p-value<0,05	TR^2=5,455033 **<** $\chi^2(6)$=12,5916 *and also* all p-values**>**0,05	Not reject H_0

Source: own processing; results from Gretl based on data from Eurostat available at www.epp.eurostat.ec.europa.eu

The high coefficient of determination R^2 = 0,994656 means that the estimated econometric model explains 99,46% of the variability of the selected dependent variable. On the other hand, this high value may indicate a high multicollinearity between variables. For this reason, we have calculated the *Variance Inflation Factor (VIF)* with Gretl, which should not be greater than 10. It is given by the formula:

$$VIF = \frac{1}{(1-R_j^2)} \qquad \text{j=1, 2, 3, ..., k} \qquad (3)$$

Table 4 Detection of multicollinearity by using the Variance Inflation Factor

Variable	VIF	Result
ACT	3.037 < 10	No collinearity problem
UNE	5.599 < 10	
INAC	6.339 < 10	

Source: own processing; results from Gretl based on data from Eurostat available at www.epp.eurostat.ec.europa.eu

Table 5 Results from Breusch-Godfrey test for first-order autocorrelation

	Hypotheses	Reject H_0 if	Results from Gretl	Result
Autocorrelation (Rho = 0,484833 indicates positive autocorrelation)	H_0: $\beta_1, \beta_2, \beta_3 = 0$ (no autocorrelation) H_1: $\beta_1, \beta_2, \beta_3 \neq 0$ (autocorrelation)	$TR^2 > \chi^2$ *or* p-value<0,05	TR^2= 4,808908 **>** $\chi^2(1)$= 3,84146 *or* all p-values**>**0,05	Not reject H_0

Source: own processing; results from Gretl based on data from Eurostat available at www.epp.eurostat.ec.europa.eu

The result of *Model 1* is the following equation with basic information:

^FED_NFE = 2.37 + 0.724*ACT + 0.718*UNE + 0.205*INAC
(0.321) (0.0594) (0.199) (0.0195)

T = 10, R-squared = 0.995
(standard errors in parentheses)

OLS Model with Two Selected Variables

For the dependent variable we have chosen *UNE* - unemployed - the proportion of the labor force that is without work, but is available and looking for a job. For independent variable we have chosen *UNE_RT* – unemployment rate - represents the share of unemployed people to the economically active people (i.e. workers and unemployed). After that we have done a linear model estimation of parameters in the Gretl program using the *Ordinary Least Squares estimator*, so-called OLS model.

Model 2 OLS, using observations 2004-2013 (T = 10)
Dependent variable: UNE
HAC standard errors, bandwidth 1 (Bartlett kernel)

	Coefficient	*Std. Error*	*t-ratio*	*p-value*	
UNE_RT	0.14897	0.00992498	15.0096	<0.00001	***

Mean dependent var	2.070000	S.D. dependent var	0.459589
Sum squared resid	1.501057	S.E. of regression	0.408392
R-squared	0.966457	Adjusted R-squared	0.966457
F(1, 9)	225.2879	P-value(F)	1.12e-07
Log-likelihood	-4.707308	Akaike criterion	11.41462
Schwarz criterion	11.71720	Hannan-Quinn	11.08268
rho	0.439378	Durbin-Watson	1.040290

Source: own processing in Gretl based on data from Eurostat available at www.epp.eurostat.ec.europa.eu

Table 6 Results of tests for verification of the econometric model in the program Gretl

	Results of the verification tests
***t*-statistics**	parameters are significant
***F*-statistics**	model as a whole is significant
Heteroscedasticity	heteroskedasticity is not present
Multicollinearity	multicollinearity is not present
Autocorrelation	no autocorrelation

Source: own processing; results from Gretl based on data from Eurostat available at www.epp.eurostat.ec.europa.eu

The result of *Model 2* is the following equation with basic information:

^UNE = + 0.149*UNE_RT
(0.00992)

T = 10, R-squared = 0.966
(standard errors in parentheses)

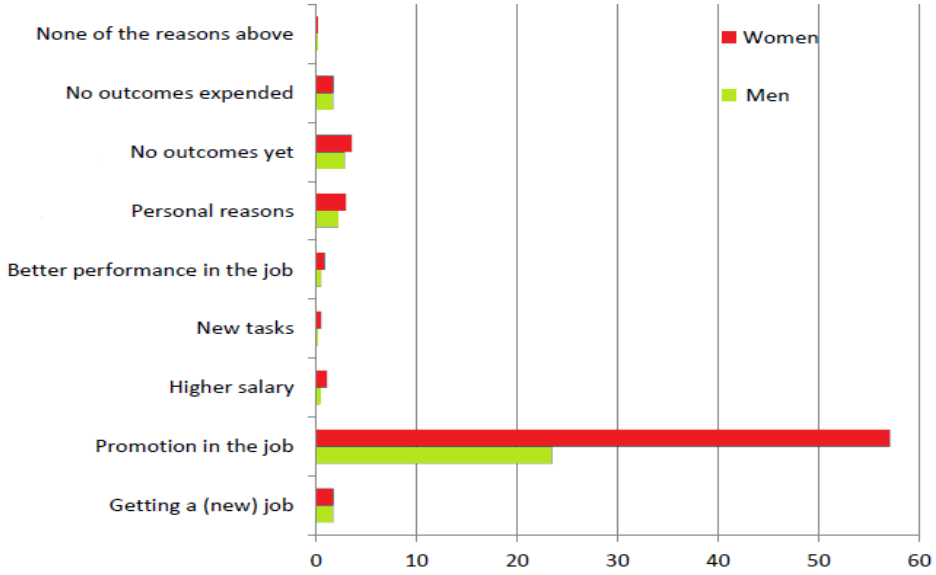
Outcomes of Further Education

In 2013, the Statistical Office of the Slovak Republic published a study which is focused on selected indicators about lifelong adult education. The survey was realized in the form of a questionnaire on a sample of 7472 respondents on the whole territory of Slovakia (the total rate of return was 62%, i.e. 5000 questionnaires). The reference period was 12 months - from 1.10.2011 to 15.11.2011. On the chart below we can see the results of the use of new knowledge and skills acquired through formal education.

It is obvious that the greatest motivation to an individual is to engage in further learning when the individual has achieved a promotion in their job - this trend can be observed especially among women. Reasons such as better performance in the job, higher salary, personal benefits, or getting a (new) job do not reach far such level as promotion in the job. It is interesting that some respondents do not expect any outcomes from participation in further education. We assume that it can be caused by reason of

involuntary participation in education, for example mandatory participation of the unemployed people in courses organized by labor offices.

Figure 2 Outcomes of new skills/knowledge acquired through formal education (%)



Source: Statistical Office of SR (2013): Selected indicators about lifelong adult education in the Slovak republic

4 Conclusions

There are several determinants that affect the participation of adults in lifelong learning, for example the type of household (one member per household, a household with children), the highest level of education successfully completed, gender, employment status, employment rate, respectively unemployment rate, expenditures on education, etc. In our contribution, we have compiled the most probable regression model of selected determinants of lifelong learning in the Slovak Republic.

In *Model 1* we have analyzed the impact of individual independent variables and the way in which they change (in our case the adult population divided according to labor status) on the dependent variable, which was the total participation of adults in formal and non-formal education *(FED_NFE)*. The results show that if there was a unit increase in the *economically active population (ACT)*, whilst the values *UNE (unemployed people)* and *INAC (inactive persons)* unchange, the *FED_NFE* will grow on average by 0,7240. When there was a unit increase in the UNE, whilst the values ACT and INAC unchange, the FED_NFE will grow on average by 0,7181. When there was a unit increase in the INAC, whilst the values ACT and UNE unchange, the growth of the FED_NFE was on average by 0,2053. From the above findings we suggest, that the inactive population does not show sufficient efforts to educational activities of the state. Therefore, it may be necessary to reconsider the state support activities focused on this population group.

In *Model 2* we have analyzed the impact of the change of one independent variable (in our case it was the unemployment rate, i.e. *UNE_RT)* on the dependent variable, which was the unemployed people (*UNE)*. The outputs show that if there was a unit increase in the UNE_RT, then UNE will grow on average by 0,1490. The result can be interpreted in another way, because the individual parameters are representing elasticities. Then the parameter β expresses, that if the unemployment rate increases by 1%, then the total number of unemployed people that are participating in lifelong learning will increase on average by 0,15%. Despite the fact, that the given parameter value is low, it indicates the efforts of the unemployed people to participate in the further education and vocational training. We can justify it by the fact, that the unemployed people want to

participate in lifelong learning (during the periods of high unemployment rate) to become more attractive for employers and thereby increase their chances of getting a job.

The adult participation in formal and non-formal education and vocational training has an increasing trend. This can be a result of the wide range and availability in the form of a relatively large number of universities in Slovakia, various educational institutions, educational facilities of enterprises, private educational institutions, but it can also be a result of awareness of perspectives of better chance and the position of educated people in the labor market.

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The Utilization of Sovereign Bond Spreads: The Case of V4 Countries

Jana Hvozdenská, Petr Červinek

Masaryk University
Faculty of Economics and Administration, Department of Finance
Lipova 41a, 602 00 Brno, Czech Republic
E-mail: 174974@mail.muni.cz, cert@mail.muni.cz

Abstract: *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 outperforms other financial and macroeconomic indicators in predicting recessions two to six quarters ahead. The steepness of the 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 real growth the near term. This paper aims to analyze the dependence between slope of the yield curve and an economic activity of V4 countries (Czech Republic, Hungary, Poland, Slovakia) between the years 2000 and 2013. The slope of the yield curve can be measured as the yield spread between sovereign 10-year bonds and sovereign 3-month bonds. The natural and probably the most popular measure of economic growth is by GDP growth, taken quarterly. The results showed that the best predictive lags differ in each country and each time span we chose. The most common lags of spreads are lag 4 and 5 quarters. The results presented confirm that 10-year and 3-month yield spread has significant predictive power for real GDP growth. These findings can 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: GDP prediction, yield curve, slope, spread

JEL codes: E43, E44, E47, G01

1 Introduction

The yield curve simply plots the yield of the bond against its time to maturity. 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 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 outperforms other financial and macroeconomic indicators in predicting recessions two to six 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, 2005; Chinn and Kucko, 2010). Most of the studies are focused on the relationship of the yield curve and GDP activity of United States of America.

The aim of this paper is to show if the yield spread possesses the predictive power of future economic activity in the countries of Visegrad group – Czech Republic, Hungary,

Poland and Slovakia and to examine which time lag of the spread is the best for prediction of the future GDP.

Despite various researches, there is not any comprehensive theory that would prove the correlation between the yield spread and economic development of the country yet. Often we come across the statements that have only theoretical basis without generally valid empirical evidence. Economic models are largely based on the argument that the yield curve tends to be flatter in the situation of the tight monetary policy and the economic slowdown typically occurs with a slight time lag (Szarowská, 2013).

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 of 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). 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 much preliminary work. There is the principle which needs to be hold: 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 different model of constructing.

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 (Estrella and Hardouvelis, 1991; 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 the Czech Republic, Hungary, Poland and Slovakia.

There is no previous research which would prove or reject the hypothesis of real GDP and bond spread dependence in European countries.

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 4Q2013. 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 assumption that the lag of four quarters is the best one.

Model Specification

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 year was the previous year of financial crisis and should show some changes in prediction of the yield curve spread) were run.

The following equation (1) was estimated for each country:

$$Real\ GDP_{t+n} = \propto + \beta * spread_t + \varepsilon_t \quad (1)$$

Where:

$Real\ GDPt + n$ is a prediction of the future real GDP in time $\mathrm{t} + \mathrm{n}$
n is the lag of spread, value of the lag can be 2, 3, 4, 5 or 6
$spread_t$is spread between 10-year and 3-month state bonds in time t
ε_t is a white noise

3 Results and Discussion

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 4Q2013. A regression of the whole sample was run and we got the results as seen in Table 1.

For the Czech Republic the best results were gained with lag of spreads by six quarters, for Hungary and Poland with lag of spreads by 5 quarters and for Slovakia by 2 quarters.

We can say that all models are statistically significant, because the p-values are under 1% and R^2 are quite high. These models could be used as predictive models. The R^2 coefficients (coefficients of determinations) show us how many percentage of the sample can be explained by these models.

Table 1 Results of All Countries and Whole Sample from OLS Regression

Whole sample	Constant	Spread	P - value (F - test)	R^2
Czech Republic (n=6)	0.00448935	0.466538	0.0021 ***	0.161881
Hungary (n=5)	0.0108453	-0.746805	3.78e-05 ***	0.271896
Poland (n=5)	0.0386123	0.270458	0.0024 ***	0.158135
Slovakia (n=2)	0.0599752	-1.48410	0.0002 ***	0.233567

Source: author's calculations

For example we can say that future real GDP of Czech Republic will be:

$$Real\ GDP\ Czech\ Republic_{t+6} = 0.00448935 + 0.466538 * spread_{Czech\ Republic\ t}$$

By this model we can predict future real gross domestic product for Czech Republic six 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 4Q2013 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 – 4Q2013 (second sample) are in Table 3.

Table 2 Results of All Countries and Sample from 1Q2000 to 4Q2007

1Q00 – 4Q07	Constant	Spread	P - value (F - test)	R^2
Czech Republic (n=3)	0.0188702	1.77703	5.48e-05 ***	0.423696
Hungary (n=6)	0.0265233	-0.400833	0.0003 ***	0.363500
Poland (n=5)	0.0517323	0.512878	2.47e-07 ***	0.593939
Slovakia (n=4)	0.0659750	-1.24058	0.0181 **	0.172565

Source: author's calculations

In the first period the best results for the Czech Republic were gained with lag of spreads by three quarters, for Hungary by six quarters, for Poland with lag of spreads by 5 quarters and for Slovakia by 4 quarters.

Again we can say that all models are statistically significant, because the p-values are under 1% (in case of Slovakia under 5%) and R^2 are high. In case of Poland 59% of the sample can be explained by this model, which is very good.

In the second period the best results for the Czech Republic were gained with lag of spreads by 4 quarters, for Hungary by 3 quarters, for Poland with lag of spreads by 4 quarters and for Slovakia by 2 quarters.

The model for Hungary cannot be used as predictive model because of high p-value (0.1147). The p-value should be lower than 0.1 (10%) in order to be used as a predictive model. The coefficients of determination are lower than in the previous period. It may be caused by different behavior of financial markets after the financial crisis (after year 2008).

Table 3 Results of All Countries and Sample from 1Q2008 to 4Q2013

1Q08 – 4Q13	Constant	Spread	P - value (F - test)	R^2
Czech Republic (n=4)	-0.0282836	1.35588	0.0306 **	0.195403
Hungary (n=3)	-0.0143276	0.908517	0.1147	0.109222
Poland (n=4)	0.0185486	1.05235	0.0059 ***	0.297380
Slovakia (n=2)	0.0549248	-1.66673	0.0201 **	0.222059

Source: author's calculations

The best predictive models are as follows:

$$Real\ GDP_{Czech\ Republic\ \ t+4} = -0.0282836 + 1.35588 * \ spread_{Czech\ Republic\ t}$$

$$Real\ GDP_{Hungary\ \ t+5} = 0.0108453 - 0.746805 * \ spread_{Hungary\ t}$$

$$Real\ GDP_{Poland\ t+4} = 0.0185486 + 1.05235 * \ spread_{Poland\ t}$$

$$Real\ GDP_{Slovakia\ \ t+2} = 0.0599752 - 1.48410 * \ spread_{Slovakia\ t}$$

The data used for models of the Czech Republic and Poland should start from 1Q2008 and the data used for models of Hungary and Slovakia should start from 1Q2000. Models which describe the behavior and dependence of the gross domestic product and bond spreads from 1Q2000 to 4Q2007 cannot be used as predictive, because this trend was already broken by financial crisis. Therefor it is better to use the model with data from 1Q2000 or from 1Q2008 and both of them end on 4Q2013.

For example if there would be a change of 1% up in the spread of the Czech Republic then the GDP would increase about 1.33% (-0.0282836+1.35588*1%).

At the end we can summarize the findings and predict the future GDP of the selected countries.

Prediction of Real GDP in 2014 – Czech Republic, Hungary, Poland and Slovakia

The spreads are known from the year 2013. The predictions of future GDP are in Table 4.

The GDP of the Czech Republic should increase in all four quarters approximately about 2%. GDP of Hungary should increase in the first two quarters of 2014 and later very slowly decrease. GDP of Poland should increase in all observed periods between 2.8% and 4%. GDP of Slovakia should increase in both periods around 2.6% and 2.9%.

Table 4 Prediction of Real GDP in the Selected Countries

Prediction of GDP	Czech Republic		Hungary		Poland		Slovakia	
	spread	GDP	spread	GDP	spread	GDP	spread	GDP
1Q2014	0.01573	-0.0069	0.0064	0.0062	0.00966	0.02872	0.022826	0.026099
2Q2014	0.0222	0.0019	0.0153	0.00606	0.01636	0.03576	0.020666	0.029305
3Q2014	0.0218	0.0014	0.0184	-0.0006	0.01912	0.03867		
4Q2014	0.02433	0.00478	0.0223	-0.0029	0.02074	0.04038		
1Q2015			0.027	-0.00581				

Source: author's calculations

However we can use the models for predicting of the GDP, we cannot summarize any new theoretical knowledge about which lag is the best for predicting of the future GDP. We can see that the best lag always differs in all countries and even in every period. At the end we can write down a short summary (n for whole sample, 1st period, 2nd period).

Czech Republic – n=6, n=3, n=4
Hungary – n=5, n=6, n=3
Poland – n=5, n=5, n=4

Slovakia – n=2, n=4, n=2

The most common lags (and possibly maybe the most suitable for predicting of the GDP) are lag 4 a lag 5.

4 Conclusions

Does the yield curve accurately predict the real economic growth? Answering this seemingly simple question requires a surprising amount of preliminary work. The 10-year, 3-month spread has substantial predictive power and should provide good forecast of real growth two to six quarters into the future. Nevertheless we showed that the best predictive lags differ in each country and each time span we chose. The most common lags of spreads are lag 4 and 5 quarters. The results presented above confirm that 10-year and 3-month yield spread has significant predictive power for real GDP growth and the models which can be used as predictive for GDP growth in Hungary and Slovakia were computed from the data which start in 1Q2000. Models for GDP prediction in the Czech Republic and Poland should were computed from the data which start in 1Q2008.

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 4 is the best for predicting future GDP growth even in the countries of European Union (as it was proven only in USA).

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The Issue of Dividend Policies of Companies Listed on Warsaw Stock Exchange - Results of the Research

Bartłomiej Jabłoński, Jacek Kuczowic

University of Economics in Katowice
Department of Investments and Real Estate
Ul. 1 Maja 50, 40-287 Katowice
E-mail: bartlomiej.jablonski@ue.katowice.pl, jacek.kuczowic@ue.katowice.pl

Abstract: *The article describes the problem of dividend policies of the companies quoted on Warsaw Stock Exchange. The objective of the article is to present the result of the research carried out on the information provided by 118 stock exchange companies in the period 2006-2012. The research aimed at the description of the types of dividend policies applied by the companies and the analysis of investor relations from the point of view of the regularity of passing the information about the dividend policy to investors, its principles, possible changes or stopping the dividend payout. The research covered information provided in the Internet, financial statements and emission prospectuses of the companies. The outcome of the research shows that dividend policy is not an essential tool for the stock exchange company value management and its role in investor relations is marginal.*

Keywords: dividend policy, dividend companies, investor relations

JEL codes: G35, G23, G11

1 Introduction

The value of the paid out dividend by an issuer in relation to the reinvested profit has a significant influence on the capital structure of a company. The decisions connected with capital structure- together with strategic decisions and the decisions connected with corporate supervision- are one of three elements used to create the value for shareholders.

The level of a company profit and a dividend level are strictly connected with the capital structure and the average cost of the total capital. The reinvestment of the profit results in increasing the equity capital, which with the unchanged level of the borrowed capital causes a grow of share of the former in the structure of the capital (Wrońska, 2006). On the other hand, the changes of the market price are a result of the ability of a company to generate profits (cash flows) and, consequently, an ability to pay out dividends in the future (this ability depends, among others, on the capital remaining at the disposal of the company; the bigger the capital the higher profits in the future). The influence of the value of the dividend and its participation in the earned profit of the company on the wealth of shareholders are not unambiguous: on the one hand, higher dividends mean the rise of the wealth, on the other hand they limit the potential of the rise of the company profits in the future and limit potential capital gains of the investors. (Cwynar et al., 2007). Therefore, systematic informing of the investors about the realised dividend policy as an element of the investor relations should be included in the basic elements of the company value management.

In the article the results of the research on dividend policies of the companies listed on Warsaw Stock Exchange have been described. The research focused on the identification of the types of dividend policies applied by companies and the analyses of the forms of communication of the approved principles of the division of the retained earnings to investors. The objective of the research was the answer to the question about the role the managers of the companies give to the dividend policy in the process of company management and the place of the dividend policy in the investor relations. One must emphasize that such study approach neglects the real decisions about profit division and only companies' declarations are analysed.

2 Dividend Policy as an Element of Investor Relations

Dividend policy, being an element of payout policy, specifies what part of the profit is passed to investors and what remains in the company for further distribution.

Companies which are in the first stages of development are characterised by an especially big need for capital, so, in their case, usually the whole profit is used for realising investment projects. That is why only companies in the mature phase of development can pay out significant dividends without producing a negative effect on the realised investment projects (see Bulan et al., 2009). Company profit can be divided into two streams of cash flow. The first goes to shareholders in the form of a dividend. The other is retained in a company and can be used for financing its growth and development.

Similarly to the debt policy, the dividend policy can be formulated in a resolution made during a shareholders' meeting. (Pomykalska et al., 2007).

A dividend policy can be an element of investor relations which comprise a wide scope of company communications with its environment, especially with capital market investors. The objective of investor relations is providing full financial and economic information about the activity of a company, especially on the cooperation with capital market investors. The key advantage of such approach is eliminating the information gap which is caused by an informational asymmetry between a company and investors (see Stradomski, 2006). Investor relations, as the name suggest, concentrate on the relationship between an entity and investors, among which shareholders, in other words owners, play a special role. (Dziawgo, 2011). Defining investor relations can be done from the point of view of the investor and the entity that uses them. The definition from the point of view of the investor characterises them as a mutually beneficial process of bilateral communication of the company with investors and the opinion forming environment. The main goals of this activity are: informing investors about the activity of the company, building the trust, lowering capital cost and achieving full valuation of the company (Niedziółka, 2008).

The communication of the company with capital market investors can take place according to three accepted methods described as investor relations models. The concentration of the company on fulfilling minimal information obligations is typical of the traditional model (the passive model). The second model- described as the modern model- involves not only the active communication with the receivers of investor relations, but also active feedback information. It is essential that in this model the question of a stable dividend policy is emphasized. The target model, being the last model in the accepted classification of investor relations models is characterised by transparency of a company in the widest possible scope. It is a result of bigger and bigger demands of the participants of the capital market. What is emphasized, among others, is the fact of using investor relations as a way of generating company value (see: Dziawgo, 2011).

For investors, who point out the fact of receiving dividend as one of the determinants for the selection of shares to the portfolio, the level of investment relations will have a big significance. They will be especially looking for information concerning the accepted dividend policy and will verify the degree to which the company fulfilled the promises concerning the division of profit in the past.

3 Dividend Policy from the Point of View of the Participants of the Capital Market

The participants of the capital market, apart from the institutions connected with the organisation of the trade of securities, are issuers and investors, including natural persons and institutional investors. As far as the effectiveness of the results of investment is concerned, they are characterised by the same goal of investment decisions– achieving a satisfying rate of return being a result of changes of share prices

and the sum of the received dividends. Therefore, there are two groups of capital market investors that are interested in the dividend policy. They are investors and issuers of securities. One should add that receiving dividends is one of property rights to which capital market investors are entitled.

Investors interested in dividend companies, while looking for investor relations information will search for information on dividend policy and will decide to which extend it suits them. So the decisions of an issuer on the changes of the value of the paid out dividend in relation to the planned value cause the fall of share prices of the companies that had disappointed the investors with their activities. In this situation investor relations should be especially used to eliminate negative results of such events in the future.

The payouts of dividends can influence the level of share prices if they pass to investors the information on the expectations and planned decisions of the management board of a company or give other signals (see more: Francis, 2000). In the literature the patterns of behaviour of investors and issuers concerning dividend payout have been described. One of them is the bird-in-the-hand theory – the income of the investor in the form of the expected dividend is more important than the expected capital gain because the dividend payout is certain and potential gains from the rise of price share are uncertain. Another pattern of behaviour was called the catering theory. A company responses to the demand from investors providing the dividend on the level which is needed. Other results connected with dividend policy are the effect of signalisation (a rise of the value of dividend causes an increase of share prices and its decrease or shortage, causes a decrease of share price) and the clientele effect (companies setting a given dividend policy attract a concrete type of investors, especially those who want to obtain dividends (see: Kowerski, 2011; Stalmacha, 2005; Cwynar et al., 2007; Sierpińska, 1999). As a result of the signalisation effect, in practice it is far more common to find decisions on the increase of the dividend or its maintaining at a fixed level rather than decisions about its lowering or total stopping of the dividend payout (Miller et al., 1985). Moreover, the behaviour of the capital market investors as far as dividend policy is concerned is psychologically motivated. The mentioned bird-in-the-hand theory is connected with the so called certainty effect an investor prefers to be sure of the prize rather than risk even if the risk is small. (see more: Zaleśkiewicz, 2003). Most of the investors have a tendency to avoid risk and choose shares with stable dividends and not companies characterised by higher profits caused by changes of share prices.

From the point of view of an issuer, growth stocks should not pay out dividends. The return rate they obtain from the invested capital exceeds the cost of the capital. They maximize their value by retaining profits and their investments. On the other hand, the entities that are not able to invest earned profits (called 'declining companies') should pay out dividends when the effectiveness of the investment is below the cost of the capital. The third group of issuers are typical companies, that operate in a condition of static balance and in the case of which the return rate from investment equals the cost of the capital. It is assumed that in case of these companies the policy of dividend payout does not influence the value of shares. (Francis, 2000). The stock exchange companies that want to have stable shareholdership should, especially as a part of investor relations, publish information not only about financial results forecasts, but also about the dividend policy, including the principles of their construction and all changes connected with them. The dividend policy realised by a company is not free from the influence on the capital structure because paid out dividends are one of the elements that shape the structure of the liabilities. In the theory of finances, the capital structure theory is often emphasized. The first one – the static theory of substitution– says that there is an optimal capital structure that causes the maximization of the market value of the company. The other theory – the hierarchy of financing sources theory – assumes that the entities obtain sources of financing according to a given order, i.e. a company finances its needs from retained earnings and only later uses borrowed capital in a form of a loan. As a last resort, it uses own capital built from the emission of shares. One can assume that a company financed from borrowed capital is interested in implementing

investment projects characterised by high profitability. That is why a transfer of capital to shareholders – in a form of a dividend or independently, or by share redemption and cancellation – should be done from a part of a profit and not from borrowed capital. The way of financing the activity of a company and the life cycle of an entity also influence the dividend payout policy. It is assumed that for a company it is important how a present structure of the capital relates to optimal values, so the payouts for shareholders are one of the ways of getting to the capital optimum. A big share of debt in the profit should lower the indices describing payout policies because a company, first of all should use the cash for the service of this debt. It will result in making the limitations concerning the elasticity of financing company activity smaller. From the relations above, one can conclude that, the higher the share of debt in the capital structure the lower the indices of the payout policy (see: Cwynar et al., 2007).

A company using a dividend policy in the periods of bigger need for capital can pay out dividends from the profits accumulated in previous periods. Such dividend can be lower but the continuity of dividend payout will be preserved. It is especially important if an issuer belongs to immature companies (DeAngelo et al., 2006). That is why companies realising investment projects will make efforts to limit dividend payout and invest in their development. It has been confirmed by a research made by E.F. Fame and K.F. French, which showed that the dividend payout depends, among others, on the profitability of a company (Fama et al., 2001).

Having studied the literature on the topic one can conclude that dividend policy has been and will be closely observed by investors, especially those who plan making investments from received dividends. No matter if dividend policy will be part of investor relations or will be presented as separate information on the Internet web page of the issuer or in company documents (e.g. in the emission prospectus), it should be communicated in a clear way and realised in accordance with an accepted model of its estimation.

4 The Methodology of the Conducted Research

In order to realise the objective of the article the following plan and methodology of the resarch have been adopted:

1. The time scope has been set.
2. The criteria for the selection of a representative group of companies from all the companies listed on Warsaw Stock Exchange have been set.
3. The research areas of the dividend policy for a representative group of companies have been identified.
4. The sources of the information on the dividend policy of the issuers have been selected in accordance with point 2.

One should add that in the research the focus has been made on the identification of the types of the dividend policy applied by the companies and the analisys of the ways of communicating to the investors of the accepted rules of the division of retained earnings.

In accordance with the adopted plan and the methodology of the research, the following conclusions have been made:

The time scope of the research will be the companies listed on Warsaw Stock Exchange in the period 2006-2012.

1. A dividend company is defined here as a company that during last 5 years has paid out dividends at least 3 times. Dividend companies have been selected according to this criterion in each year covered by the research. The analysis covered companies which in the period chosen for the research at least once were classified as dividend companies.
   As a result, 118 dividend companies listed on Warsaw Stock Exchange in the period 2006-2012 were covered by the research.
2. The research focused on two aspects of company dividend policy:
   a. the form of constructing dividend policy,

b. the development of investor relations as far as dividend policy is concerned.

3. The carried out analisys covered the information of the companies refering to the realised or planned dividend policy. It means that the analisys was based on the information declared by the companies and not the information on the factual payout of dividends. Such information has been found on the webpages of 64 out of 118 studied companies. This means that almost half of the companies classified as dividend companies have not informed the investors on the principles according to which they divide the profits.

5 Types of Dividend Policies and its Place in Investment Relations in Polish Stock Exchange Companies

Presented research covered 118 dividend companies listed on Warsaw Stock Exchange in the period 2006-2012. By a dividend company we understood a company which paid out dividend at least 3 times during last 5 years. According to this criterion dividend companies have been selected for each year. The analysis covered companies that in the accepted period of research were at least once classified as dividend companies.

The research focused on two aspects of company dividend policy:

1. The forms of constructing dividend policies.
2. The realisation of investor relations in the scope of the dividend policy.

The analysis made covered the information from companies related to the realised or planned dividend policy. This means the analysis referred to the declaration of companies about the payout and not the decisions about the actual payout of the dividend. Such information has been found on Internet pages of 64 of 118 studied companies. So almost half of the companies classified as dividend ones did not inform the investors about the principles according to which they decide on the division of profits.

The principles of dividend payout presented by companies are in most cases very imprecise. Because of the wording used it is not possible to match a given dividend policy with a specific type of dividend policy presented in the literature. The announcements have usually a descriptive character and rarely describe target dividend payout indices. Most of them inform about a number of conditions on which the decision on dividend payout depends. Because these conditions have a quality nature, the dividend policy based on them is very general.

The interpretation of the information provided by companies enabled to create the breakdown of the most often used types of investment strategies (Table 1). Almost half of the companies (44%) declare the payout of dividend only from financial means left after securing capital needs resulting from a widely understood development. We can conclude that this group of companies applies the residual dividend policy. Another group of companies (27%) declares the payout of a dividend at a level expressed by an index related to the profit or (rarely) dividend rate. The declared dividend payout index is very varied for different companies. In most cases (77%) it is between 20% - 60% of the profit to be divided. A higher index was declared only by 6 companies. One should stress that many companies inform only about the order (lower or upper) of dividend payout or gave a wide percentage scope (in extreme cases 50-100%). Such form of dividend policy does not provide an investor with essential information.

A big group of companies (23%) gives only a description of the conditions of the payout of dividends. A list of such conditions includes mainly endogenous factors. Most often the companies inform that the division of profit will depend on widely understood capital needs, including development needs (34% of indications), income (15%) and a need for preserving financial liquidity or paying back liabilities (11%). Sometimes the conditions are described in a very general way and refer to unclear perspectives or situation on the market.

Table 1 Forms of the declared dividend policy in the studied companies.

Dividend strategy	All companies	WIG20 index companies	WIG 80 index companies and outside the index
Lack of dividend	1	0	0
A fixed dividend	1	0	1
A rising dividend without giving an index	2	1	1
Dividend according to a fixed index of dividend payout	17	2	13
Residual dividend	28	3	20
Conditional dividend	15	3	9
In total	64	9	44

Source: own study

The approach of companies to formulating dividend policies does not depend on their size. The structure of types of dividend policy in big companies (from WIG 20 index) and small companies (from WIG 80 index or not included in basic indexes) is similar.

Very imprecise rules of dividend policy might be a result of the fact that they are documents prepared by company managers. As many as 65% of the analysed dividend policies were documents signed by company management boards (including two approved by supervisory boards). Only in two cases the dividend policy was approved by annual meeting of shareholders. In many cases (28%) companies did not give a source of the presented dividend policy. Specifying in the official documents precise principles of profit division in the future causes a risk of investors' dissatisfaction in case the promises are not fulfilled. At the same time a big uncertainty of future conditions causes a significant risk of such situation taking place. That is why the use of very general wording in dividend policies enabling their free interpretation becomes a safer form from the point of view of the management board. On the other hand, annual general meeting of shareholders may not feel the need to approve the dividend policy assuming that they make the final decision on the division of profit.

A place of dividend policy in investor relations constituted the other area of study. The way investors are informed about dividend policy clearly shows that companies do not treat it as an important area of investor relations. It is confirmed both by a small percentage of companies informing of the used dividend policy (54%) and the way the information is passed (Table 2).

Table 2 The place of publishing the information on declared dividend policy of a company

Dividend strategy	All companies	WIG 20 index companies	WIG 80 index companies and outside the index
Emission prospectus	33	2	26
A bookmark on the company web page	11	4	5
In another document on the company web page	16	3	10
Financial statement	4	0	3
In total	64	9	44

Source: own study

Internet is the main channel of communication in investor relations, nowadays. The way the information is presented in the Internet, its clarity and completeness is a reflection of the state of investor relations. Still, finding information about dividend policies of the studied companies is usually a difficult task. The information on this topic is usually hidden in other published documents of a company. Only every sixth company (17%) has

a bookmark on its web page devoted to the issue of a dividend. If we take into consideration the fact that this percentage refers only to dividend companies that publish dividend policy and the fact that the information contained in such bookmark is limited sometimes to the information about paid out dividends, one can conclude that company management boards are not interested in publishing information about the preferred principles of profit division.

In the rest of the analysed cases the information on dividend policy was hidden under various bookmarks of the web page or other documents of the company. In four companies the information about current division of profit was found only in the current financial statement. The description of the dividend policy in financial statement is undoubtedly justified but only when it is a reminder of the rules used in a continuous way. Nevertheless, in the financial statements one can find information about dividend policies for the given year or a two-three year period. It shows a lack of understanding of the essence of the dividend policy. Current setting of the principles of the division of profit does not mean applying the dividend policy.

Conclusions

The presented research shows the following:

1. The division of profit in Polish public companies is a result of current factors determining the payout and value of the dividend.
2. Only some stock exchange companies (we can assume about 15%) inform the investors about the declared dividend policy, but most of them do it in an unreliable way and often because it is enforced by law. The frequency and reliability of information about dividend policy increases with the size of the companies.
3. The majority of the companies (67%) with dividend policy applies residual dividend policy or dividends depend on satisfying other capital needs.
4. The conditions for the dividend payout described by companies have first of all endogenous character.
5. The dividend policy of a quarter of the companies has only a descriptive character, which makes it more difficult for the investors to foresee the dividends.

The analysis of the way the companies communicate with investors let us conclude that the dividend policy is not treated by Polish public companies as an important area of investor relations. The research does not give an answer to the question about the role of dividend policy in the management of companies. Frequent changes and short term understanding of the dividend policy can suggest that management boards of some companies consider the problem of the share of the profit to be irrelevant from the point of view of a strategic development of the entity. As from the point of view of company managers giving detailed information about dividend policy increases their responsibility (and thus it is unadvisable), the appropriate changes can be enforced only by investors looking for companies with a stable dividend policy.

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Disability Benefits for Victims of Traffic Accidents – Size of Compensations Offered by the Current Amount of Coverage in MTPL Insurance

Anna Jędrzychowska, Ewa Poprawska

Wroclaw University of Economics
Faculty of Management, Computer Science and Finance, Department of Insurance
Komandorska 118/120 bud. Z, 53-345 Wroclaw, Poland
E-mail: anna.jedrzychowska@ue.wroc.pl, ewa.poprawska@ue.wroc.pl

***Abstrac**t: Liability insurance protect the insured against the financial consequences of the potential claims of persons or entities to whom the insured causes injury and, according to law, is obliged to repair. At the same time liability insurance protects third parties who are injured as a result of the events for which the insurance holder is responsible. They give a sense of security and greater certainty of receipt of future benefits. It should be remembered that the responsibility of the insurer in the liability insurance is limited by amount of cover defined in the contract, representing mostly the limit of liability for one and / or all of the events. The authors attempt to investigate how the proposed amounts of cover are sufficient to cover potential claims made by victims. The authors will focus on the issue of disability benefits, due to the fact that the highest compensation are paid in the event of personal injuries, especially in the case of disability benefits. In the study simulations will be carried out which purpose will be to answer the question of how high the benefit may get injured party and how many victims may be paid a certain amount in the assumed amount of the amount of cover. Simulations will be conducted by gender, age of the victim and for selected European countries.*

Keywords: MTPL insurance, personal injuries, provision for capitalized value of pensions

JEL codes: G22, G28, J17

1 Introduction

Motor Third Party Liability (MTPL) insurance is compulsory and therefore the most popular insurance product in European countries. At the same time one of the problems related to functioning of the insurance companies offering MTPL insurance is the increasing value of compensations paid, it is worth noting that personal injury become particularly problematic. According to Munich Re (see more in Mayr, 2011), in recent years there has been an increase in payments in connection with the same only damages associated with the loss of income by as much as 14% within 5 years.

One of the essential elements of the personal injury is annuities which have to be paid by insurer in two cases (according to Polish Civil Code, articles from 444 to 447):

1. to directly injured person (disability annuities) – this benefit should cover loss of income and increased needs, in most of the cases annuity have to be paid for life,
2. to close relatives (compensation for loss of income because of death of victim of accident) – annuity payable for life or to the age of majority or end of education.

Annuities are paid for many years, they should cover the financial damage that affected relatives of the deceased after his death. Most of its amount is determined adequately to the income that the household requested deceased.

The system of compulsory insurance, which in EU countries include the MTPL insurances, provides protection for both sides of a road accident. The obligatory MTPL system protects the victims (both directly and indirectly affected such as family members of person died in the accident) giving them a guarantee of payment of compensation payable by financial institutions (insurance companies). The takeover by the insurance financial obligations related to the accident raises confidence of receiving the benefit, as well as separates its payment from the length of life of the offender (it matters especially if the offender is a person advanced in years, and the compensation is to be paid as life

annuity for a young person).

The responsibility of the insurer in the liability insurance is limited by amount of cover defined in the contract. In different countries it can be set on different level, in EU countries the minimum amounts are proposed in 5th Directive concerning motor insurance and they can be equal to:

- for personal injuries - EUR 5 mln in respect of any one event, the effects of which are covered by insurance regardless of the number of casualties (this solution is used in Poland) or EUR 1 mln per person,
- for damage to property - EUR 1 mln in respect of any one event, the effects of which are covered by insurance regardless of the number of casualties,

but for example in Ukraine, Russia, Belarus, Moldavia, Serbia, minimum amounts of cover may be at lower level (see Table 1).

In Europe the Green Card System, which main objective is to ensure the protection of victims and offenders beyond the borders of their countries of origin. In this system operates Multilateral Agreement. Countries that belong to this agreement are required to sell MTPL with warranty covering the minimum requirements of the EU. Drivers of vehicles registered in countries belonging to the multilateral agreement can navigate through their territories without a Green Card. Four of the countries discussed in the article do not belong to this agreement (Russia, Ukraine, Belarus and Macedonia), for travelling the area of these countries must have a green card insurance, citizens of those countries travelling the area of the states belonging to the Multilateral Agreement also required are to have a Green Card. In case of having a Green Card, the compensation shall be paid by the insurer within the limits of liability of the holder of the vehicle as defined by the law of the event - up to the limits of the legal regulations in the particular country or to the sum of the guarantee specified in the contract.

It is worth answering a question whether the minimum amount of the coverage is high enough to provide coverage for claims relating to the payment of annuities to the casualty in the accident. This article aims is to check if the amount of the present value of a whole life annuity and the minimum amount of cover is high enough to cover annuities. Because compensation have to restore the financial situation and the quality of life of the victims before the accident and take into account the realities of the economic and social environment from which the injured, the calculation shows a few assumptions allowing for close calculations for these premises. In insurers and reinsurers methodology, loss of earnings are calculated factoring in life expectancy (according to Munich Re data, see more in Mayr, 2011; half of the claimants are under the age of 20 at injury, that is why analyzing value of annuity should be divided by age categories) and inflation and then methods based on NPV are in use (Smosna, 2009). In two European research projects: Unification of Accounts and Marginal Costs of Transport Efficiency UNITE and Generalization of Research on Accounts Cost Estimation GRACE developed a methodology for estimating the costs of traffic accidents. In Poland the problem of depletion of the amount of the guarantee is undertaken primarily by lawyers, and the Insurance Ombudsman (Kiziewicz, 2009, Orlicki, 2011).

2 Methodology and Data

Methodology

The simulation of several typical annuities payment variants will be presented in the paper. They were conducted in several versions of age and gender for average value of net earnings, as the value of single payment. The analysis was conducted for the Polish economy, the average value of wages for the central and eastern European countries and, for a contrary, also for Germany, Austria and Sweden.

The calculation of provisions for annuities can be done using a life annuity, which are created using the actuarial method, using data about the probability of survival and death in the following periods. The provision is equal to the expected value of a random

variable, the values of which are discounted future payments to the beneficiary. The amounts of net payments are adopted as the basis for calculations, it was done because the lack of unequivocal provisions on what charges the amounts received as compensation benefits due to civil liability insurance should be subject to.

Thus, the present value of future benefits for annuity in the amount of EUR 1 payable annually in advance can be expressed as the sum of the product of the discounted payments and the probability of survival to the next payment date. This formula can be expanded by supplementing it, for example by a factor that reflects the future growth of benefits for inflation, etc. (in the paper geometrical grown, has been assumed,), and finally, present value of annuity ($I\ddot{a}_x$) for x-years old person is given by:

$$I\ddot{a}_x = \sum_{k=0}^{\omega-x} (1+i)^{k-1} v^k \cdot {}_k p_x \qquad (1)$$

where: ${}_k p_x$ – probability that *x*-years old person will survive next *k* years, $v = 1/(1+r)$ – discount factor, where *r* is annual interest rate, *i* – rate of annual grown of annuity payment, ω – maximum age to which the life tables are created in a given country.

Assumptions and Data

In the calculations were made the following assumptions:

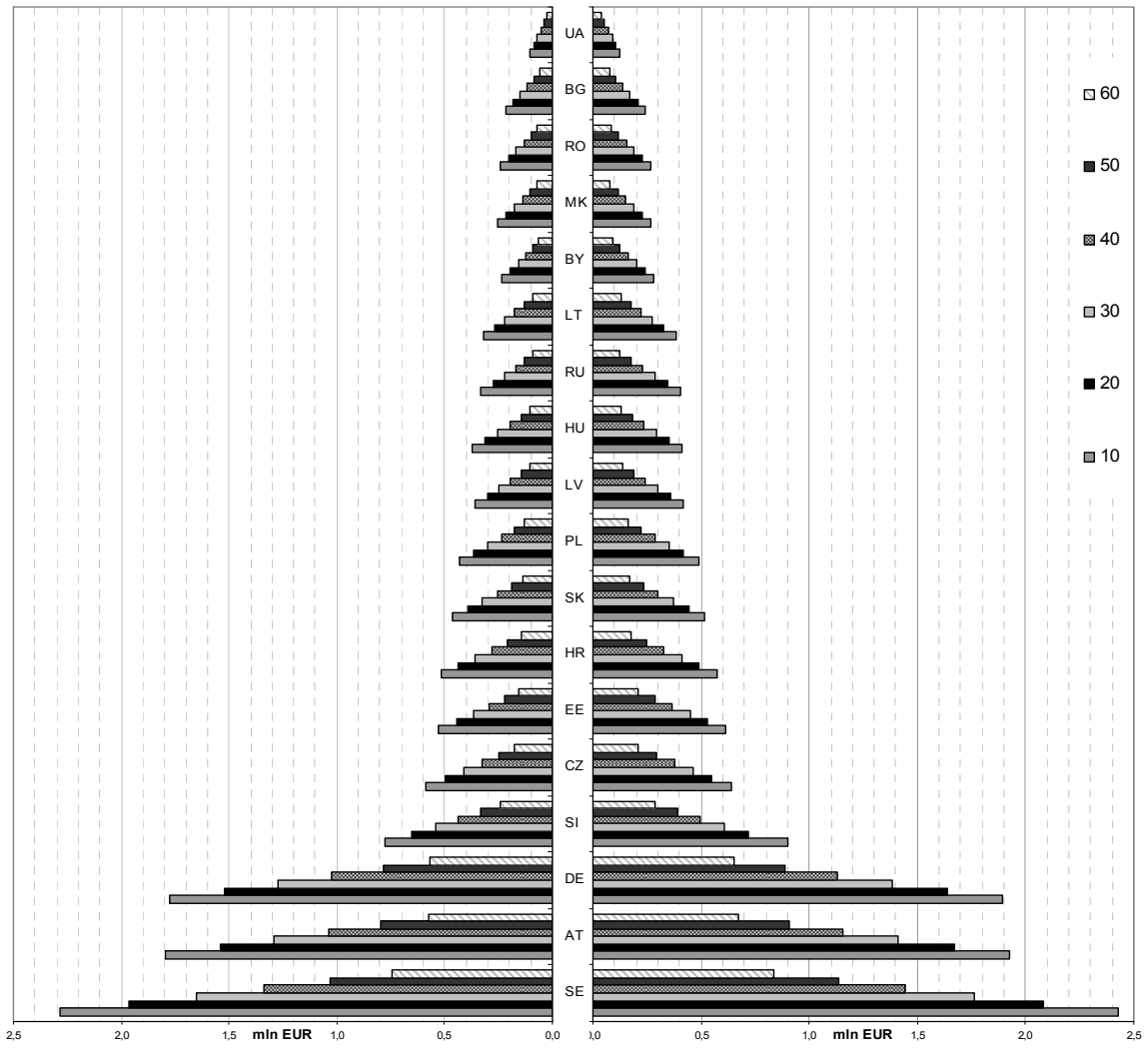
- The annuity is paid once a year, at the beginning of the year (this assumption will slightly overestimate the obtained values, but greatly simplify the calculation);
- The probability of survival are calculated using life tables for each country (last available, for most countries of 2012); calculations has been done fort men and women separately). Life tables used in the calculations has not been modified to take into account disability of the person the annuity is paid to, due to low availability of life tables for disabled persons in particular countries (the probability of living through the successive periods for disabled persons will be lower than it results from the life tables for the whole populations). The upper limit of the sum is the value equivalent age, which reached the oldest member used to create the cohort life tables;
- The interest rate used to discount payments (r) based on the amount of the maximum technical rates used by insurance companies in the calculations related to, among others, life insurance, in calculations **r=3.5%.** In Poland, the maximum height of the technical rate in 2013 its height is 3.52% (according to Financial Supervision Commission Communication of 17 January 2013 on the maximum rate of technical);
- Annual payment is adequate to the size of the average annual net salary in each of the analyzed countries (according to Eurostat and national sources for non-EU countries), data presented in Table 1.
- It was assumed for the annual indexation of benefits for inflation (according to Eurostat), which was adopted at the level of **i=3.5%.** This value was determined as the average inflation rate based on the average annual rate of inflation calculated based on twenty-years data (after the rejection of each series of the two extreme values) for each country from EU adopted the analysis. Due to the unavailability of consistent data on annual levels of inflation in countries outside the EU taken for analysis (eg Russia, Ukraine, Belarus) data from these countries are not included.

The study concerned selected 18 countries from Central and Eastern Europe. Due to the country of origin of the authors of selected Central European countries close to the Polish border, or frequently visited by the Poles - Germany, Austria, Hungary, and, for a contrary, Sweden (because of high level of income and life expectancy).

3 Results and Discussion

Chart 1 presents the current value of annuities calculated on the basis of two factors adequately matched to each country: life expectancy (more precisely the probability of survival consecutive years) and the average monthly net salary in the economy.

Chart 1 Present value of annuities in different countries based on the average net wage in the economy for men (left) and women (right) for different age categories (for 10, 20, 30, 40, 50 and 60 years old people)



Source: own calculations

By far the highest volume of the present value of annuities were obtained for developed countries - Sweden, Austria, Germany. The highest value of annuities (in each case is analyzed pension for an injured woman at the age of 10 years, on the basis of these comparisons have been made) reached multiplicity: EUR 2,431,106, EUR 1,926,352 and EUR 1,894,458, respectively. Further countries according to the size of the present value of annuities are: Slovenia, Czech Republic, Estonia, Hungary, Slovakia. The values of the highest annuities in the case are as follows: EUR 899,917, EUR 638,802, EUR 612,678, EUR 571,432 and EUR 517,779. However, in all other ten countries, the highest of acquired annuities does not exceed EUR 500,000. In this group, the highest annuity was obtained for Polish (EUR 486,667), while the lowest values were obtained for Ukraine (EUR 125,803). These results therefore show how important it is to meet the conditions of the need to take into account the realities of the economic and demographic environment of origin of the victim in the calculation of the damages claim.

Due to the differences in the values of current pensions which may be granted to the victims, it is worth answering the question, what is the relationship between the potential amounts of annuity payments, and the value of the minimum amount of coverage in MTPL insurance. Dividing the value of the minimum amount of cover by the expected value of annuities, we get the number of persons for which a pension may be paid from the amount of cover. This information can provide an illustration of what a sense of security gives the perpetrators of personal injury possession of their liability insurance.

Table 1 Number of life annuities possible to pay in each country from different level of minimum amount of coverage

Country and gender	average annual wages in EUR	Minimum amount of cover in EUR															
		1000000 per person					5000000 per accident					specific to the country					
		Age cathegories															
		20	30	40	50	60	20	30	40	50	60	per accident	20	30	40	50	60
AT women	26 893	0,6	0,7	0,9	1,1	1,5	3,0	3,5	4,3	5,5	7,4	5 000 000	3,5	4,1	5,0	6,4	8,6
AT men		0,6	0,8	1,0	1,3	1,7	3,2	3,9	4,8	6,3	8,7	5 000 000	3,8	4,5	5,6	7,3	10,1
BY women	4 236	4,2	5,0	6,2	8,0	11,2	20,8	25,0	30,9	40,2	56,0	10 000	0,04	0,05	0,06	0,08	0,11
BY men		5,1	6,3	8,2	11,0	15,8	25,6	31,7	40,8	55,2	79,1	10 000	0,05	0,06	0,08	0,11	0,16
BG women	3 599	4,9	5,8	7,2	9,4	13,2	24,3	29,1	36,2	47,2	66,2	5 112 919	24,8	29,8	37,0	48,3	67,7
BG men		5,5	6,7	8,6	11,6	16,4	27,4	33,5	42,8	57,9	82,0	5 112 919	28,0	34,2	43,8	59,2	83,9
HR women	8 544	2,0	2,4	3,0	4,0	5,6	10,2	12,2	15,2	19,9	28,1	464 045	0,9	1,1	1,4	1,8	2,6
HR men		2,3	2,8	3,6	4,8	6,9	11,5	14,0	17,9	24,1	34,6	464 045	1,1	1,3	1,7	2,2	3,2
CZ women	9 218	1,8	2,2	2,7	3,4	4,7	9,1	10,8	13,3	17,2	23,7	*1 354 800	2,5	2,9	3,6	4,7	6,4
CZ men		2,0	2,4	3,1	4,1	5,7	10,0	12,1	15,3	20,3	28,7	*1 354 800	2,7	3,3	4,1	5,5	7,8
EE women	8 813	1,9	2,2	2,7	3,5	4,8	9,4	11,1	13,6	17,4	23,8	5 000 000	9,4	11,1	13,6	17,4	23,8
EE men		2,3	2,7	3,4	4,6	6,5	11,3	13,7	17,2	22,8	32,3	5 000 000	11,3	13,7	17,2	22,8	32,3
LT women	26 683	3,0	3,6	4,5	5,7	7,8	15,2	18,1	22,3	28,7	39,0	5 000 000	15,2	18,1	22,3	28,7	39,0
LT men		3,7	4,5	5,8	7,7	10,6	18,5	22,7	28,8	38,3	53,2	5 000 000	18,5	22,7	28,8	38,3	53,2
LV women	6 178	2,8	3,3	4,1	5,3	7,3	13,8	16,5	20,4	26,4	36,5	5 000 000	13,8	16,5	20,4	26,4	36,5
LV men		3,3	4,1	5,2	6,9	9,8	16,5	20,3	25,9	34,7	48,9	5 000 000	16,5	20,3	25,9	34,7	48,9
MK women	5 635	4,3	5,2	6,6	8,7	12,5	21,6	26,1	32,8	43,5	62,6	675 000	2,9	3,5	4,4	5,9	8,5
MK men		4,7	5,7	7,2	9,8	14,3	23,3	28,3	36,2	49,1	71,3	675 000	3,1	3,8	4,9	6,6	9,6
DE women	6 245	0,6	0,7	0,9	1,1	1,5	3,1	3,6	4,4	5,7	7,7	7 500 000	4,6	5,4	6,6	8,5	11,5
DE men		0,7	0,8	1,0	1,3	1,8	3,3	3,9	4,9	6,4	8,9	7 500 000	4,9	5,9	7,3	9,6	13,3
PL women	4 152	2,4	2,8	3,5	4,5	6,1	11,9	14,2	17,4	22,4	30,5	5 000 000	11,9	14,2	17,4	22,4	30,5
PL men		2,7	3,3	4,2	5,6	7,7	13,7	16,6	21,0	27,9	38,7	5 000 000	13,7	16,6	21,0	27,9	38,7
RU women	7 009	2,9	3,5	4,3	5,7	7,9	14,5	17,5	21,7	28,4	39,6	*3 625	0,01	0,01	0,02	0,02	0,03
RU men		3,7	4,6	5,8	7,8	11,0	18,3	22,8	28,9	39,0	55,0	*3 625	0,01	0,02	0,02	0,03	0,04
RO women	6 324	4,3	5,2	6,5	8,4	11,7	21,7	26,0	32,3	42,0	58,5	5 000 000	21,7	26,0	32,3	42,0	58,5
RO men		4,9	6,0	7,6	10,3	14,3	24,5	30,0	38,2	51,3	71,6	5 000 000	24,5	30,0	38,2	51,3	71,6
SK women	4 004	2,2	2,7	3,3	4,3	6,0	11,2	13,4	16,6	21,5	29,8	5 000 000	11,2	13,4	16,6	21,5	29,8
SK men		2,5	3,1	3,9	5,3	7,5	12,7	15,4	19,6	26,3	37,3	5 000 000	12,7	15,4	19,6	26,3	37,3
SI women	7 574	1,4	1,6	2,0	2,6	3,5	6,9	8,2	10,1	12,9	17,4	5 000 000	6,9	8,2	10,1	12,9	17,4
SI men		1,5	1,8	2,3	3,0	4,2	7,7	9,2	11,5	15,1	20,9	5 000 000	7,7	9,2	11,5	15,1	20,9
SE women	11 708	0,5	0,6	0,7	0,9	1,2	2,4	2,8	3,5	4,4	6,0	34 490 300	16,6	19,6	23,9	30,4	41,2
SE men		0,5	0,6	0,7	1,0	1,3	2,5	3,0	3,7	4,8	6,7	34 490 300	17,6	20,9	25,7	33,4	46,3
UA women	33 423	9,3	11,3	14,0	18,3	25,8	46,7	56,3	70,0	91,7	129	*9 070	0,08	0,10	0,13	0,17	0,23
UA men		11,4	14,2	18,2	24,4	34,5	57,1	71,0	90,8	122	172	*9 070	0,10	0,13	0,16	0,22	0,31
HU women	1 968	2,8	3,4	4,2	5,5	7,6	14,1	16,9	21,1	27,5	38,0	5 327 620	15,0	18,0	22,5	29,3	40,5
HU men		3,2	3,9	5,0	6,8	9,5	16,0	19,6	25,2	34,1	47,7	5 327 620	17,0	20,8	26,8	36,3	50,9

* these countries do not have regulation per accident, it's limit in variant per person

Source: own calculations, Eurostat data available at http://epp.eurostat.ec.europa.eu, data available at Lithuanian Information Centre

The Table 1 (right) contains the results of dividing the value of the minimum amounts of cover adopted in different countries by the present value of annuities. The results show that the security of Ukraine in case of damage to one person is lower than indicated in the beginning, as established in the country minimum amount of cover for one person is only EUR 9,070, which does not provide coverage in full for any annuity computed for the people of this country. Similarly, insufficient level of the minimum amounts of cover were obtained for Belarus and for Belarus is even worse security, because the limits of the guarantee sum occur in both variants. By far the highest level of the minimum amount of

the guarantee set out in Sweden (nearly 35 million) gives protection for at least a dozen annuities, even the highest of the calculated in the study. Also, lawmakers in Germany and Austria raised the requirements for minimum amounts of cover. However, these amounts are much lower and are sufficient for protection from a few to several disability benefits. Left for about EU-level amount of cover in Romania and Lithuania gives good protection - at a level of from about 15 to about 72 times the coverage of any benefits. Insufficient protection should be explicitly considered as limited to the level of 464 thousand Euro minimum amount of coverage in Croatia (about once to three times the present value of annuity coverage). The level of the minimum amount of coverage in Moldova should also be classified as low.

Large disproportions in coverage of minimum amounts of coverage of present value of annuities allows to put even one proposal (Table 2).

Table 2 Number of life annuities possible to pay in each country from different level of minimum amount of coverage in accident with foreigner by gender

victim of a traffic accident - women

the perpetrator of a traffic accident	AT	BY	BG	HR	CZ	EE	LT	LV	MK	DE	PL	RU	RO	SK	SI	SE	UA	HU
AT	4,1	28,9	33,8	14,2	12,5	12,9	21,0	19,2	30,3	4,2	16,4	20,3	30,1	15,5	9,5	3,3	65,3	19,6
BY	0,02	0,15	0,17	0,07	0,06	0,07	0,11	0,10	0,16	0,02	0,09	0,10	0,16	0,08	0,05	0,02	0,34	0,10
BG	3,6	25,5	29,8	12,5	11,0	11,4	18,5	16,9	26,7	3,7	14,5	17,9	26,6	13,7	8,4	2,9	57,5	17,3
HR	0,3	2,3	2,7	1,1	1,0	1,0	1,7	1,5	2,4	0,3	1,3	1,6	2,4	1,2	0,8	0,3	5,2	1,6
CZ*	1,0	6,8	7,9	3,3	2,9	3,0	4,9	4,5	7,1	1,0	3,8	4,7	7,0	3,6	2,2	0,8	15,2	4,6
EE	3,5	25,0	29,1	12,2	10,8	11,1	18,1	16,5	26,1	3,6	14,2	17,5	26,0	13,4	8,2	2,8	56,3	16,9
LT	3,5	25,0	29,1	12,2	10,8	11,1	18,1	16,5	26,1	3,6	14,2	17,5	26,0	13,4	8,2	2,8	56,3	16,9
LV	3,5	25,0	29,1	12,2	10,8	11,1	18,1	16,5	26,1	3,6	14,2	17,5	26,0	13,4	8,2	2,8	56,3	16,9
MK	0,5	3,4	3,9	1,7	1,5	1,5	2,4	2,2	3,5	0,5	1,9	2,4	3,5	1,8	1,1	0,4	7,6	2,3
DE	5,3	37,4	43,7	18,4	16,2	16,7	27,2	24,8	39,1	5,4	21,3	26,2	39,0	20,1	12,3	4,3	84,4	25,4
PL	3,5	25,0	29,1	12,2	10,8	11,1	18,1	16,5	26,1	3,6	14,2	17,5	26,0	13,4	8,2	2,8	56,3	16,9
RU*	0,003	0,018	0,021	0,009	0,008	0,008	0,013	0,012	0,019	0,003	0,010	0,013	0,019	0,010	0,006	0,002	0,041	0,012
RO	3,5	25,0	29,1	12,2	10,8	11,1	18,1	16,5	26,1	3,6	14,2	17,5	26,0	13,4	8,2	2,8	56,3	16,9
SK	3,5	25,0	29,1	12,2	10,8	11,1	18,1	16,5	26,1	3,6	14,2	17,5	26,0	13,4	8,2	2,8	56,3	16,9
SI	3,5	25,0	29,1	12,2	10,8	11,1	18,1	16,5	26,1	3,6	14,2	17,5	26,0	13,4	8,2	2,8	56,3	16,9
SE	24,4	172	201	84,4	74,5	76,8	125	114	180	24,9	97,7	121	179	92,4	56,7	19,6	388	117
UA*	0,006	0,045	0,053	0,022	0,020	0,020	0,033	0,030	0,047	0,007	0,026	0,032	0,047	0,024	0,015	0,005	0,102	0,031
HU	3,8	26,6	31,0	13,0	11,5	11,9	19,3	17,6	27,8	3,8	15,1	18,6	27,7	14,3	8,8	3,0	59,9	18,0

victim of a traffic accident - man

the perpetrator of a traffic accident	AT	BY	BG	HR	CZ	EE	LT	LV	MK	DE	PL	RU	RO	SK	SI	SE	UA	HU
AT	4,5	36,8	38,8	16,2	14,1	15,9	26,3	23,5	32,9	4,6	19,3	26,4	34,8	17,9	10,7	3,5	82,3	22,7
BY	0,0	0,2	0,2	0,1	0,1	0,1	0,1	0,1	0,2	0,0	0,1	0,1	0,2	0,1	0,1	0,0	0,4	0,1
BG	4,0	32,4	34,2	14,3	12,4	14,0	23,2	20,7	29,0	4,0	17,0	23,3	30,6	15,8	9,4	3,1	72,6	20,0
HR	0,4	2,9	3,1	1,3	1,1	1,3	2,1	1,9	2,6	0,4	1,5	2,1	2,8	1,4	0,9	0,3	6,6	1,8
CZ*	1,1	8,6	9,1	3,8	3,3	3,7	6,2	5,5	7,7	1,1	4,5	6,2	8,1	4,2	2,5	0,8	19,2	5,3
EE	3,9	31,7	33,5	14,0	12,1	13,7	22,7	20,3	28,3	3,9	16,6	22,8	30,0	15,4	9,2	3,0	71,0	19,6
LT	3,9	31,7	33,5	14,0	12,1	13,7	22,7	20,3	28,3	3,9	16,6	22,8	30,0	15,4	9,2	3,0	71,0	19,6
LV	3,9	31,7	33,5	14,0	12,1	13,7	22,7	20,3	28,3	3,9	16,6	22,8	30,0	15,4	9,2	3,0	71,0	19,6
MK	0,5	4,3	4,5	1,9	1,6	1,8	3,1	2,7	3,8	0,5	2,2	3,1	4,0	2,1	1,2	0,4	9,6	2,6
DE	5,8	47,6	50,2	21,0	18,2	20,5	34,1	30,4	42,5	5,9	24,9	34,1	44,9	23,2	13,8	4,5	106	29,3
PL	3,9	31,7	33,5	14,0	12,1	13,7	22,7	20,3	28,3	3,9	16,6	22,8	30,0	15,4	9,2	3,0	71,0	19,6
RU*	0,003	0,023	0,024	0,010	0,009	0,010	0,016	0,015	0,021	0,003	0,012	0,017	0,022	0,011	0,007	0,002	0,051	0,014
RO	3,9	31,7	33,5	14,0	12,1	13,7	22,7	20,3	28,3	3,9	16,6	22,8	30,0	15,4	9,2	3,0	71,0	19,6
SK	3,9	31,7	33,5	14,0	12,1	13,7	22,7	20,3	28,3	3,9	16,6	22,8	30,0	15,4	9,2	3,0	71,0	19,6
SI	3,9	31,7	33,5	14,0	12,1	13,7	22,7	20,3	28,3	3,9	16,6	22,8	30,0	15,4	9,2	3,0	71,0	19,6
SE	26,7	219	231	96,6	83,6	94,3	157	140	195	27,1	115	157	207	106	63,3	20,9	490	135
UA*	0,007	0,058	0,061	0,025	0,022	0,025	0,041	0,037	0,051	0,007	0,030	0,041	0,054	0,028	0,017	0,005	0,129	0,035
HU	4,1	33,8	35,6	14,9	12,9	14,6	24,2	21,6	30,2	4,2	17,7	24,3	31,9	16,5	9,8	3,2	75,6	20,8

Source: own calculations

Residents of highly developed countries traveling to countries with lower economic level have the highest level of protection against potential claims from victims. For example, the minimum amount of cover in Sweden, will cover the highest annuity calculated for

the Ukraine until 274 times, for Poland – up to 70 times or 54 times in the Czech Republic. However, this situation can be analysed in the opposite direction. So it should be assessed what protection have citizens of for example Ukraine or Belarus for travel to Sweden or Austria. For example, for a citizen of Ukraine minimum amount of cover would be enough to cover only 0.04% of the highest annuity calculated for citizen of Sweden or 0.5% of annuity for the citizen of Austria. Such a disproportion justifies the need to buy additional insurance (green card) for citizens of those countries. It must be stressed that the citizens of the countries of the multilateral agreements, for example with the Polish and the Czech Republic, are not required to purchase additional MTPL insurance. To cover potential claims from the Sweden, Austria or Germany, they must be sufficient minimum amount of cover for the EU level. As indicated in the analysis of the higher value of pension benefits applicable in these countries, does not give as good protection. The EUR 5 million allows to cover fully two annuities for injured women aged 10 years coming from Sweden, and 2.6 times coverage of the annuity for a citizen of Austria, or 2.6 times coverage for the citizen of Germany.

Conclusions

The system of compulsory insurance in the area of Eastern and Central Europe is not fully efficient. The victim can sue the owner and the driver to cover the claim, however, in most cases, the effectiveness of the investigation of these claims is negligible. In some cases the courts decided that, despite the exhaustion of the amount of cover, the insurer must cover the entire damage for every persons injured in accident.

Typical cases in which the victim may remain with no compensation includes situation of very high cost of treatment, rehabilitation of people seriously injured (the use of highly specialized procedures, not reimbursed from public funds, the consequences of an accident persist for many decades), also the situation when victim is a person whose earnings before the accident were very high, and as the result of an accident he or she has lost the ability to achieve these incomes, victim is a foreigner (higher level of wages and higher costs of treatment in western European countries), and finally, situation, when the result of a traffic accident is injury or death of many people.

In countries (eg Belarus, Russia, Ukraine) minimum amount of cover do not provide coverage even in the event of an accident with people from the same country. Large differences in insurance limits in European countries (low in former USSR!) and the lack of cover of potential claims for personal injury for foreigners justify the need to purchase additional insurance when entering the territories of the countries with higher guarantees. But there is still the problem of lack of coverage of such commitments when there is an accident in the example in Ukraine, and the victims will be a citizen of more developed country.

It is worth to point several ways to solve the problem of depletion of sum insured in the compulsory MTPL insurance. First is to define the minimum amount of cover for personal injury claims not for a single event, but for one victim (this solution has been accepted in the preamble to Directive 2009/103/EC). Second of possible solutions is significant increase in minimum amounts of cover. Such postulates are already under discussion in the environment of insurers and lawyers, for example the Expert Group on European Insurance Contract Low postulate to raise minimum amounts of cover by the average inflation rate (Expert Group, 2013). Next possible way to solve this problem is introduction of unlimited insurance coverage (this solution was operating in Poland before 1990). at the end it is worth mentioning that one of the options considered is to cover claims in excess of the minimum amount of cover from the Insurance Guarantee Fund. This approach is systemic in nature and it does not allow the occurrence of a situation in which any person injured is not complete, due to its compensation.

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Statistical Tools for Modeling Claim Severity

Pavla Jindrová[1], Ľubica Sipková[2]

[1] University of Pardubice
Faculty of Economics and Administration, Institute of Mathematics and Quantitative Methods
Studentská 84, 532 10 Pardubice, Czech Republic
E-mail: Pavla.Jindrova@upce.cz

[2] University of Economics in Bratislava
Faculty of Economic Informatics, Department of Statistics
Dolnozemska cesta 1, 852 35 Bratislava, Slovak Republic
E-mail: Lubica.Sipkova@euba.sk

Abstract: *The main aim of the paper is point out on a new approach to statistical modelling of claims severity by using quantile functions. In addition to explain the theoretical principles and present the application of claims severity models that based on quantile function. Claims severity in non-life insurance refers to the monetary loss of an insurance claim and is usually modeled as a non-negative continuous random variable. The conditions under which claims are performed and data are collected allow considering the claims severity to be samples from specific heavy-tailed probability distribution. Probability models of claims severity creates the basis for solving of many substantial problems in non-life insurance company. To find the models based on empirical data can be used several methods such as goodness of fit tests, kernel densities, composition distributions or mixture distributions. In this regard, quantile methods provide an appropriate and flexible approach to the probability modelling needed to obtain well-fitted tails. By using this approach, it has been confirmed the advantages of quantile models and their usefulness for non-life insurance practice.*

Keywords: claims severity model, quantile function, lognormal distribution, Pareto distribution

JEL codes: C14, C46, G22

1 Introduction to Quantile Modelling of Claims Severity Distributions

The modeling of the claims severity distributions in non-life insurance is one of the problem areas, where obtaining a good fit to the extreme tails of a probability model is of major importance. The objective of the article is to find probability distribution that adequately describes the claims severity heavy-left-tailed and long-right-tailed distribution. New approach to probability modeling by using quantile functions provide an appropriate and flexible approach to the distributional modeling needed to obtain well-fitted tails. Modern computer techniques open up a wide field of practical applications for this theory concept.

Quantile functions make it possible to create a distribution model by combining a number of component models. This creates new possibilities for probability modeling in the cases when the standard approach fails to produce adequate results. But these methods are almost unknown in non-life insurance practice.

More precise results could be achieved by building a conceptual quantile model to reflect data properties, as well as by being relevant to the particular application area. The "construction kit" for the quantile modeling process in general, analyses of methods and techniques for identifying, estimating and validating probability quantile models especially for skewed heavy left distributions could be found in the monograph by Sipková and Sodomová (2007).

Therefore, the procedure and the results of the actual application of the referred conceptual quantile modeling methodology on the values of 1 236 individual claims made on an non-life insurance portfolio are explained only. This data was obtained from an unnamed Czech insurance company. The data set contains the claim amounts from third party insurance in year 2013.

We assume that these individual claim amounts, which could be called as losses for the insurance company, are drawn from a particular probability distribution, called a loss distribution.

It is the main goal of this article to apply the quantile probability method of conceptual modeling of whole loss distribution, exploring its potential uses and analyzing its advances and drawbacks. The investigation will elaborate and apply the quantile modeling methods that are broadly described in Warren Gilchrist's Modeling with Quantile Distribution Functions (Gilchrist, 2000).

The basis for the approach to statistical modelling based on quantile function models is that quantile functions can be added and, in the right circumstances, multiplied to obtain new quantile functions. The components should be properly weighted. Quantile density functions can also be added together to derive new quantile density functions. Quantile functions of the best fitted distributions in the classical approach are the simple components that can be used to construct models of the complexities of real claims severity data. Extremes are well modeled by Pareto right tail of the conceptual quantile models, which was presented in the article by Pacáková and Linda (2009) or Pacáková and Gogola (2013). Application of quantile based conceptual modelling methods has its foundation in the Order statistics theory (David and Nagaraja, 2003).

2 Methodology and Data

We want to link the sample features to corresponding features in the populations from which our sample comes, e.g. to features of positive asymmetrical long-right-tailed loss distribution. There are four different ways in which we may define the model for random variation of losses:

- The *Cumulative Distribution Function* (CDF), denoted by $F(x)$, is defined as
$$F(x) = P(X \le x) = p \tag{1}$$
- The *Probability Density Function* (PDF), $f(x)$, is the derivative of the CDF:
$$f(x) = \frac{dF(x)}{dx} \tag{2}$$
- The *Quantile Function*, QF, denoted by $Q(p)$, expresses the *p*-quantile x_p as a function of *p*:
$$x_p = Q(p) \tag{3}$$
where x_p is the value of X, for which $p = P(X \le x_p) = F(x_p)$.

The definitions of the QF and the CDF can by written for any pairs of values (x, p) as $x = Q(p)$ and $p = F(x)$. These functions are simple inverses of each other, provided that they are both continuous increasing functions. Thus, we can also write $Q(p) = F^{-1}(p)$ and $F(x) = Q^{-1}(x)$. For sample data, the plot of $Q(p)$ corresponds to the plot of x_p against *p*.

- In the same way that the CDF can be differentiated to give the PDF, we can use the derivative of the QF. The *Quantile Density Function*, QDF, is defined as:
$$q(p) = \frac{dQ(p)}{dp} \text{ for } 0 \le p \le 1 \tag{4}$$

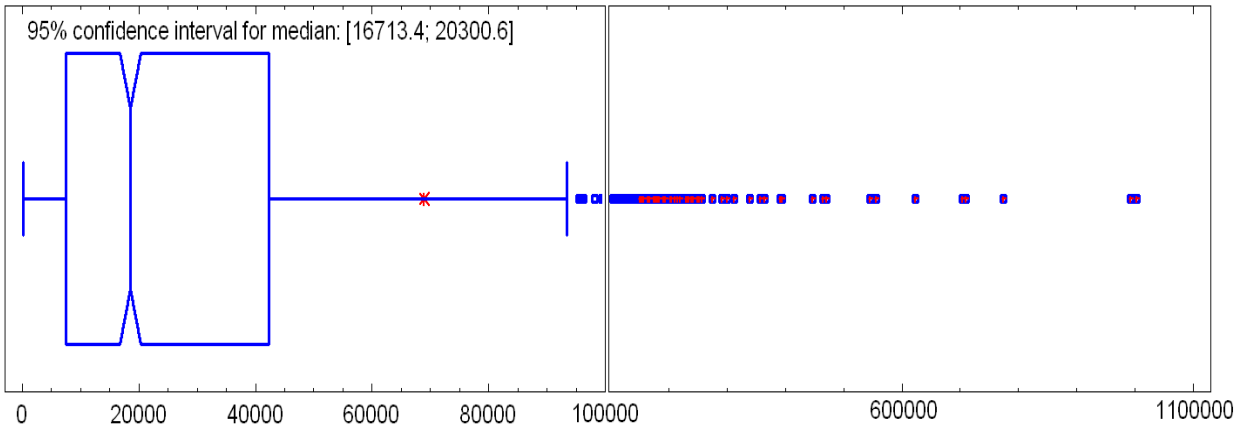
Besides broad use of maximum Likelihood estimation loss-models defined by PDFs of exponential, Weibull, Pareto, lognormal and gamma shapes, there is a reasonable phenomenon of grooving utilization in loss distribution studies of methods based on Galton's quantile and Order Statistics theory known as modeling by Quantile Functions.

We suggest it in the case, when the classical approach to probability modeling of losses does not bring satisfying results concerning the long right tail area. But, other advantages of loss distribution definition by form of QF, e. g. as a good base for rankit Monte-Carlo simulations and parametrical bootstrapping could be used.

The article includes the methods and the results of the statistical quantile modelling of loss distribution based sample real data of 1 236 claims in Czech koruna (CZK) of non-life insurance portfolio, ranging from 149 to 25 940 800.

The best way to develop a perception of the data variation are graphs (Figure 1 and Figure 2), with the support of some numerical summaries of the properties (Table 1).

Figure 1 Box plot of claims in Czech koruna



Source: authors' own elaboration in Statgraphics Centurion XVI

The fact that the average (68 823) is almost 4-times the median (18 507), the range over the upper quartile (42 248) is approximately a 3 500-times higher than the range under the lower quartile (7 501) and the number of very high values, sixty of which exceed three times the interquartile range placed above the upper quartile (e.i. 0.2 % from all claims are extremely high values), give clear evidence of an enormously long right tail of the loss distribution.

The largest claim values in the Box plot on Figure 1 are displayed in the changed proportion of the scale and the three largest claim values: 1 307 412; 8 217 110; 25 940 000 are not displayed in the Box plot.

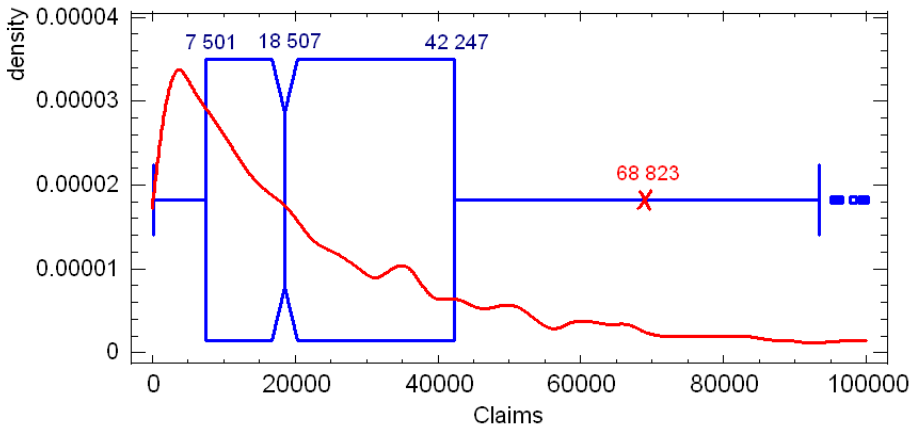
Table 1 Summary Statistics for Claims in CZK

Count	1 236	**Lower quartile**	7 501
Average	68 823	**Upper quartile**	42 248
Median	18 507	**Interquartile range**	34 747
Standard deviation	777 056	**1/6 sextile**	4 804
Coeff. of variation	1 129%	**5/6 sextile**	60 366
Minimum	149	**Intersextile range**	55 562
Maximum	25 940 000	**Stnd. skewness**	443
Range	25 939 851	**Stnd. kurtosis**	7 224

Source: authors' own calculation

Non-parametric model of the PDF of the loss distribution (Figure 2), as typical graphical presentation of distributions, presents the properties, that are expected of "good fit" model defined by well known PDF.

Figure 2 Kernel estimate of PDF for claims in CZK



Source: authors' own elaboration in Statgraphics Centurion XVI

The original data *x* has been sorted by magnitude. This is a fundamental step in the probability modelling using quantile methods. With each ordered value *x* of individual claim we will associate a probability *p*, indicating that the *x* lies in proportion to *p*, of the way through the data. At first guess, we would associate the r^{th} ordered observation from *n* values, denoted by $x_{(r:n)}$, with $p_{r:n} = r/n$, $n = 1, 2, ..., 1236$. The range of values we would expect for *p* is $(0, 1)$. Hence, to get the *p* values symmetrically placed in the interval $(0, 1)$, we use the formula $p_{r:n} = (r - 0{,}5)/n$, which corresponds to breaking the interval $(0, 1)$ into 1235 equal sections. Thus, we have pairs of values describing the data as $(x_{(r:n)}, p_{r:n})$. The value of claim *x* for any *p* is referred to as the *sample p – quantile* of loss distribution. They are the base for the construction of a quantile model of loss distribution.

3 Results and Discussion

Results of Goodness-of-fit Tests with the values of Log-likelihood (summarized in Table 2) confirm that the best of all fitted known PDFs are shifted 3-parameter logarithm-normal distribution (mean = 44077.2, standard deviation = 101343, lower threshold = –129.001) for left tail and shifted 2-parameter Pareto (shape = 0.210123, lower threshold = 149) for long right tail of the loss distribution.

Table 2 Comparison of Alternative Distributions

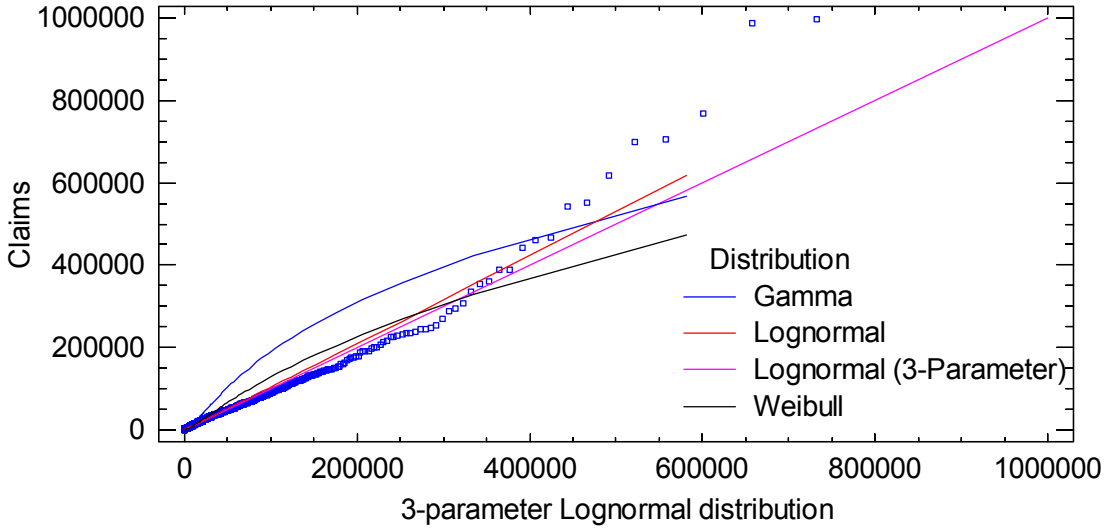
Distribution	Est. Parameters	Log Likelihood	Chi-Squared P	KS D	V
Lognormal (3-Parameter)	3	-14221	0.95	0.023	0.045
Lognormal	2	-14222	0.79	0.027	0.052
Pareto (2-Parameter)	2	-15231	0.00	0.362	0.553
Pareto	1	-16119	0.00	0.480	0.740
Weibull or Gamma (3-Parameter)	<no fit>				

Source: authors' own calculation

Nevertheless, according to the Q-Q graphs, none of the tested PDFs, with maximum likelihood parameters estimation, represent a good approximation of positively skewed heavy left and long right tailed individual loss distribution (see S-shape of empirical data

for lognormal distribution in Figure 3 and low adaptation of the other fitted theoretical distributions to the empirical data).

Figure 3 Quantile-Quantile graph of fitted PDFs for claims in CZK



Source: authors' own elaboration in Statgraphics Centurion XVI

The conclusion of classical approach to modeling of the loss distribution is, that none of all applied PDFs fits the whole empirical individual claims' data interval well without data transformation and the best fit of applied PDFs represents logarithm-normal, but this distribution does not fit the long right tail well enough.

Quantile Model Specification

Using a modelling kit based on quantile functions, we have elaborated the semi-linear parametric composition of basic logarithm-normal and Pareto inverse forms of CDFs. The composition by adding was generalized to include position and scale parameters by using the transformation:

$$Q(p) = v_1 LNINV\ (p) + v_2 PARETOINV\ (p) \tag{5}$$

where parameters $v_1 = \omega\,(1-p)$ and $v_2 = \kappa p$ were set as the functions of probability p, to give proper weight and spread to lognormal and Pareto shapes on each side of the distribution. The basic form of $PARETOINV\ (p)$ was built by using modification rules for QF (Sipková and Sodomová, 2007):

$S\ (p) = p$ by the reciprocity rule to $R[S(p)] = \dfrac{1}{S(1-p)}$

and by the Q-transformation rule to $S_{PAR}(p) = \dfrac{1}{(1-p)^{\delta}}$, were $\delta > 0$.

The final shape of the composite semi-linear quantile LN-Pareto model for losses is:

$$Q(p) = \omega\,(1-p)\,LNINV\ (p;\beta.\gamma) + \kappa p \Big/ (1-p)^{\delta},\ 0 < p < 1, \delta > 0 \tag{6}$$

Models are optimaly weighed to respect data properties. The deviations of the data from a given quantile function are called the distributional residuals: $e_r = x_{(r)} - Q(p_r;\Theta)$, where r = 1, 2, …, n.

The applied method of estimation, the method of least squares, uses ordered values of claims, thus $x_{(r:n)}$. The steps of minimization of the criterion depend on the general numerical minimization procedure. All the calculations in the process of estimation were

done by Solver in Excel. The criterion for approximate generalized Öztürk and Dale method of least squares for estimation by Gilchrist (2000, p. 198):

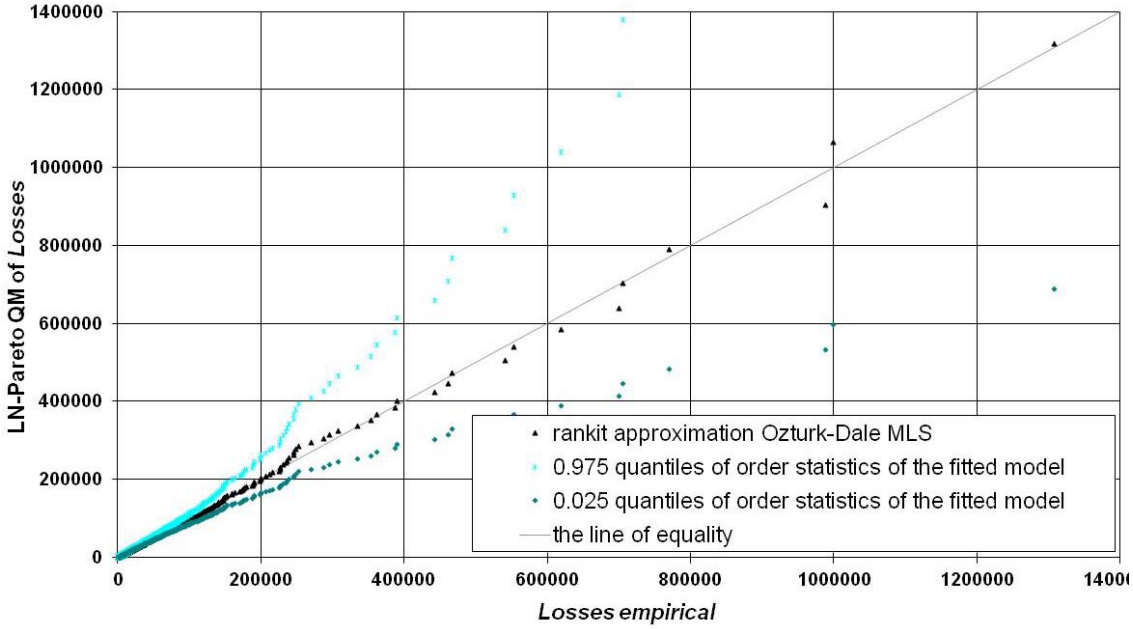
$$\text{find } \Theta \text{ to minimize } \sum \left(x_{(r:n)} - Q\left(p_{r:n};\Theta\right)\right)^2 \tag{7}$$

where $p_{r:n}$ is rankit approximation $p_{r:n} = (r - 0.5)/n$.

The best fitted quantile LN-Pareto model of loss distribution with its parameters for LNINV: 0.739244268523002, 9.76640751897177 and its weight of 1.808245128609 and for PARETOINV: 0.743818564930615 with it weight of 14950.6022736473 was compared graphically with empirical data.

There are many aspects of graphical and numerical validation, but here we concentrate only on those of direct relevance to modelling with quantiles. The natural plot to start with is the fit-observation diagram or Q-Q plot of the validation data against the corresponding fitted values (Figure 4). Sometimes the look of more fitted plots is very similar and it is useful to have some numerical measures to supplement the analysis. The suitable measure of the quality of the fit is the correlation between the calculated rankit values of the model the actual values.

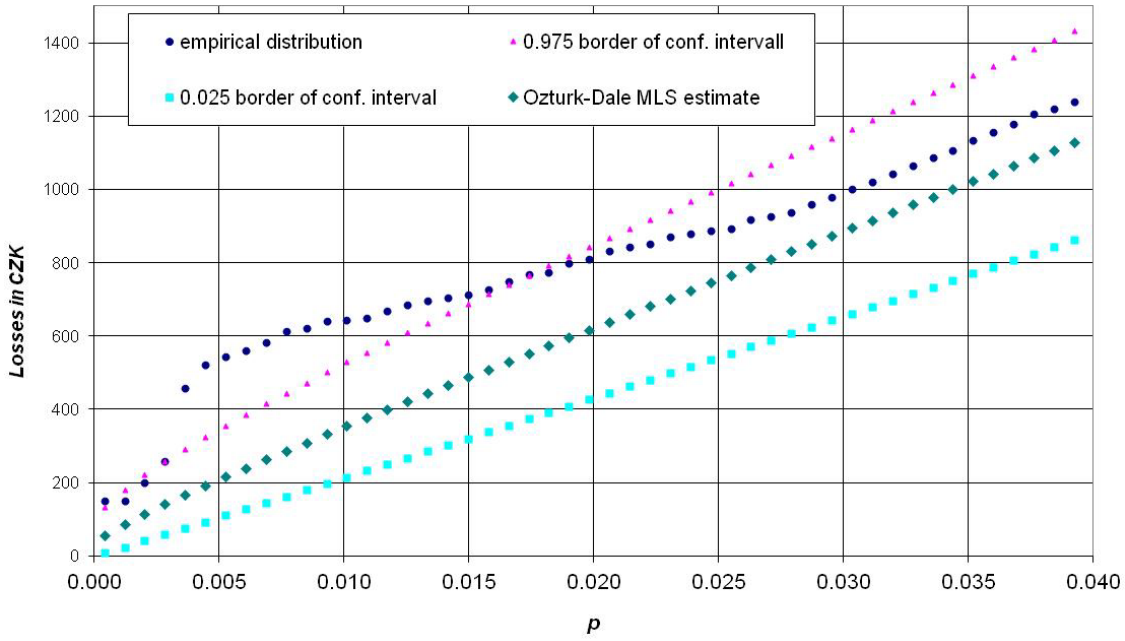
Figure 4 Graphical validation the lognormal-Pareto model of claims by Q-Q graph



Source: authors' own elaboration based on simulation techniques in Excel

In the case of the validated models, values of correlation coefficients are high in case of quantile lognormal-Pareto model (0.8943) signalling very strong linear correlation. The fitted quantile model, that is appropriate also for the long right tail, is LN-Pareto quantile model fitted by approximate generalized Öztürk and Dale method of least squares. The worst fitted part of loss distribution by the LN-Pareto quantile model is the left tail up to 4th percentile (see Figure 5).

Figure 5 Graphical validation the lower part of the lognormal-Pareto quantile model by quantile function with its 95% confidence interval



Source: authors' own elaboration based on simulation techniques in Excel

4 Conclusions

Probability models of claim severity are very important for the risk management of insurance company. The objective of this paper is to call attention to a new approach to statistical modelling using quantile functions. The application of quantile methods of loss distribution modeling demonstrates their usefulness, especially by the results which were obtained by applying them on complex asymmetric distributions with the existence of extremes. The constructed conceptual quantile models treat extremes themselves. The modelling of loss distributions in non-life insurance is one of the problem areas, where obtaining a good fit to the extreme tails of a distributional model is of major importance. The use of models based on quantile methods provides an appropriate and flexible approach to the distributional modelling needed to obtain well-fitted tails and to simulate the extreme losses.

Acknowledgments

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Relative Premium in Vehicle Insurance

Silvie Kafková

Masaryk University
Faculty of Economics and Administration, Department of Finance
Lipová 41, 602 00 Brno, Czech Republic
Email: 175424@mail.muni.cz

Abstract: *Very important task of the actuary is to create a fair tariff structure. This structure has to fairly divide the burden of claims among policyholders. The subject of this paper is bonus-malus system in vehicle insurance. This system penalizes drivers responsible for accidents and rewards the drivers for claim-free years. First the long term behavior of BM system is examined. A stationary distribution of the drivers is calculated based on Markov chains. Then the relative premium associated with each level of BM system is calculated. For this purposes, quadratic loss function and Bayesian approach are used. Finally, we compare the calculated relative premium to the relative premium from Czech Insurance Company.*

Keywords: Markov chain, premium, bonus-malus system

JEL codes: C11, G22

1 Introduction

Vehicle insurance is a contract by which the insurer assumes the risk of any loss the owner of a car. This loss may incur through damage to property or persons as the result of an accident. Very important aim of actuary is to suggest rating system that will distribute policyholders into the tariff groups. The policyholders in the same tariff class will pay the same premium. The insurance premium is usually derived from an annual frequency of claims, which is modeled by using statistical data. This approach for computation of the premium can be found in (Kaas, 2009) and (Ohlsson and Johansson, 2010). Generalized linear models can be used for this a priori classification.

Nevertheless, many important factors stay hidden in a priori segmentation. Therefore, certain degree of heterogeneity still remains in these risk classes. For these reasons, insurance companies approach to individualization of risk and they use the Bonus-Malus system (BMS). Then the premium amount paid by the policyholder depends on the risk factors but also on the claims history. This problem is solved by Pitrebois et al. (2004).

BMS penalizes drivers responsible for accidents by additional premium (maluses) and rewards drivers without accident with discount for insurance. The amount of premium is adjusted each year on the basis of the individual claims experience. Afterwards, it is necessary to determine the amount of insurance on the individual levels of B-M scale. The relativity associated to level ℓ is denote as r_ℓ. A policyholder occupying level ℓ in the B-M scale has to pay r_ℓ times the base premium (Denuit et al., 2007).

2 Methodology and Data

The data used to illustrate this paper are related to vehicle insurance and can be found in (Heller and Jong, 2008). The data set is based on one-year vehicle insurance policies recorded in 2004 or 2005. There are 67 856 policies and 4 624 of them (6,8%) had at least one claim. The total amount of claims is 4 937.

Based on generalized linear models, the drivers from this portfolio were divided into 36 groups. Table 1 gives the estimated expected annual claim frequencies and the relative importance of each risk class.

Table 1 A priori risk classification for our portfolio

Risk class	Exp. annual Claim freq. (%)	Weights (%)
1	15.88	1.35
2	15.53	0.37
3	12.59	1.04
4	11.95	0.23
5	15.83	6.98
6	15.49	3.24
7	12.55	5.49
8	11.91	3.02
9	14.25	0.10
10	13.94	1.62
11	11.30	0.47
12	10.72	3.54
13	17.85	2.34
14	17.47	0.67
15	14.16	2.48
16	13.44	0.61
17	17.80	9.86
18	17.41	4.74
19	14.12	11.49
20	13.40	5.52
21	16.02	0.15
22	15.67	1.85
23	12.70	1.19
24	12.06	6.19
25	20.69	1.67
26	20.24	0.43
27	16.41	1.82
28	15.57	0.29
29	20.63	5.37
30	20.18	1.81
31	16.36	7.94
32	15.53	2.08
33	18.57	0.06
34	18.17	0.67
35	14.72	0.84
36	13.97	2.48

Source: Author

The Bonus – Malus System

We can denote by s the number of levels in our BM system. The levels ℓ are numbered from 1 to *s*. Claims are penalized by malus points (the driver goes up a certain number of levels each time he files a claim). Each claim-free year is rewarded by bonus point (the driver goes certain number of levels down).

We assume that the knowledge of present level and of 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 $\{L_1(\vartheta), L_2(\vartheta), \dots\}$ denote 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 ℓ_2 for

policyholder with mean frequency $\boldsymbol{\vartheta}$. Further, $\boldsymbol{P}(\vartheta)$ is the one-step *transition matrix*, thus

$$\boldsymbol{P}(\vartheta) = \{p_{\ell_1\ell_2}(\vartheta)\}, \ \ \ell_1, \ell_2 = 1,2, \dots s.$$

When we want to explore the long term behavior of BMS, we have to define the *stationary distribution* of policyholders $\boldsymbol{\pi}(\vartheta) = \big(\pi_0(\vartheta), \pi_1(\vartheta), \dots, \pi_s(\vartheta)\big)'$. $\pi_{\ell}(\vartheta)$ is the stationary probability for policyholder with mean frequency $\boldsymbol{\vartheta}$ to be in level ℓ, thus

$$\pi_{\ell 2}(\vartheta) = \lim_{n\to\infty} p^n_{\ell 1 \ell 2}(\vartheta).$$

Stationary probability $\boldsymbol{\pi}(\vartheta)$ does not depend on the starting level. We can compute the $\boldsymbol{\pi}(\vartheta)$ as a solution of the system

$$\begin{cases} \boldsymbol{\pi}'(\vartheta) = \boldsymbol{\pi}'(\vartheta)\boldsymbol{P}(\vartheta) \\ \boldsymbol{\pi}'(\vartheta)\boldsymbol{e} = 1, \end{cases}$$

where $\boldsymbol{e} = (1,1,\dots,1)$.

The Residual Heterogeneity

Even with a priori segmentation, some heterogeneity remains within the risk classes. This is a residual heterogeneity with a random effect Θ_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 θ expresses the residual heterogeneity. We suppose that Θ_i are independent and that they have 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 $\mathrm{E}[\Theta_i] = 1$, $Var[\Theta_i] = \frac{1}{a}$. A consistent estimator for a is given by

$$\frac{1}{\hat{a}} = \frac{\sum_{i=1}^n \left\{\left(n_i - \widehat{\lambda_i}\right)^2 - n_i\right\}}{\sum_{i=1}^n \widehat{\lambda_i}^2}.$$

Bayesian Relative Premium

The relativity associated with level ℓ is denote as r_{ℓ}. Insured occupying the level ℓ pays an amount of premium equal to r_{ℓ}% of the *a priori* premium determined on the basis of his observable characteristics. The aim is to make r_{ℓ} as close as possible to the risk factor Θ of a policyholder picked at random from the portfolio. For this purpose, the minimization of

$$\mathrm{E}[(\Theta - r_L)^2]$$

is most commonly used.

We assume that we pick at random a policyholder from the portfolio. We denote as Λ his *a priori* expected claim frequency and Θ the residual effect of the hidden risk factors. Then the actual expected claim frequency of the policyholder is $\Lambda\Theta$. The random variable Λ and Θ may reasonably be assumed to be mutually independent. We denote w_k the weight of the kth risk class whose annual expected claim frequency is λ_k. Then

$$\mathrm{P}[\Lambda = \lambda_k] = w_k.$$

We denote L the level occupied by this randomly picked policyholder who has a stationary position in level ℓ. Then

$$\mathrm{P}[L = \ell] = \sum_{kl} w_k \int_0^{\infty} \pi_{\ell}(\lambda_k\theta)u(\theta)\mathrm{d}\theta, \quad \ell = 0,1,\dots s,$$

where $\pi_{\ell}(\lambda_k\theta) = \mathrm{P}[L = \ell|\Lambda = \lambda_k, \Theta = \theta]$.

Now we can estimate $\boldsymbol{r_{\ell}}$ as the minimum of $\mathrm{E}[(\Theta - r_L)^2]$. We can write

$$E[(\Theta - r_L)^2] = \sum_{\ell=0}^{s} E[(\Theta - r_L)^2 | L = \ell] \ \mathrm{P}[L = \ell] = \sum_{\ell=0}^{s} \int_0^{\infty} (\theta - r_\ell)^2 \ \mathrm{P}[L = \ell | \Theta = \theta] u(\theta) d\theta$$
$$= \sum_k w_k \int_0^{\infty} \sum_{\ell=0}^{s} (\theta - r_\ell)^2 \pi_\ell(\lambda_k \theta) u(\theta) \mathrm{d}\theta.$$

By the solution of the equations

$$\frac{\partial \mathrm{E}[(\Theta - r_L)^2]}{\partial r_\ell} = 0, \qquad \ell = 0, \ldots, s$$

we get

$$r_\ell = \frac{\sum_k w_k \int_0^{\infty} \theta \pi_\ell(\lambda_k \theta) u(\theta) \mathrm{d}\theta}{\sum_k w_k \int_0^{\infty} \pi_\ell(\lambda_k \theta) u(\theta) \mathrm{d}\theta} \tag{2}$$

3 Results and Discussion

In this section, we give numerical examples of computation of Bayesian relative premium. Let us consider the rating systems from one of the Czech insurance companies.

The BMS from Czech Insurance Company

The BMS from Czech Insurance Company consist of a scale with 16 steps having relativities described in Table 2.

Table 2 BMS from Czech Insurance Company

Level ℓ	Relativities	Level ℓ	Relativities
16	50%	**8**	90%
15	55%	**7**	95%
14	60%	**6**	100%
13	65%	**5**	110%
12	70%	**4**	120%
11	75%	**3**	140%
10	80%	**2**	170%
9	85%	**1**	200%

Source: *http://www.ceskapojistovna.cz/documents/10262/50010/pojisteni-vozidla-pp.pdf*
Adapted by author

The transition rules are the following:

- each year a one-class bonus is given.
- each claim is penalized by going three classes down.
- the maximal bonus is class 16.
- the maximal malus is class 1.

Bayesian Relative Premium for our Portfolio

Now we try to compute Bayesian relativities r_ℓ according to (2) and compare them with relativities from Czech Insurance Company. We assume that the number of claims obeys the distribution defined by (1). By using the claim frequencies and weights from Table 1 we get the relativities mentioned in Table 3.

Table 3 shows us that the most policyholders (55.61%) is on the level 16 and pays only 49.86% of the *a priori* premium. The result is similar to the BMS from Czech Insurance Company where policyholders on the level 16 pay 50% of the premium. However, the relative premium on the level 1 is different. According our results the policyholders should pay 304.68% but they pay only 200% in fact. Our proposed system is much stricter than Czech Insurance Company's BMS.

Table 3 Bayesian relative premium for our portfolio

Level ℓ	$\mathbf{P}[L = \ell]$	r_ℓ	Level ℓ	$\mathbf{P}[L = \ell]$	r_ℓ
16	55.61%	49.86%	**8**	1.85%	164.67%
15	4.45%	85.32%	**7**	1.84%	177.73%
14	4.98%	88.98%	**6**	1.74%	194.05%
13	5.78%	92.88%	**5**	1.90%	209.39%
12	2.57%	119.32%	**4**	2.26%	227.46%
11	2.52%	126.38%	**3**	2.28%	248.73%
10	2.38%	135.47%	**2**	3.39%	273.57%
9	1.86%	153.96%	**1**	4.59%	304.68%

Source: Author

4 Conclusions

We met with the bonus-malus system and we showed that it is very useful when we have a heterogeneous portfolio in the insurance company. We showed the computation of Bayesian relative premium for our portfolio and the comparison of these relativities with the BMS from Czech Insurance Company. According to our results the BMS should be stricter and the policyholders with insurance claims should pay more.

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CDS Spreads Determinants of the European Financial Institutions

Veronika Kajurová, Boris Šturc

Masaryk University
Faculty of Economics and Administration, Department of Finance
Lipová 41a, 602 00 Brno, Czech Republic
E-mail: vkajurova@mail.muni.cz, sturc@mail.muni.cz

Abstract: *Credit default swap spreads can reflect the potential situation, resp. financial health of a company, and also are considered as a measure of credit risk and as a leading indicator of the future development of company's creditworthiness. Investors should pay attention to the factors that can affect credit default swap spreads. The aim of this study is to find out which determinants had the influence on the spreads of credit default swaps issued on the debt of the European financial reference entities. Panel data regression is employed in order to explore the influence of selected determinants in the pre-crisis, crisis and post-crisis period within individual rating groups. The theoretical factors at companies' level and market determinants are taken into consideration. In most of the cases, the results are consistent with theoretical assumptions, but explanatory power of determinants varied across time and rating categories.*

Keywords: credit default swap, determinant, panel regression, spread

JEL codes: C01, C33, C58, G15, G2

1 Introduction

Credit default swaps (CDS) have become very popular instruments since they allow investors to manage their credit risk by buying or selling credit risk or protection. The rapid development of credit default swap markets has led to the increasing attention of investors in these products. Factors that can affect CDS spreads are therefore in the centre of their attention. The aim of this study is to examine the influence of CDS spread determinants on daily changes of corporate CDSs of the European financial reference entities. To capture the altering role of the selected determinants – leverage, liquidity, equity volatility, CDS volatility, risk-free rate, slope of term structure, market return and market volatility, a panel data regression is employed in the pre-crisis, financial crisis and post crisis period for individual rating groups.

The increased attention has been paid to CDSs determinants since the financial crisis burst and determinants of their spreads are still in the spotlight of researchers or policy makers who try to discover influence of selected factors on CDS spreads. Published works are focused on firm-specific factors, market factors or both, e.g. see Hull et al. (2004), Blanco et al. (2005), Houweling and Vorst (2005), Zhu (2006), Ericsson et al. (2009), Forte and Peña (2009), Tang and Yan (2010), Annaert et al. (2013), Corò et al. (2013), Galil et al. (2014) or Mayordomo et al. (2014).

Finding appropriate determinants and understanding their influence on CDS spreads is crucial and beneficial for investors, analysts or policy makers. Together with the growing degree of both financial and economic integration in global, the role of determinants should not be underestimated since CDSs enable to transfer not only credit risk but also contagion.

2 Methodology and Data

All data were obtained from Bloomberg database. Information for CDSs is provided in CDS world monitor. It includes 101 CDS of the European financial institutions, but due to missing data in database, our dataset includes 86 CDSs on the senior debt of the European financial entities. Each time series has 2,608 observations at most, non-trading days are omitted. A number of observations differs for each CDS depending on date when it was issued. All CDSs are of 5-year maturity in accordance with Mayordomo's et al. (2013) contribution which shows that this maturity-provider combination reflects new

information more rapidly than CDSs of other maturities. Table 1 summarizes the number of CDSs by country of reference entity origin.

Table 1 Overview of CDS reference entities' origin countries

Country	No of CDSs	Country	No of CDSs	Country	No of CDSs
Austria	3	France	10	Italy	11
Belgium	1	Great Britain	20	Netherland	5
Germany	7	Greece	4	Norway	1
Denmark	1	Switzerland	5	Portugal	3
Spain	7	Ireland	3	Sweden	5

Source: Bloomberg

Ratings are obtained from Bloomberg database as well. 65 CDSs belong to investment grade rating groups (AA – 10, A – 38 and BBB – 17) and 16 CDS are of non-investment grades (BB – 10, B – 2 and CCC – 4). Five are unrated.

The total sample period covers 10 years (January 2004 – December 2013) and is divided into three sub-periods according to trends in development of the Markit iTraxx Europe index – pre-crisis period (01/01/2004 – 05/31/2007), financial crisis period (06/01/2007 – 10/31/2009) and post-crisis period (11/01/2009 – 12/31/2013). The financial crisis period is deemed as a period of the biggest turmoil in financial markets. Then the crisis was transformed into a sovereign debt crisis, although in our study, it is denoted as the post-crisis period.

Several explanatory variables of same frequency as CDS spreads are considered in our analysis. It evaluates the explanatory power of both company specific (leverage, liquidity, asset volatility) and market factors (market return and volatility – national and European, risk-free rate and slope of term structure). Company-specific determinants are based on the paper by Merton (1974). Market factors are included since they are considered to have significant influence.

Table 2 provides a summary of selected determinant, indicators and expected relationship between change in the determinant and CDS spread change.

Table 2 Selected determinants, indicators and expected/theoretical relationship

Determinant	Indicator	Expected relationship
Asset volatility	Historical CDS and equity 30-day volatility	+
Leverage	Equity returns	-
Liquidity	CDS Bid-Ask spread	+
Market return*	Country's stock market index	-
Market volatility*	30-day volatility of country's stock market index	+
Risk-free rate	Overnight index swap rate	-
Term structure	10y-2y government bonds	-

* European stock market index return and its volatility are also included in the regression.

Following Christie (1982) or Annaert et al. (2013), stock returns are used as a proxy for leverage. It follows the assumption that if stock returns are positive, leverage will decrease, leading to lower credit spreads or vice versa. Asset volatility for each stock and CDS is obtained from Bloomberg database as historical 30-day volatility. Based on general knowledge, high asset volatility should reflect in higher credit spreads since it increases the probability of default. As a measure of liquidity, bid-ask spread of individual CDS prices is considered. Lower spread shows on the higher liquidity that should result in the lower probability of default.

According to Annaert et al. (2013), it is likely that common variation is linked to the economic environment, capturing general market and economic conditions. Therefore countries' stock market indices are used as a measure of business climate and 30-day volatility of these indices as a measure of market volatility. The higher market return should lead to the lower CDS spreads because the lower probability of default is expected. Market volatility has the reverse impact because of the increasing uncertainty.

The impact of risk-free rate is added to our model as well. Overnight index swap (OIS) rate is used as a proxy of risk-free rate. Hull and White (2012) suggest that OIS rates should be used as the risk-free rate when valuing derivatives instead of LIBOR and LIBOR-swap rates. They argue that the OIS rate is the most appropriate rate for calculating the no-default value of both collateralized and non-collateralized transactions. Negative relationship is expected between risk-free rate and CDS spread, since lower risk-free rates should lead to increasing credit spreads and vice versa. Finally, the term structure slope is considered as a determinant and also a negative relationship is expected as in the case of risk-free rate. It is calculated as a difference between the 10year and 2year government bonds.

Descriptive statistics results for used variables are not reported, but they reject normality in all cases.

Model Specification

Panel structure of data allows us to use panel estimation techniques that acquaint us to estimate how the independent variables may influence the dependent variable. Panel regressions for individual rating groups in all sub-periods are employed in order to find out whether the changes of selected variables have influence on CDS spread changes. The model is specified as follows:

$$\Delta CDS_{it} = \beta_0 + \beta_1 \Delta CDS_{i(t-1)} + \beta_2 \Delta CVOL_{it} + \beta_3 \Delta LIQ_{it} + \beta_4 \Delta LEV_{it} + \beta_5 \Delta EVOL_{it} + \beta_6 \Delta MVOL_{jt} + \beta_7 \Delta MRET_{jt} + \beta_8 \Delta STS_{jt} + \beta_9 \Delta RF_{jt} + \beta_{10} \Delta EURET_{jt} + \beta_{11} \Delta EUVOL_{jt} + \varepsilon_{it} \quad (1)$$

where i identifies reference entity specific explanatory variables, j identifies common market explanatory variables, t is time period, CDS is CDS spread, $CDS_{i(t-1)}$ is lagged CDS spread, $CVOL$ is CDS spread volatility, $EVOL$ asset (equity) historical volatility, LIQ is bid-ask spread, LEV is leverage (equity return), $MVOL$ is market volatility, $MRET$ is market index return, STS is slope of term structure, $EURET$ is Euro Stoxx index return, $EUVOL$ is volatility of Euro Stoxx index and ε is error term.

While employing panel regression, it is important to choose between fixed or random effects estimation. Random effects estimation is used to assess the effects of the explanatory variables in the model which means that uncorrelated heterogeneity is assumed, and with correlated heterogeneity, we have to use fixed effects estimations (Andreß et al., 2013). Hausman test (Hausman, 1978) is one of method which can be used when deciding about fixed and random effect. It evaluates if fixed and random effects estimation is substantially different. The results of Hausman tests (unreported here) showed that fixed effect estimation should be used.

3 Results and Discussion

Panel regressions were run in the period before, during and after the financial crisis for all available rating categories. Table 3 provides the result in pre-crisis period. Changes in CDS volatility, liquidity, leverage, market volatility (country-specific and European) and in Euro stoxx return were important when analysing all sample, but they explained only 9.37% of the variation. Constant and changes in lagged CDS spreads were significant as well. The role of determinants within individual rating groups differed. In the majority of categories, the most significant were changes in liquidity, CDS volatility, Euro stoxx index volatility, and lagged CDS spreads. The explained variation varied across rating groups. The highest explained variation reached up to 61.93% within rating BB and the lowest

0.86% within B category. Market factors did not seem to have such an explanatory power as they had in the following periods.

Table 3 Panel regression results in pre-crisis period (probabilities in parenthesis)

	All	AA	A	BBB	BB	B	CCC
No of CDSs	54	7	29	9	7	2	-
Constant	-0.001 (0.001)	-0.001 (0.151)	-0.001 (0.003)	-0.001 (0.233)	-0.001 (0.051)	-0.001 (0.150)	-
CDS(-1)	-0.206 (0.000)	-0.195 (0.000)	-0.170 (0.000)	-0.235 (0.000)	-0.228 (0.000)	-0.057 (0.089)	-
CVOL	**0.011** (0.000)	**0.020** (0.001)	**0.012** (0.000)	**0.010** (0.006)	0.001 (0.466)	-0.007 (0.374)	-
LIQ	**0.040** (0.000)	**0.028** (0.000)	**0.027** (0.000)	**0.063** (0.000)	**0.126** (0.000)	**0.017** (0.010)	-
LEV	**-0.080** (0.000)	**-0.150** (0.007)	**-0.101** (0.000)	-0.039 (0.403)	-0.043 (0.462)	-0.098 (0.149)	-
EVOL	-0.002 (0.563)	0.011 (0.353)	-0.001 (0.781)	0.004 (0.683)	-0.008 (0.748)	0.002 (0.764)	-
MVOL	**0.009** (0.038)	-0.013 (0.369)	**0.014** (0.008)	**0.024** (0.039)	-0.011 (0.274)	0.013 (0.348)	-
MRET	-0.066 (0.117)	**-0.269** (0.039)	0.008 (0.882)	-0.145 (0.320)	-0.040 (0.715)	-0.105 (0.412)	-
STS	-0.0001 (0.570)	0.0004 (0.428)	-0.001 (0.201)	0.001 (0.835)	-0.001 (0.232)	-0.001 (0.698)	-
RF	0.0004 (0.544)	-0.001 (0.417)	0.001 (0.078)	-0.001 (0.684)	0.001 (0.728)	0.002 (0.472)	-
EURET	**-0.090** (0.042)	0.035 (0.806)	**-0.154** (0.005)	0.043 (0.760)	-0.106 (0.276)	-0.039 (0.689)	-
EUVOL	**0.074** (0.000)	**0.143** (0.000)	**0.068** (0.000)	0.023 (0.461)	**0.063** (0.061)	0.052 (0.189)	-
Adj. R^2	9.37%	6.13%	6.28%	9.41%	61.93%	0.86%	-
D-W stat.	2.04	2.05	2.02	2.09	2.23	2.00	

Statistically significant coefficients that are in accordance with theoretical assumptions are in bold.
Source: Author's calculation in Eviews

The results for the crisis period are reported in Table 4. Explained variation lowered to 7.61% in the period (all ratings included). Compared to the previous period, changes in liquidity, CDS volatility, leverage, market return both country-specific and European were statistically significant for full sample and were in accordance with the theoretical assumptions. Changes in equity volatility, slope of term structure and OIS were statistically significant, but were contrary to the theory. The lowest explained variation 2.30% was detected for rating BB and the highest for rating AA. The explained variation arose in all rating groups apart from BB rating group compared to the previous period. Country stock market and European stock market changes in returns became more significant compared to the company-specific factors.

Table 4 Panel regression results in crisis period

	All	AA	A	BBB	BB	B	CCC
No of CDSs	76	10	35	16	7	2	1
Constant	0.004 (0.000)	0.002 (0.004)	0.004 (0.000)	0.003 (0.000)	0.005 (0.000)	0.003 (0.148)	-0.007 (0.043)
CDS(-1)	0.079 (0.000)	0.155 (0.000)	0.081 (0.000)	0.135 (0.000)	0.055 (0.000)	0.170 (0.000)	-0.013 (0.875)
CVOL	**0.004** (0.001)	**0.123** (0.000)	**0.081** (0.000)	**0.003** (0.134)	**0.003** (0.538)	-0.030 (0.237)	-0.024 (0.129)
LIQ	**0.001** (0.005)	0.001 (0.310)	**0.007** (0.000)	**0.001** (0.065)	**0.004** (0.001)	-0.004 (0.036)	**0.014** (0.016)
LEV	**-0.084** (0.000)	-0.023 (0.488)	**-0.090** (0.000)	**-0.102** (0.000)	**-0.066** (0.030)	-0.076 (0.435)	-0.097 (0.562)

	All	AA	A	BBB	BB	B	CCC
EVOL	0.019 (0.004)	0.030 (0.107)	0.019 (0.052)	-0.015 (0.288)	0.048 (0.018)	-0.013 (0.785)	-0.114 (0.281)
MVOL	-0.006 (0.510)	-0.027 (0.216)	-0.003 (0.820)	-0.007 (0.678)	-0.017 (0.4898)	0.039 (0.424)	-0.086 (0.447)
MRET	**-0.105** (0.007)	0.070 (0.480)	**-0.124** (0.030)	-0.001 (0.992)	-0.128 (0.229)	-0.157 (0.444)	-0.201 (0.377)
STS	0.002 (0.001)	0.001 (0.437)	0.002 (0.001)	0.001 (0.437)	-0.002 (0.512)	0.038 (0.039)	**-0.491** (0.028)
RF	0.052 (0.000)	0.034 (0.002)	0.059 (0.000)	0.024 (0.026)	0.048 (0.061)	0.061 (0.090)	-0.010 (0.904)
EURET	**-0.759** (0.000)	**-1.044** (0.000)	**-0.809** (0.000)	**-0.843** (0.000)	**-0.304** (0.008)	**-0.846** (0.000)	**-0.541** (0.067)
EUVOL	0.030 (0.107)	0.064 (0.155)	-0.021 (0.440)	**0.093** (0.012)	0.041 (0.470)	-0.152 (0.164)	-0.132 (0.606)
Adj. R^2	7.61%	16.51%	10.25%	10.25%	2.30%	14.78%	8.84%
D-W stat.	2.09	2.12	2.10	2.10	2.04	2.11	2.03

Statistically significant coefficients that are in accordance with theoretical assumptions are in bold.
Source: Author's calculation in Eviews

Table 5 summarizes the results in the post-crisis period. Explained variation was the highest in this period, it reached to 14.54%. The highest explained variation reached up to 24.30% in rating grade AA and the lowest 3.87% in the class BB.

Table 5 Panel regression results in post-crisis period

	All	AA	A	BBB	BB	B	CCC
No of CDSs	83	10	37	16	10	2	2
Constant	0.001 (0.000)	0.001 (0.014)	0.001 (0.000)	0.001 (0.001)	0.001 (0.003)	0.001 (0.028)	0.001 (0.073)
CDS(-1)	0.081 (0.000)	0.047 (0.000)	0.087 (0.000)	0.113 (0.000)	0.056 (0.000)	0.127 (0.000)	-0.011 (0.608)
CVOL	**0.001** (0.290)	**0.051** (0.000)	**0.001** (0.013)	-0.004 (0.000)	**0.011** (0.020)	**0.025** (0.000)	**0.048** (0.000)
LIQ	-1.15E-05 (0.580)	0.001 (0.135)	-2.57E-05 (0.353)	-0.001 (0.1735)	-3.11E-05 (0.475)	3.24E-05 (0.700)	**0.001** (0.005)
LEV	**-0.078** (0.000)	**-0.206** (0.000)	**-0.207** (0.000)	**-0.034** (0.000)	**-0.043** (0.000)	**-0.073** (0.028)	0.028 (0.077)
EVOL	0.005 (0.021)	0.016 (0.013)	0.006 (0.052)	-0.001 (0.862)	-0.004 (0.561)	**-0.030** (0.066)	0.009 (0.575)
MVOL	**0.012** (0.000)	0.002 (0.772)	**0.006** (0.091)	0.001 (0.832)	**0.033** (0.001)	**0.055** (0.004)	-0.006 (0.726)
MRET	**-0.119** (0.000)	0.391 (0.000)	-0.0002 (0.994)	**-0.714** (0.000)	**-0.253** (0.000)	-0.089 (0.376)	**-0.050** (0.099)
STS	**-0.001** (0.049)	-0.002 (0.766)	-0.003 (0.430)	**-0.002** (0.092)	-7.11E-05 (0.584)	-1.11E-05 (0.946)	**-0.001** (0.016)
RF	**-0.001** (0.002)	**-0.001** (0.006)	**-0.001** (0.040)	0.005 (0.147)	0.006 (0.298)	0.008 (0.440)	0.023 (0.016)
EURET	**-0.784** (0.000)	**-1.513** (0.000)	**-1.039** (0.000)	**-0.170** (0.000)	**-0.188** (0.001)	**-0.406** (0.000)	-0.059 (0.255)
EUVOL	**0.011** (0.096)	-0.012 (0.486)	0.005 (0.635)	0.020 (0.120)	**0.043** (0.056)	-0.036 (0.389)	0.047 (0.200)
Adj. R^2	14.54%	24.30%	19.06%	19.44%	3.87%	9.5%	4.55%
D-W stat.	2.12	2.16	2.17	2.17	2.05	2.08	2.04

Statistically significant coefficients that are in accordance with theoretical assumptions are in bold.
Source: Author's calculation in Eviews

Statistically significant and in harmony with the theory were changes in CDS volatility, liquidity, leverage and all market factors – market return and volatility (country and

European). Slope of term structure and OIS were also statistically significant and in accordance with the expectations only in the post-crisis period.

At last we estimate panel regression with fixed effect for all and individual ratings in full period. The results are reported in Table 6. The changes in CDS volatility, liquidity, leverage, equity volatility, market volatility and return (both country's and European stock market) were statistically significant and in accordance with our expectations. Constant and the change in lagged CDS spread were significant variables as well. Market volatility (MVOL and EUVOL) and return (MRET and EURET) had the most significant importance when evaluating the influence of changes in market variables on the CDS spread changes, and leverage when assessing the influence of company-specific variables. Changes in slope of term structure and OIS were not significant.

Table 6 Panel regression results in full period

	All	**AA**	**A**	**BBB**	**BB**	**B**	**CCC**
No of CDSs	83	10	37	16	11	3	3
Constant	0.001 (0.000)	0.001 (0.000)	0.001 (0.000)	0.001 (0.001)	0.001 (0.000)	0.001 (0.012)	0.001 (0.410)
CDS(-1)	0.022 (0.000)	0.039 (0.000)	0.040 (0.000)	0.032 (0.000)	-0.024 (0.001)	0.139 (0.000)	-0.005 (0.807)
CVOL	**0.003** (0.004)	**0.063** (0.000)	**0.007** (0.000)	-0.001 (0.241)	0.003 (0.139)	**0.013** (0.027)	**0.033** (0.000)
LIQ	**5.76E-05** (0.036)	**0.001** (0.037)	2.53E-05 (0.529)	**0.001** (0.032)	5.33E-05 (0.368)	1.07E-05 (0.911)	**0.001** (0.003)
LEV	**-0.085** (0.000)	**-0.082** (0.000)	**-0.133** (0.000)	**-0.055** (0.000)	**-0.052** (0.000)	-**0.069** (0.028)	0.028 (0.003)
EVOL	**0.007** (0.001)	**0.019** (0.002)	**0.009** (0.002)	-0.002 (0.660)	**0.011** (0.093)	-0.013 (0.210)	0.007 (0.645)
MVOL	**0.005** (0.080)	-0.011 (0.138)	0.005 (0.168)	0.004 (0.518)	0.003 (0.719)	**0.040** (0.005)	-0.010 (0.553)
MRET	**-0.126** (0.000)	**0.254** (0.000)	**-0.061** (0.014)	**-0.516** (0.000)	**-0.215** (0.000)	**-0.206** (0.004)	**-0.051** (0.100)
STS	1.44E-05 (0.884)	0.001 (0.204)	0.001 (0.120)	0.001 (0.424)	-0.001 (0.499)	-6.22E-06 (0.973)	**-0.001** (0.022)
RF	-0.001 (0.509)	**-0.001** (0.0420)	0.001 (0.711)	-0.001 (0.929)	0.003 (0.211)	0.003 (0.432)	0.021 (0.034)
EURET	**-0.720** (0.000)	**-1.258** (0.000)	**-0.882** (0.000)	**-0.307** (0.000)	**-0.237** (0.000)	**-0.572** (0.000)	**-0.109** (0.037)
EUVOL	**0.026** (0.000)	**0.033** (0.052)	0.007 (0.441)	**0.038** (0.006)	**0.069** (0.002)	-0.053 (0.128)	0.042 (0.272)
Adj. R^2	7.23%	12.96%	8.86%	8.61%	1.97%	10.07%	2.93%
D-W stat.	2.08	2.11	2.09	2.09	2.03	2.08	2.03

Statistically significant coefficients that are in accordance with theoretical assumptions are in bold.
Source: Author's calculation in Eviews

4 Conclusions

The aim of this study was to find out which determinants had the influence on the spreads of credit default swaps issued on the debt of the European financial reference entities. Understanding the influence of determinant on CDS spreads is crucial and beneficial for investors, analysts or policy makers.

The influence of selected variables was evaluated via panel regression technique using fixed effects estimation. The results are consistent with theoretical expectations and meet our expectations in most of the cases, but the power of individual variables differed in the particular periods and rating groups. The determinants of financial institutions CDS spreads varied across time and across individual rating groups. Both firm-specific and market factors had the influence on changes in CDS spreads and their importance should not be underestimated, even if the explained variation is quite low. The explanatory power of market factors is more important since the crisis burst out.

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The Impact of Discount Rate on Commercial Rates in the Czech Republic: The Cybernetic Approach

František Kalouda

Masaryk University
Faculty of Economics and Administration, Department of Finance
Lipová 41a, 602 00 Brno, Czech Republic
E-mail: kalouda@econ.muni.cz

Abstract: *The paper is devoted to the Czech banking system identification as a cybernetic system. The behaviour of banking system defined in this way is analysed here in the branch of capital cost management (bank loan). The aim of the paper is analysis of the managing system relations (regulator – central bank) to managed system (regulated cadre – commercial banks) as relationships between operational indicator (discount rate) and regulated indicator (commercial rates). The analysis encompasses the study of research time periods choice influence on research results. The main results of the paper are working conclusions related to structure and to behaviour of the Czech banking system as cybernetic system too and to impacts of structure and of such system behaviour on cost of capital management.*

Keywords: banking system, cybernetics, cost of capital

JEL codes: C67, E58, G21, G32

1 Introduction

Even the importance of bank loan has partly decreased in favour of the "newly entering ones" (Johnson and Scholes, 1989), the bank loan is in the Czech Republic still the most important companies financial resource (Kalouda and Málek, 2009). Its basic parameter is price, i.e. market interest rate (Revenda, 1999).

There is still the opinion between the financial theorists that the market interest rate is highly influenced by the central bank and by its discount rate. "Discount rate … designates … the price of loans in an economy. … Staying in the loans branch, we are able to identify six main interest rates, resp. interest measures ….:" (Revenda, 1999). Further, we will consider discount rate and market interest rate from these six interest rates.

According to Revenda, Z. (1999) „The main aim of discount rate changes … caused by central bank … is affection of movement, resp. of other interest rates level in economy and therefore influence on subjects' loans demand.". These central bank tendencies are in market economies quite analogic. This fact can be supported by an example from the USA "… as the instrument of FED serves **discount rate** – that is interest rate related to loans granted by FED to banks." (Mankiw, 2000).

The ambiguity of discount rate effects known from theory can on one side lead to extreme, when "Problematic discount rate changes impressions … on banks behaviour are the main reason why these rates are in many countries changed only slightly and in longer time periods." (Revenda, 1999). On the other side in different circumstances "… banks … react on changes of (primarily) discount rate very sensibly. Sometimes it is not necessary to change this rate but it is sufficient that the central bank will convey … deciding about discount rate change. The reaction is almost the same ….. . We speak about the *announcement effect* of discount rate …. ." (ibid).

This ambiguity of discount rate influence on market interest rate is the main motive for this paper creation. The main aim of the paper is therefore the analysis of discount rate impact on market interest rate. To reach this aim there will be investigated following problem areas:

- fundamental applicability of cybernetic approaches in selected area

- rationality of the Czech banking system structure recognized as cybernetic system
- linearity of the Czech banking system
- overstability of the Czech banking system
- regulation accuracy of the Czech banking system.

2 Methodology and Data

The discount rate influence on market interest rate is in this paper conceptualized in general terms as a problem of communication and of management. Therefore it is suitable to apply methodical apparatus of theoretic discipline in these terms that was in the Czech Republic used for these intensions only marginally. This theoretic discipline is "cybernetics … as a science about general laws of origination, transmission and processing of information in complex systems and about general principles of these systems management." (Kubík et al., 1982).

From these methodical instruments of cybernetics (more exactly of technical cybernetics) there will be further used:

- static function (Kubík et al., 1982),
- step function response (Kubík et al, 1982), resp. Švarc (2003) and
- theory of hysteresis function (Švarc, 2003).

For the purposes of verification (including visualization) of step function response there will be from the applied mathematics apparatus used:

- theory of differential equations, especially in the form of
- Laplace transform.

As parts of the paper methodical apparatus are except above mentioned techniques also used description and common analytically-synthetic procedures.

In data and results presentation there are the graphic outcomes preferred because of the data extent. The paper is based on publicly available entry data http://www.cnb.cz/cs/financni_trhy/penezni_trh/pribor/rok_form.jsp which are (because of range reduction) cited here. These data cover time period from 31st January 2004 to 30th August 2013.

3 Results and Discussion

Fundamental Applicability of Cybernetic Approaches in the Selected Area

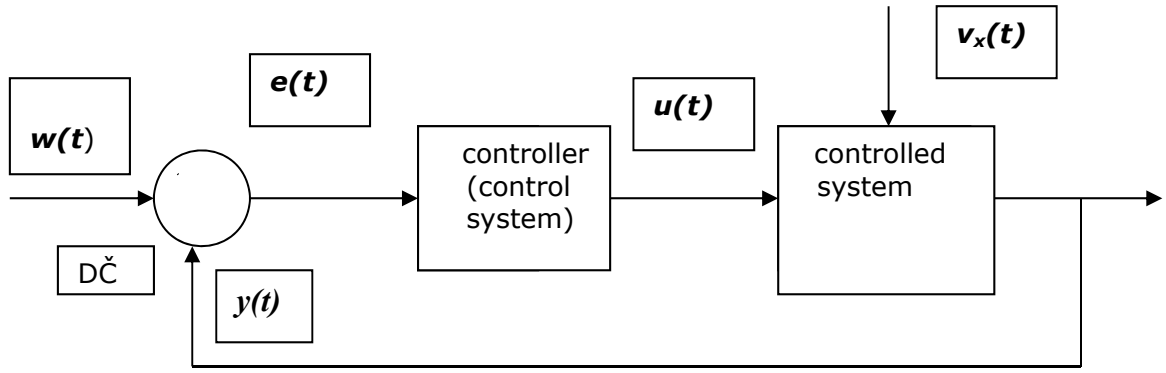
The source Allen (1971) emphasizes in these terms unequivocal opinion: „There is necessary only the formal similarity to anticipate that the methods used in technics will be suitable for economic models too." This condition is met in our case.

Nevertheless, the same source mentions an important problem with application of methods that have been successfully proved in technical sphere on the economic sphere – the linearity of the models. „Linear models can be generally suitable for technics where everything can be accurately managed. Be sure that they are not suitable up to the same extent for the economic models." However, there is accepted the possibility of linearization.

Rationality of the Czech Banking System Structure Recognized as Cybernetic System

The study of this phenomenon brought the first and striking result. For its relevant interpretation there will be firstly described the concept of control loop in its classical form (see Figure 1).

Figure 1 The classical scheme of control loop



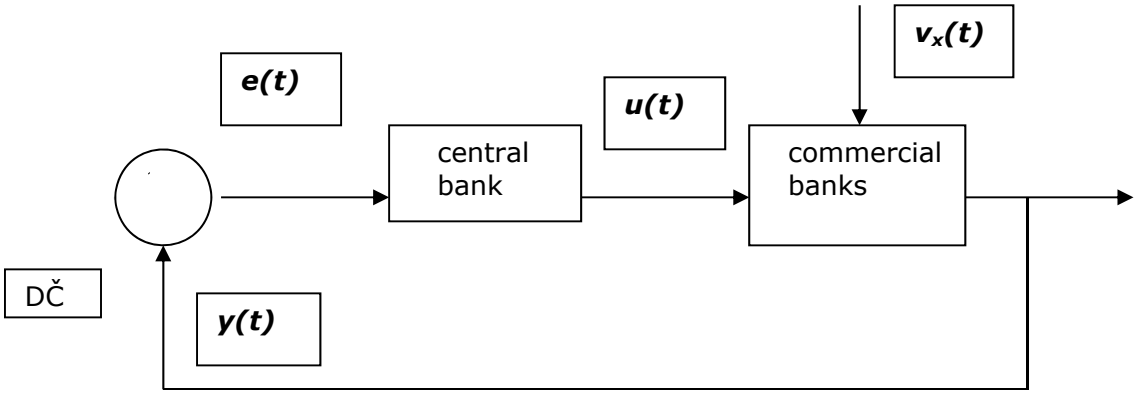
Legend:

w(t) …… command variable	– unknown indicator, it cannot be interpreted
e(t) ……error	- - „ -
u(t) …… manipulated variable	- discount rate
$v_x(t)$ …… disturbance variables	- are recognized as a part of ceteris paribus assumption
y(t) …… controlled variable	- commercial rate / rates
DČ …… differential element (*e=w–y*)	- unknown component, it cannot be defined

Source: Adapted from Švarc et al. (2011, pp. 62-65).

Modification of the classical scheme of control loop for the influence of central bank official independence is obvious (see Figure 2). The system feedback is preserved indeed but its ability of target behaviour is in absence of command variable *w(t)* at least disputable.

Figure 2 The modification of control loop – consequence of central bank independence



Source: Own construction of the author based on Švarc et al. (2011, pp. 62-65).

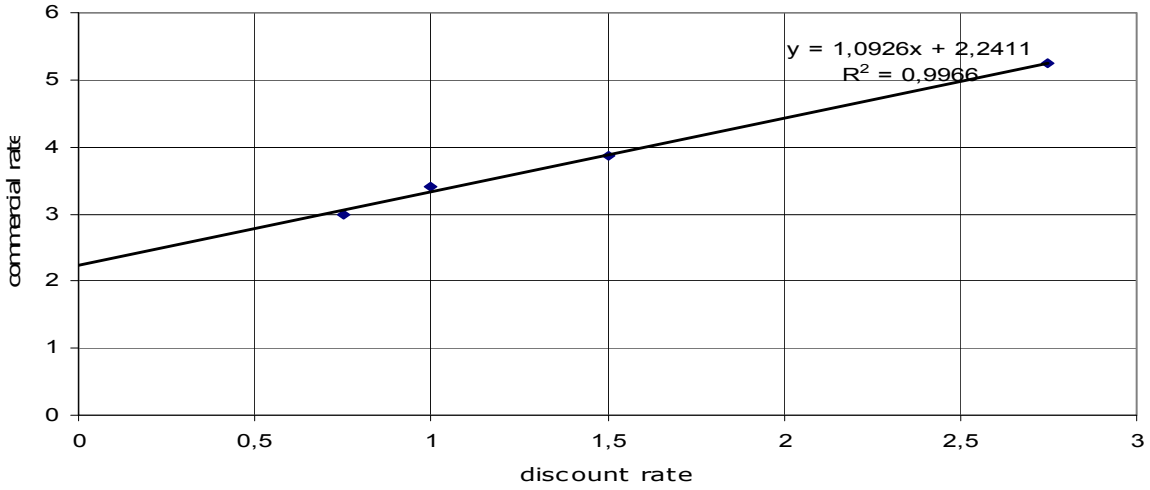
It is even possible to express more radical conclusion – entire absence of command variable makes this control loop dysfunctional. That is the reason why there arises the obvious need to substitute the officially non-existent command variable by its equivalent. That is probably possible in the form of informal organizational structures built in the Czech banking system as well as beside it. It is in interesting way proved by typing error of the source (Revenda, 1999). „The main aim of discount rate changes … from the side of central bank (government) is *to influence progression,* resp. *the level of other interest rates* ... and therefore to affect the demand ... for loans."

Linearity of the Czech Banking System – Static Function of Commercial Banks

"Static characteristics of control members are mostly expressed by the static function, i.e. the dependence between the output indicator in stabilized state and entry indicator in stabilized state." (Švarc, 2003). That means the values constant for our purposes during the time period long at least six months. It is obvious that the system of commercial banks can be with acceptable inaccuracy rate recognized for linear (see Figure 3).

For comparison – dependence quite same in type is presented as a linear one in source Balátě (2004) too.

Figure 3 Static function of commercial banks

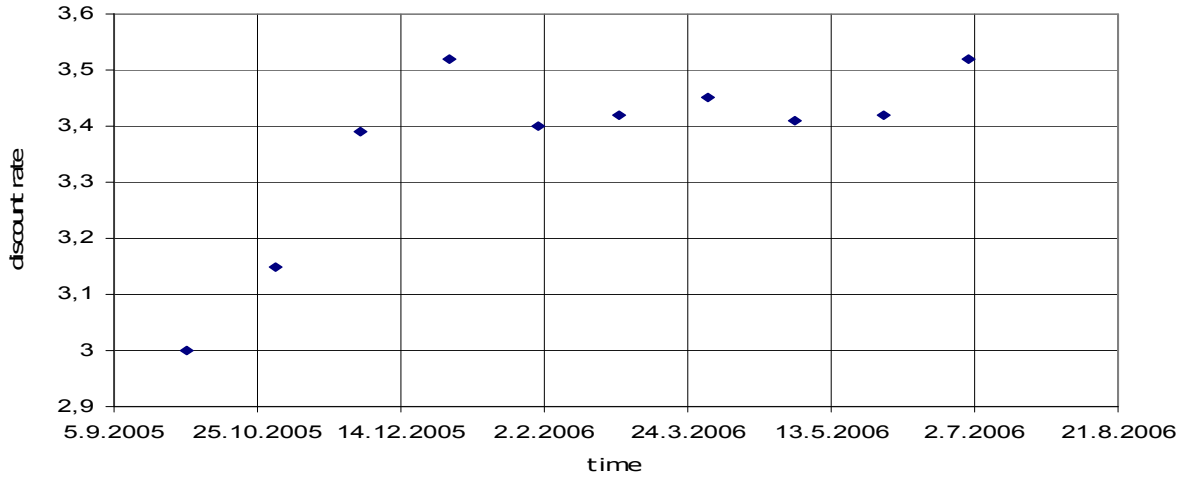


Source: Own construction of the author

Static Accuracy of the Czech Banking System – Step Function Response of Commercial Banks

Step function response is constructed on the basis of above mentioned "second cycle" data. More closely it is spoken about the data from the time period between 31st January 2004 and 30th August 2013. Related step of entry indicator (discount rate) is the change from value 0.75 % to 1.00 %.

Figure 4 Step function response of commercial banks

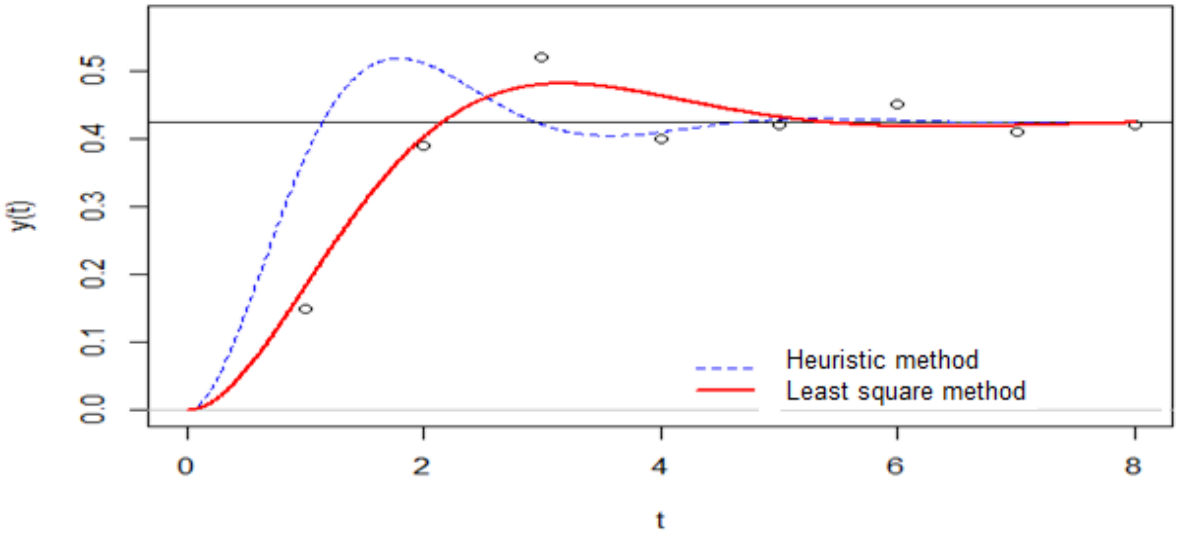


Source: Own construction of the author

Expert evaluation of data in Figure 4 leads us to working conclusion that the commercial banks represent in fact locally stable static oscillating system of second order.

Verification of the assumption according to selected methodology (Fikar and Mikleš, 1999) can be seen in Figure 5. This methodology constructs correspondent differential equation of system transmission in heuristic way and it uses the values that were empirically gained from the transition function (dashed line).

Figure 5 The verification of the step function response of commercial banks



Source: Bíza (2014). Working paper (SVA outcome) in the framework of OP VK project "Věda a vědci pro vzdělanost moderní společnosti" (CZ.1.07/2.3.00/35.0005), unpublished work, FEA MU, May 2014.

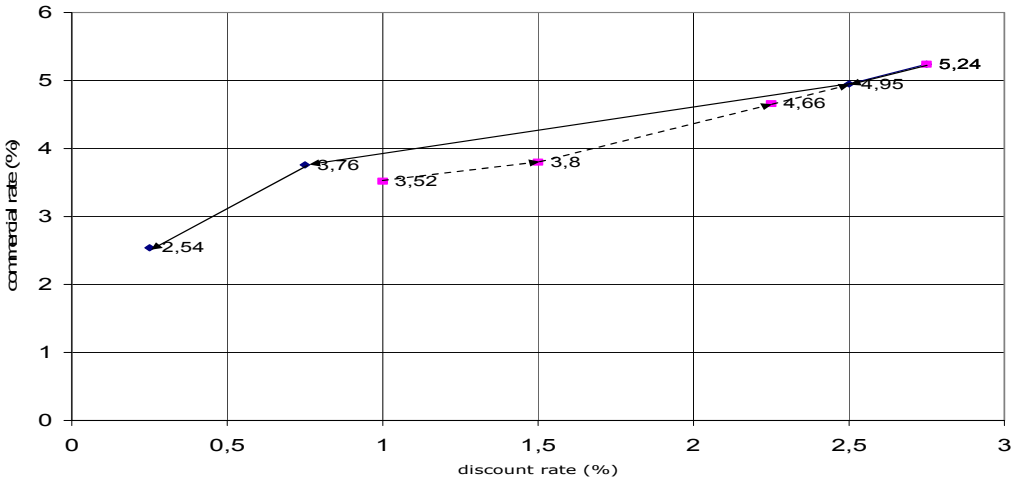
In Figure 5 there is presented also the result of alternative methodology application, i.e. least square method (full line). Outcomes of this methodology are more reliable than the above described heuristics. Deeper discussion of this phenomenon is, unfortunately, beyond the borders of this paper.

However, it is necessary to consider that both mentioned constructions do not take into account the last gained data that could be recognized as the exposure of system tendency to start unstable vibrate. This problem will need further more detailed analysis of accessible data.

Regulation Accuracy of the Czech Banking System (Central Bank and Commercial Banks)

Interaction between central bank and commercial banks leads to negative synergies when there occurs the non-linearity of the hysteresis type (see Figure 6). This state eventuates in conclusion that announcement effect of discount rate consecutively erodes. In its implications it means that after certain cycles number of "increase-decrease" type the discount rate will lose its ability to regulate commercial rate.

Figure 6 The hysteresis erosion of discount rate announcement effect



Source: Own construction of the author

4 Conclusions

The paper conclusions are formulated in relation to above mentioned structure of partial analysed problem areas. With consideration of theoretic knowledge and according to stated available data processing there can be on the discussion basis formulated succeeding paper conclusions:

- fundamental applicability of cybernetic approaches in selected area

Cybernetic approaches are for the settled task (inquiry into economic processes) undoubtedly utilizable. The possible problems with disputable linearities can be in the first approximation solved by linearization of tackled problem. The methodology of non-linear regulation can be used in well-founded cases.

- rationality of the Czech banking system structure recognized as cybernetic system

The assumption of central bank independence leads to absence of command variable w(t). The Czech banking system appears at this state of affairs as the system with feedback but in fact as the uncontrolled system. The possibilities of rational target behaviour are in this case quite limited.

- linearity of the Czech banking system – static function of commercial banks

Commercial banks conduct themselves as a linear system in principle. The rate of the current identifiable nonlinearities is so low that the linearization does not bear any major problems.

- static accuracy of the Czech banking system – step function response of commercial banks

Step function response of commercial banks leads to partial conclusion that the commercial banks can be from dynamic view perceived as locally stable static oscillating system of second order. However, accessible data do not exclude tendencies to non-stationary oscillations with the risk of potential system destabilization.

- regulation accuracy of the Czech banking system (central bank and commercial banks)

The nonlinearity of hysteresis type is typical for coexistence of central bank with commercial banks. The consecutively erosion of discount rate announcement effect is a result of this state. It can even lead to loss of applicability of discount rate as cost of

capital (bank loan) management instrument at the level of commercial rate. Present level of discount rate confirms this theoretic possibility in praxis.

The paper results are surprising in a certain manner. They can raise fears concerning banking system stability. In addition they theoretically confirm limited possibilities of discount rate as an instrument for regulation of cost of capital in the form of bank loan (market interest rate). In this relation there can be clearly seen possible similarity with the monobank management potential (Kalouda and Svítil, 2009), (de SOTO, 2009) even if there are taken into account all disadvantages resulting from this variant of banking sector organizational order (Revenda, 1999).

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Influence of Political System on Merger Legislation

Alois Konečný

Masaryk University
Faculty of Economics and Administration, Department of Finance
Lipová 41a, 602 00 Brno. Czech Republic
E-mail: alois@econ.muni.cz

Abstract: *In the article "Influence of Political System on Merger Legislation" there are analysed, compared and upon this comparison found differences in the legal regulations ruling mergers according to the changes in socio-economic and political conditions. Subsequently the reasons which led to the creation of the various concepts of the valid legal framework are caught up. The topic is highly up-to-date because the financial markets and financial systems are widely dependent on the legislation in countries of (mainly) continental law. In this paper the dependence is studied from the view of merger legislation. The work itself consists of two basic parts – the period of Czechoslovakia between 1918 and the beginning of the 1950s (First republic, Protectorate of Bohemia and Moravia and then Czechoslovak Republic), and the time period from the 1950s till 1989 (socialist period). Each of these chapters takes care mainly on the substance of merger legislation and partly on merger accounting over the given period. The political influences and their impact on merger legislation are the subject matter too. As there will be explained, the differences were huge and they were mainly caused by the circumstances and conditions of political environment in that they had originated. The methods used in this paper include literary research, analysis and comparison.*

Keywords: merger, legislation, Czech countries

JEL codes: G34, K22, M41, P26

1 Introduction

Those who do not understand history are bound to relive it - it is an worldwide applicable proverb documenting that it is always important to learn about historical development, e.g. about development of social sciences when studying these (i.e., in our case, economic, political and legal sciences). An insight into transformations of legal regulations enables a better understanding of the way in which individual institutions were developing – in relation to the political development of the period, of course.

It has been decided to pursue legal framework of mergers on the territory of today's Czech Republic in this work. During the research there have been studied a lot of sources concerning mergers and acquisition and there has been found out that a lot of studies is concentrated on development of mergers and merger effectiveness. Examples can reader find in sources (Sedláček, Valouch, Králová, 2013) and (Sedláček, et al., 2013). Recent scientific papers are also sometimes aimed on connection between mergers and related accounting procedures (Sedláček, Křížová, Hýblová, 2012). But only rarely we are able to find some studies concerning impact of legal regulations on number or shape of mergers or impact of political systems and their claims on the same area. That was the reason for creation of this kind of paper.

This analysis, resulting in the future in comparison with the present state of affairs, will facilitate understanding of the development and comparison of individual legal regulations of a given area, which would consequently lead to outline possible changes.

The selected topic is highly up-to-date. The reason is simple - the financial markets and financial systems are widely dependent on the legislation in countries of continental law as the Czech Republic is. In this paper the dependence is studied from the view of merger legislation in the Czech conditions. It brings new knowledge from the branch of relationship between legislation important for financial systems and socio-political circumstances.

As finding a common definition of mergers or other processes corresponding with the term is likely to be difficult, we will have to make it with a general description when looking for processes in which formerly independent entities merge/get together/integrate etc. and during which one or more of these cease to exist.

It is important to point out at the beginning that where we mention the language of specific legal sources, it is the language of the date of its origin, or a different date (which is mentioned in such case). Where we speak of contemporary regulation in force, we refer to the situation of 15 April 2014.

Although we will deal with development of a modern legal regulation of a given area in this article, it must be said that all modern legal constructions in our region are derived from Roman legal framework. The core of legal regulation on trading partnerships arose from the original societas iuric civilis, i.e. units without legal entity which were established by a social contract laying obligation solely upon partners, but not upon external individuals. New partnerships, on the other hand already had their special assets separated from private property of partners and also not only unlimited and immediate liability of partners, but gradually also joint liability and enterprising of partners under a joint venture. This led to the creation of the first general partnerships in north Italian cities of the 15th century and later also of limited partnerships. Only many years later did the first capital partnerships, especially public companies come into existence (in 1602 in Holland, 1603 in Britain, in 1628 in France etc.) In the 18th century we could see a rise in the number of partnerships companies limited by shares (Eliáš, 1994).

2 Methodology and Data

This paper is based on the knowledge gained from scientific literature, papers and from legal regulations as well. At the beginning of this research there was intention to cover not only real development of the mergers number and mergers value but also point out political influences that formed merger legislation. The first results were published at international scientific conference in Greece (Konečný, Valouch, 2012) and in this paper there can be found out next results of this research. The first version of this paper was lectured and discussed at the scientific conference European Financial Systems in Lednice held on 12th and 13th June 2014 and it was widely accepted by the scientific public.

In the next step of this analysis there will be compared the historical development with the present state of affairs. It will facilitate understanding of the development and comparison of legal regulations of a given area based on the political claims at the selected period. Therefore it should enable the legislators to be able to anticipate possible future changes.

The aim of the paper is to analyse, compare and finally evaluate the impacts of political changes and of political situation on merger legislation and therefore vicariously on financial markets too.

The problem area takes aim at mergers, mergers legislation and political situation in the former Czechoslovakia. This broad area is bounded by the time period from 1918 to 1989.

Mergers, along with acquisitions, i.e. various forms of business alliances (the terms merger and acquisition are rarely or not at all used over most of the time period we will deal with) fit into a wider area of law, i.e. law on trading partnerships and commercial law. That is why there is briefly presented the development of the whole area at the beginning. Due to the fact that Czech countries gained finally independence relatively recently, a part of the work will be devoted to the legal regulations of the political systems Czech countries used to be a part of.

The methods used in this paper include analysis, comparison and literary research. The empirical methods (e.g. statistical ones) are not used because of the paper nature. The comparative analysis performed in this paper is based on knowledge gained from wide inquiry into legal and literary resources.

3 Results and Discussion

The results of this research can be (for the selected period) divided into two main parts. The first part analyses legislation in "capitalism" of the First republic and similar economic system during The Protectorate of Bohemia and Moravia and the second one the legislation in socialist period from 1950 to 1990.

3.1 Czechoslovakia - 1918 till the Beginning of the 1950S

However strange it may seem at first sight, the legal regulation in Czechoslovakia between its formation and 1938 may also be defined as the "Austrian" period. After the creation of the Czechoslovak republic, all existing regulations in force on the territory of the republic before its creation were adopted by the so called reception act no.11/1918 Coll. This amendment was later (by act no.76/1920 Coll. and by governmental decree no.152/1920 Coll.) extended to the Hlučín area, which was acquired through a peace treaty with Germany.

With emergence of laws of the new republic specifics concerning mergers started changing. It was e.g. necessary to abide by a decree no.465/1920 Coll. (concerning establishment of limited liability companies and public limited companies (limited by shares) on increasing equity capital of such companies and establishing subsidiary institutions), which, in case equity capital of such companies increased during a merger, now required (and this was the same for public limited companies) approval of the minister of interior trade (following prior hearing of the ministry of finance).

In 1924, act no.279/1924 Coll. on transformation of a limited liability company into an association came into effect and enabled mergers between various types of companies. A *public limited company* could (as a company which is dissolved) consolidate with an *association*, in such a way that (para.97 of act no.58/1906 of Imperial Code – abbr. IC) it was first transformed into a limited liability company and this was subsequently, thanks to this law, transformed into an association. The transformed association could then (until 1939) merge with the original association following the procedure known from the Austrian period.

Practical (not only political) issues led to initiation of works on a new commercial code in the 1930s. However, for a variety of, mainly political reasons, the whole process did not lead further than to a draft (in 1937 a part called The Draft of the Commercial Code was published in print).

Former legal regulation was also effective throughout the period the World War II, but it was restricted by the war economy and other legal regulations of Nazi Germany. (The Protectorate was declared on 16 March 1939 by a decree "The Protectorate of Bohemia and Moravia", published in the Collection of laws as art.75/1939 and ceased to exist 5 May 1945 by a decree 30/1945 Coll.)

From 1939 (until 1954) *mergers between associations* on the territory of Czechoslovakia were subject to a governmental decree no.259/1939 Coll. on mergers and transformations of production enterprises and economic corporations, which specifically dealt with mergers of associations.

The decree above stipulated (part I, sect. A) procedure and conditions of mergers of associations in a way similar to the amendments of regulations of General Commercial Code (abbr. GCC) with respect to mergers of public limited companies, with exact quotation here and there. Among others, when associations merged, rights and liabilities, as well as trade and other certifications of a dissolved company were transferred ex lege, Members of a dissolved company were guaranteed the right to turn down membership in the new association in a time limit. The only substantial difference was para.3, no.1, which stated that to approve a merger agreement, a majority "of at least three quarters of members present at the GM" suffices.

Similarly, i.e. through a transformation of a limited liability company into an association and subsequent merger of the associations it was possible to carry out a merger between

an Ltd and an association (the order is not important). Nevertheless, there was a condition that the line of business of both associations should be the same or similar (governmental decree no. 259/1939 Coll.).

Of this decree, let us mention sections B and C of part I, which regulated transformations of enterprises into other types of corporations and transfer of plants to a newly formed corporation, i.e. the same area, which is today regulated as a trade sale by act no. 89/2012 Coll., New Civil Code – on acquisition of corporate assets.

A reverse case, i.e. a *merger of a public limited company with an association* as a dissolved company could not have been applied, as the legislation in force did not allow associations to be transformed into an Ltd or a Plc.

The characteristic feature of all the above mentioned mergers was their voluntary nature. However, the governmental decree no.259/1939 Coll. part II introduced an option of a *compulsory merger of associations* (in force until 1 January 1955). If it was in public interest, the authority could order that associations to execute a merger (or plant transfer) themselves within a set period and in prescribed manner, similar to the "voluntary" part I or the authority carried out the merger (plant transfer) itself. In case the associations did not conduct the compulsory merger, the authority could do so themselves.

The authority was a relevant ministry (the one responsible for associations with specifically defined line of business) under the agreement with ministry of justice (para. 25 ibid).

With the end of World War II and with Czechoslovakia recovering from the war, a presidential decree no.5/1945 Coll. was passed. This, in certain conditions (para. 3), enabled imposition of *national administration* on companies with a national administrator in charge. He could make standard decisions, but to deal with "high priority issues" he needed a consent of a body establishing the administration (para.7). As mergers fell into this category, the administrator had, if authorised, the power make a decision about a merger (as a substitute for general meeting of a Plc or an association or for general meeting of partners of an Ltd).

The original (Austrian) General Commercial Code was in force until 1950, when it was repealed by act no.141/1950 Coll. (para.568, sect. 2), of civil code, and practically united the entire private law of Czechoslovakia of that time. (Havel, 2002) The same regulation also repealed law on limited liability companies. Moreover, para.563, sect.2 of the act stated that companies formed under the former commercial law, if not specified by other regulations, and companies under general civil code will be dissolved on 1st January 1951; property settlement was liable to former legal regulation.

3.2 Czechoslovakia From The Beginning Of The 1950S Until 1989

With the radical political change at the beginning of the 1950s the legal environment changes significantly. On 1st January para.568, sec.2, act no.141/1950 Coll., of the civil code repealed commercial law put into effect by act no.1/1863 of Imperial Code and act no.XXXVII/1875 on commercial law, except for regulation amending legal provisions of associations; and also act no.58/1906 of IC, on limited liability companies; and further act no.271/1920 Coll., extending the force of act no.58/1906 of IC on limited liability companies onto Slovakia.

The same act also stated in para.563, sec. 2 that companies established by the former commercial law, if not specified differently by other regulations, and companies established by general civil code *will be dissolved* on 1 January 1951; property settlement procedure will follow former legal regulation.

A new entrepreneurial form of national (later state) enterprises came into existence in large numbers. Here it is important to clarify the difference between a national enterprise as specified by presidential nationalisation decrees of 1945 and the one defined by the governmental regulation no.6/1946 Coll., with the latter still fully based on the standard

commercial concept. And so national enterprises were supposed to have boards (with competences similar to those of a general meeting, according to GCC) with the Chief Executive at its head and a constituent company. They had to be entered in the commercial register and have full liability for their property. As opposed to that, a national enterprise which, by course of act no.103/1950 Coll. and subsequently by act no.51/1955 Coll., is a national enterprise with a corporate body still registered into commercial register, but without a constituent company, only with a title and limited liability (para.12). The state is the owner of assets of a national enterprise (in original wording it was the national enterprise itself that was the owner, even though the assets were only conferred to it). The state, however, was not liable for the assets. The "new" national enterprise was run by a director appointed by the general director.

The first amendment of transformations of national enterprises (of the new type) was determined by act no.103/1950 Coll. From the point of view of legal entity this was a breakthrough act. The concept of corporate bodies as entrepreneurial subjects completely disappeared and the new corporate bodies were closely tied with the state and most relations had a clear hierarchical management structure. The concept of alliances of such bodies was then derived from such administrative concept; it was formal, brief and explicitly state-connected. The remaining aspects of collective management (boards) disappeared and competences over mergers were taken over by the state, which subsequently delegated them to their assignees (Pelikánová, 2004).

Act no.51/1955 Coll. first outlined a concept of production-economic units (PEU) based on a principle that all bodies within a specific sector should be subordinated to one single PEU. The law also encompassed regulation on transformation and dissolution of national companies (state of affairs following amendment act of 1958). This was based on a measure taken by specific ministry following approval of the minister of finance plus negotiations with central committee of a particular industrial union. The law was only repealed by act no.109/1964 Coll., of Economic Code (further only EC) and the area was regulated until 1974 by a decree of government no.132/1965 Coll. on management of production-economic units and on their status. Para. 2 and 3 divided PEU into:

- branch enterprise – a single corporate body, to which one or more national enterprises or specific organizations could affiliate
- business trust, which was not a corporate body and consisted of specific (general) headquarters of the trust and national enterprises and specific organizations subordinated to it
- in some cases other forms defined by the government
- a decree no.91/1974 Coll., of 1974 mentioned another form of enterprise, which was a concern, a corporate body divided into concern enterprises, or concern-specific organizations with limited legal entity.

There was a general director running a PEU, who (para.5 of the decree) could have been assigned to form, merge, divide or dissolve state economic organizations subordinated to the specific headquarters of a trust or affiliated to a specific enterprise. Also para.48 through to 50 of EC specified regulation on mergers of state economic organizations.

Formally, there were also public limited companies, which were regulated by act no.243/1949 Coll. on public limited companies. Before being repealed, the law removed Plcs from the force of GCC. However, legal form of public limited companies was largely truncated (as opposed to Germany where the regulation of public limited companies was elaborately specified). Not only by a major reduction of the law (down to 20 paragraphs), but also by strengthening permit principle. Public limited companies were not designed to enable private undertaking, but to serve as a state counterpart for international trade, i.e. hidden national enterprise. Despite this fact, the law in para.13 and 14 briefly defined a possibility of dissolution of a public limited company without liquidating it – through a merger with another Plc or an association. It also defined method of insuring liabilities of the dissolved company, the necessity of registering in the company register and the possibility of a state regulation on a merger (even though neither of the terms was used in the law of that time).

4 Conclusions

In the article there were according to the stated aim outlined gradual (even if turbulent at times) changes in the legal regulation on corporate mergers that depended on the political changes. The first legal regulation on our territory came into existence in the form of General Commercial Code in 1863. The GCC introduced mergers as such, but the regulation was short and only public limited companies were subject to mergers. The whole concept was rather rigid.

When new democratic Czechoslovakia was established, the legal system of the former monarchy was taken over. Despite very different political situation the GCC was for mergers in use henceforth. As time went by, first amendments were made. Despite efforts to form a new commercial code, for a variety of reasons (mainly political) the original General Commercial Code remained in force throughout this period. The beginning of the 1st republic was very interesting from economic point of view as a range of laws and governmental regulations dealing with taxes and charges were put into force. The regulation was aimed at facilitating mergers for economic reasons and also at mitigating consequences of a monetary reform disadvantaging mergers. The decree of government from the period of protectorate, which finally regulated mergers of associations, was very important. Until then only mergers of public limited companies and limited liability companies had been regulated.

From 1945 onwards, important changes start appearing in Czech legislation, such as formation of national enterprise. While 1st wave of nationalisation took place shortly after World War II, the economy, and also the legal system were still based on market and commercial principles. With the beginning of the 1950s there are substantial and forceful changes impacting the whole system that resulted from radical political change. The legal regulation on mergers, based on the GCC and relating laws is practically discontinued as the new political system does not consider the issue important and the new regulation is rather brief. Here are several substantial knowledge how was the development of legislation concept influenced by change of political concept:

- Majority of corporate entities in the period was either directly or indirectly tied with the state (national enterprises or PEU formed a substantial part).
- When looking into legal regulation on mergers in the period until the 1940s, we will find out that a large part is oriented outwards – relations between members of a merger (union/consolidation/alliance) were regulated only formally, the rest was up to the members.
- This changed with the upcoming period. When these matters were regulated, (let us leave public limited companies out, because their regulation was brief for they were not expected to materialize), they were mandatory and strictly limited (unlike in the past). This was a logical consequence of all other political and legal changes. Many of the so far important areas lost their significance:
    - most mergers were done between subjects with the same controlling (direct or indirect) body – the state. That is why the controlling body of the new subject was again the state (let us emphasize its indirect role – e.g. para.47 of EC specified: "State-run economic organizations are not responsible for liabilities of the state or other state organizations. The state is not responsible for liabilities of state-run economic organizations…").
    - Potential problems between members of mergers were thus partially eliminated (due to a given hierarchy and the administrative procedure) and it especially eliminated a large external area impacting creditors. Although there were alliances of various forms of subjects, the proprietary and power structure background of the transaction remained unchanged and creditors´ claims were thus not jeopardised. Another reason which led to a scale-down in the volume of regulation was low protection of creditors, which had already appeared in e.g. act no.103/1950 Coll.,

para.42 – "By transferring the liability … the former debtor is acquitted. Creditor's consent is not necessary to such a transfer."

As we can see from the above stated facts, development of legal regulation on mergers was dependent on political requirements of the time upon law. It passed through a period of gradual development under the Hapsburg monarchy, when the area was just emerging, giving rise to a variety of legal entities and allowing legal framework of mergers to be adjusted. The 1st Republic and the Protectorate adopted the Austro-Hungarian regulation and later little by little completed it (maybe even precised). The reason was simple – the First Republic was created in a hurry and because the economic system was quite similar, there was no ground for creation of dissimilar legislation as well as little time. We can conclude that in this period the similarity of economic system was more important than the change in political system.

The regulation of the second half of the 20th century was rather brief as it was not expected that many transactions of that type would take place. The original legal regulation of the beginning of the period was gradually curtailed, modified and repealed, until only the most elementary part remained of it in the end. In this period the change in political system was radical in so far that it has caused wide changes in economic and legal framework too. Another substantial change which will be dealt with in the continuation of this article occurred in 1989.

The company planning the merger with foreign company should take into account the legislation claims because on the legislation depends coverage of its investment. In the time of finishing financial crisis there can be heard the demands for change in political system (in Greece etc.). As we have seen from the executed comparative analysis such change can widely affect legislation of each country as well as its financial system. Each company should be therefore aware of such calls because it can influence its assets as it was clarified in this paper.

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Changes in the Holding of Liquidity during the Present Financial Crisis

Jana Kotlebova

University of Economics in Bratislava
Faculty of National Economy, Department of Banking and International Finance
Dolnozemska cesta 1, 852 35 Bratislava, Slovakia
E-mail: jana.kotlebova@euba.sk

Abstract: *Uncertainty on financial markets during the financial crisis brings the changes in the holding of liquidity of all economic agents. The main goal of this contribution is to assess the nature of these movements in liquidity structure and on this basis to determine potential risks for meeting monetary goals of central banks. Methodologically, flow of funds analysis is used. Special attention is paid to portfolio and credit shifts in the holding of liquidity. Geographically, contribution covers analysis of Slovak and Czech economies during the period 2007 - 2014 on quarterly basis. In regard to conservatism in behavior of economic agent credit shifts are anticipated. By this way it is possible to assess also efficiency of unconventional monetary policy in these two different countries.*

Keywords: liquidity holding, monetary policy, flow of funds, financial crisis

JEL codes: E41, E5, G01, O11

1 Introduction

Effective monetary policy requires functional transmission channels. Signals of monetary policy in form of the statement of key interest rates should be transferred to the expectations and ultimately to the decisions of participants in financial market segments and real economy, which ultimately ensure price stability. Unconventional monetary policy (Smaghi, 2009) represents: "…an attempt to reduce the spreads between various forms of external finance, thereby affecting asset prices and the flow of funds in the economy. Moreover, since these measures aim to affect financing conditions, their design has to take into account the financial structure of the economy, in particular the structure of the flow of funds."

An essential part of monetary policy represents the monetary analysis, i.e. monitoring the evolution of money supply, as its changes may indicate the potential risks for the price stability. „The monetary analysis serves, in particular, as a means of cross-checking, from a medium to long-term perspective, the short to medium-term indications for monetary policy derived from the economic analysis."(ECB, 2011).

The approach based on flow of funds analysis brings high added value for monetary policy, as it connects the different sectors of the real economy to the financial sector, thus allows us to assess quality of mutual interactions. It is based on assessment of the financial assets and liabilities (both flows and stocks) while the result of their comparison in the form of net lending of one sector constitutes de facto net borrowing for another sector. This also applies to domestic economy in relation to the rest of the world. The positive balance between net acquisition of financial assets and net incurrence of financial liabilities in the form of net lending to domestic economy represents net borrowing to the rest of the world. At the same time, the major benefit of flow of funds analysis is its wide-scale use; it can be used not only for the monitoring of monetary imbalances at the level of individual sectors and the entire economy, assessing the level of financial intermediation, but also to analyze the effects of wealth as well as to evaluate the growth of public debt.

In this paper, the use of flow of funds analysis provides sufficient insight into the portfolio structure of individual economic entities, i.e. what is the balance between cash and other financial assets holding or what resources are used to fund the portfolio. Specifically, it is possible to assess the extent to which loans (foreign funds) or their own

assets in the form of other financial assets converted into money are used as a funding tool. In this way it is possible, therefore, to identify whether there is a credit shift (ratio FA/GDP) or portfolio shift present (ratio M3/FA). In addition to quantitative structure of liquidity, it is possible to assess its qualitative structure, and, ultimately, evaluate the impact of this structure on price stability.

Papers that deal with topic include Duc and Breton (2009), Bonci (2011), Castrén and Rancan (2013). The former one studies the evolution in the euro area for the period of 1997 – 2007 and states that"…the positive credit effect (with strong growth in loans to the private sector) was largely compensated by the negative portfolio shift effect, reflecting strong investment by euro area residents abroad… and between 2003 – 2007 money creation via MFI credit (mainly loans for house purchase) took a prominent role, whereas, since 2007 portfolio shifts into money have regained importance in line with increased uncertainty in financial market."

Bonci (2011) claims that households seek to generate savings (precautionary savings) due to the declining economic activity and rising unemployment while use loans from non-bank entities to meet their growing demand for consumption. Similarly, non-financial corporations, whose profits are falling and the cost of loans in times of high risk in the market are growing, take refuge in other than bank loans.

Castrén and Rancan (2013) in this respect argue that: "novel theoretical contributions are needed to facilitate better communication between financial networks and traditional macroeconomic models so as to create more complete tools for the analysis of financial shocks and financial structures in the macroeconomic environment."

The aim of this paper is, therefore, by analyzing the flow of funds to assess whether and to what extent there is portfolio or credit shift present in liquidity held by individual economic sectors in Slovakia and the Czech Republic during the current financial crisis and to identify potential risks to fulfillment of the objectives of the monetary policy of central banks.

2 Methodology and Data

Our analysis covers two economies, namely the Czech Republic and Slovakia in 2007 - 2014. Methodologically, we build on the flow of funds analysis. We use quarterly data on transactions, not stocks, as it is our intention to precisely analyze the changes, which occurred during the reporting period.

In the first step, we evaluate the performance of individual economic sectors in terms of the development of their net lender/borrower position. Consequently, the development of money stock by individual forms of money demand is evaluated.

Since the money stock (represented by the M3 monetary aggregate) is formed in the money-holding sector, in the next step we will analyze the share of money stock on their total financial assets. This allows us to assess whether and to what extent there is a movement in portfolio holdings of liquidity, i.e. whether and to what extent the sector prefers holding money in a more liquid form (in the form of M3) or in a form of other financial assets during the period analyzed.

Statistics on money stock in terms of the contribution of individual economic entities in money-holding sector is not publicly available. On the other hand, since the most important actors in the real economy are non-financial corporations and households, we will apply our analysis to these entities based on the fact that these two entities are the most involved in the creation of the money stock. Therefore we focus on the development and structure of their financial assets. Given the fact that it is our intention to assess whether there is a change in liquidity through a portfolio shift (conversion of assets with a lower degree of liquidity to more liquid assets) or through credit movement (new loans affect the level and structure of their financial assets), in the next step we will pay a special attention to the evolution of their financial liabilities with credit resources in

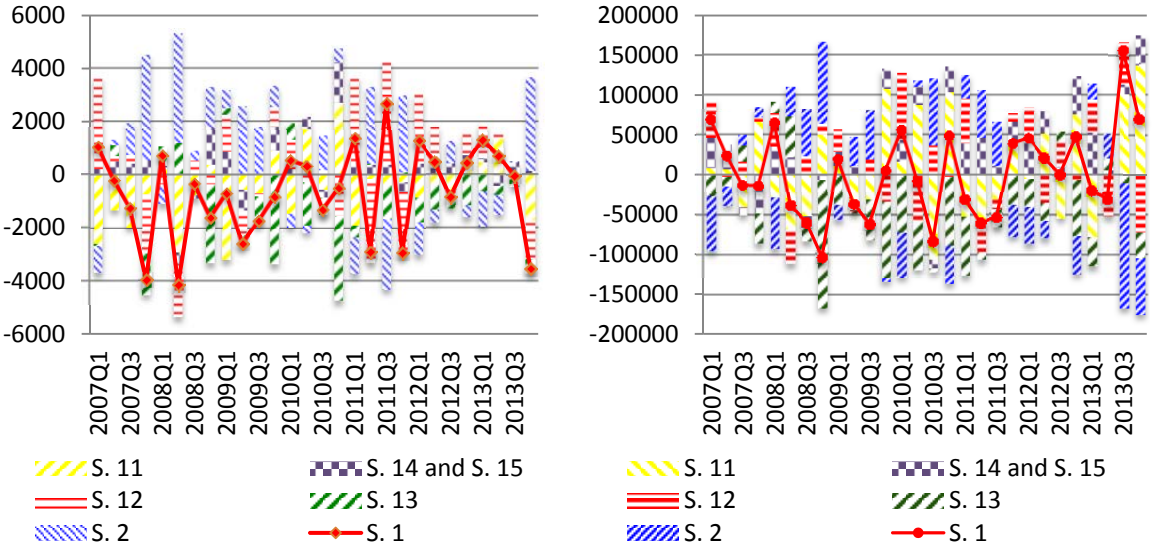
particular. The credit stock will be compared with the evolution of loans granted by monetary financial institutions to those entities.

Based on the above we will conclude to what extent the injection of liquidity to commercial banks affected the development of credit and ultimately the liquidity held by non-financial corporations and households and so whether monetary policy setting of central banks are adequate with respect to the desirable economic recovery.

3 Results and Discussion

Based on the results from operations of individual economic sectors (net lending/borrowing) it is possible to assess the state of monetary equilibrium in the economy, which is the starting point for accommodation of suitable conditions for future economic growth.

Figure 1 Net lending/borrowing of individual sectors in Slovakia in mil. EUR (left figure) and in the Czech Republic in mil. CZK (right figure)



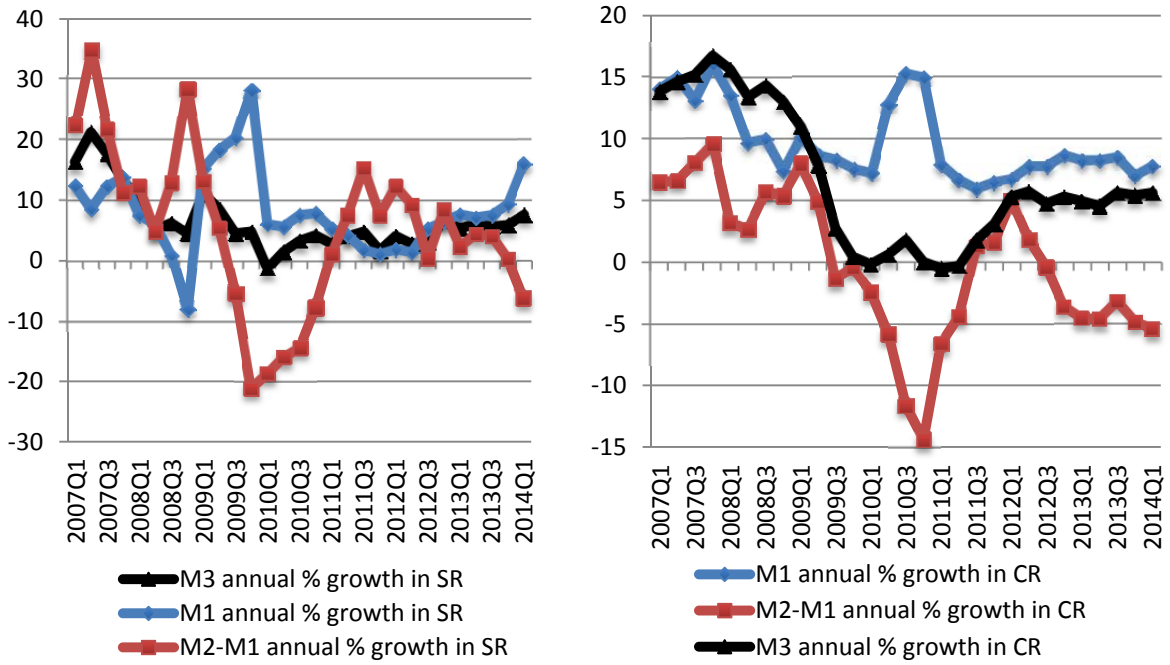
Source: own processing, data NBS, CNB (2014)

Slovakia as a whole has maintained a net debtor position during the period considered, which means that the rest of the world (S.2) has held a net creditor position. In terms of individual economic sectors, this particular development can be contributed to the non-financial institutions sector (S.11) and public sector (S.13). Positive fact is that both sectors have been successful in reducing their level of net borrowing in nominal terms. The position of the creditor has been held by the households sector for most of the time (S.14, S.15). The financial institutions sector has been switching between net creditor and debtor position on quarterly basis. Positively can be viewed that since 2010 the domestic economy has been increasingly (albeit briefly) getting into creditor position for the last year. However, the trend is on downward trajectory of the last year. For 4Q2013, the net borrowing is in amount of 3.5 bil. EUR.

In the case of the Czech economy, it is possible to talk about a similar development to some extent, i.e. domestic economy has operated mostly in debtor position, but during the 2012 and the second half of 2013 the economy switched to the creditor position. This was achieved thanks to a more active role of non-financial corporations sector that, compared to Slovakia, got into the position of the creditor for several times. Similarly positive development is present in the sector of households (net creditor), apart from the last two quarters of 2007. The public sector is a net debtor throughout the entire period. For the 4Q 2013, the Czech economy recorded net lending balance in the amount of 69.9 bil. CZK.

If there is growth in net creditor position of domestic economy, it transforms into decrease of indebtedness to foreign countries, i.e. its net financial assets are greater than its net financial liabilities. This evolution automatically translates into the development and structure of money stock. Money stock measured by the harmonized M3 monetary aggregate, which is output from the consolidated balance sheet of the banking sector, is not fully compatible with items of financial assets that are monitored under the ESA'95 system of financial accounts (inclusion of items according to the degree of liquidity, etc.). Therefore, our analysis is based on both data sources.

Figure 2 Development of the money stock (annual % rate of growth) in Slovakia (left figure) and in the Czech Republic (right figure)



Source: own processing, data NBS, CNB (2014)

Due to the unconventional monetary policy measures in the euro area (which also includes Slovakia) as well as in the Czech Republic, the substantial increase in the money stock has been expected. The increase in the money stock would certify that the financial infrastructure works, financial markets are stabilized and the recovery of real economy starts. However, the current money stock is growing only slowly, and economic growth, if present, is negligible. Problem of high unemployment resonates and central banks have to fight deflation.

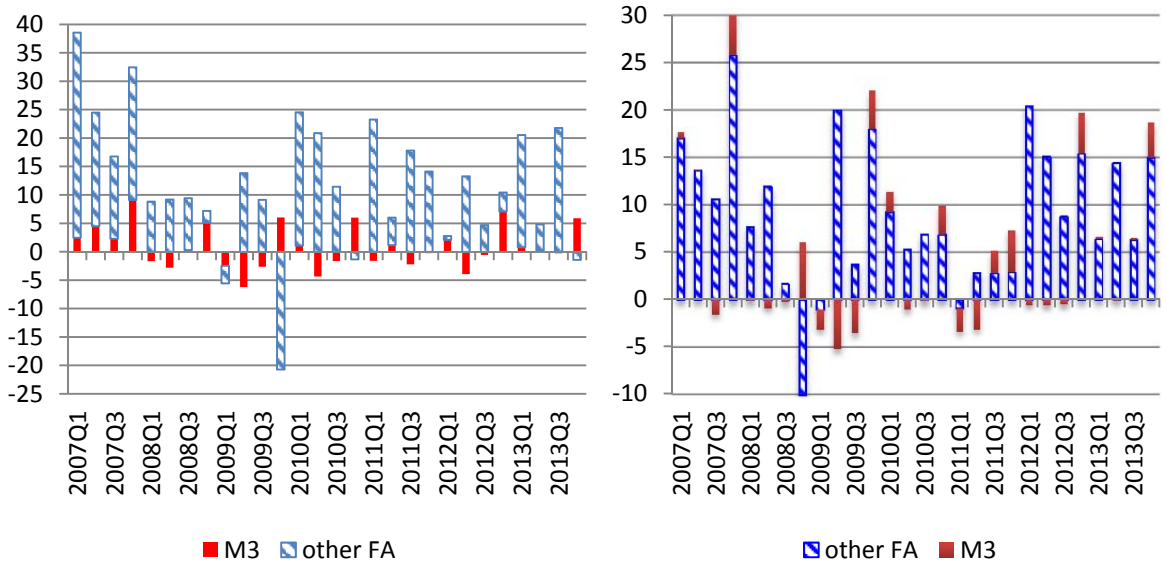
Evolution of the M3 money stock in both economies shows similar pattern in terms of its trend, only the fluctuations in the Slovak money stock were higher due to the conversion of the Slovak Koruna to the EUR. After the onset of the financial crisis, there was a decrease in growth rate in overall demand for money (M3), as well as in its individual components (transaction, precautionary and speculative demand). Slowdown in M3 growth culminated in Slovakia in early 2010, in the Czech Republic M3 growth rates reached zero even in 2011. Since this period, the money stock growth rate have been increasing (Slovakia has steeper growth rate) but only because of the transaction money demand. Demand for less liquid forms of money in both economies is declining. We can say that the development of the money stock in both economies is pro-growth, since the potential drop in less liquid money forms has been balanced by the increase in demand for more liquid forms.

Money stock is a liability in the consolidated balance sheet of the banking sector, on the other hand, in terms of money-holding sector, it is an asset. The money-holding sector

includes the following entities: non-financial corporations (S.11), other financial intermediaries (S.123), financial auxiliaries (S.124), insurance corporations and pension funds (S.125), local government (S. 1313), social security funds (S. 1314), households (S. 14) and non-profit institutions serving households (S. 15).

We start from the fact, that part of the financial assets of money-holding sector is liquid money in the form of the components of the money stock. Through changes in the structure of financial assets we are able to define whether the changes in liquidity arose as a result of the portfolio shift (share M3/FA), i.e. transfer from illiquid assets into more liquid forms (which are part of M3), or the credit shift (proportion of FA/GDP), i.e. increase in financial liabilities as the structure of financial assets improves through new loans from financial institutions or non-residents.

Figure 3 Shifts in financial assets of the money holding sector in Slovakia (left figure) and in the Czech Republic (right figure) as % of GDP



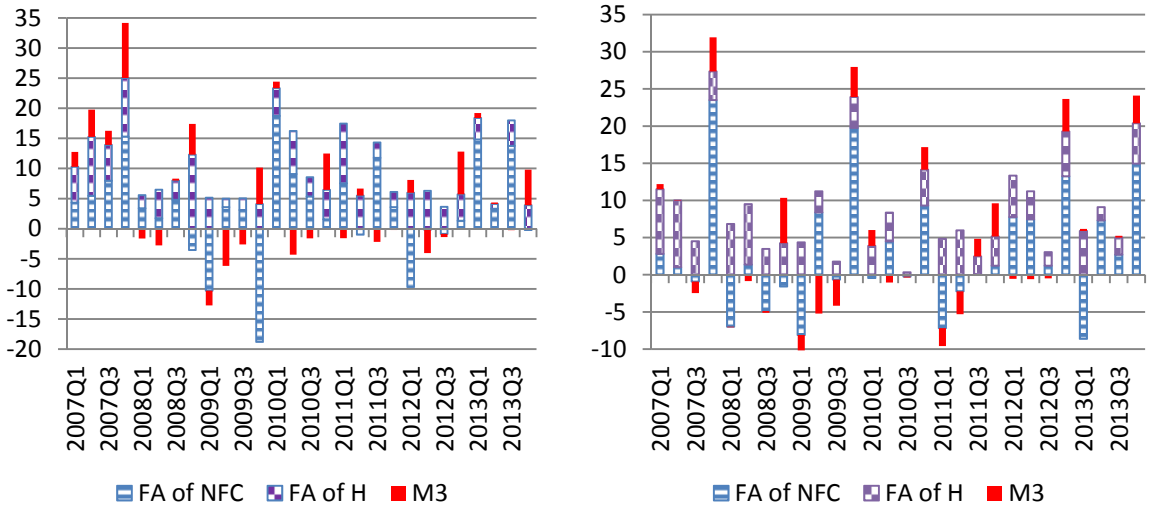
Source: own processing, data NBS, CNB (2014)

Figure 3 shows the evolution of financial assets (transactions) broken down to the money stock (transactions) and other financial assets (transactions) as % of GDP. In the case of Slovakia and the Czech Republic we can talk about credit shift in liquidity, i.e. transactions in other financial assets as % of GDP are positive but with decreasing tendency. The portfolio movements in liquidity occurred mostly in late 2009 (Slovakia) and or about a year earlier (Czech Republic), i.e. missing liquidity from loans was replaced by selling other financial assets in order to acquire the necessary liquidity.

Since the money-holding sector represents a non-homogenous group of entities and the substantial part of money stock is composed by non-financial corporations and households, in the following we draw our attention to these subjects. It is necessary to emphasize, however, that none of the central bank analyzed here does not provide statistics on the contribution of individual economic entities to the formation of the money stock in the required structure.

Serving as an example, we will analyze the development of their financial assets along with their financial liabilities, namely the volume of loans recorded in the system of financial accounts and in the balance sheet of the monetary financial institutions. This comparison is due to the fact that in the system of financial accounts it is not possible to identify which loans were granted by monetary financial institutions and which were created by lending between these entities or between residents and non-residents, for example.

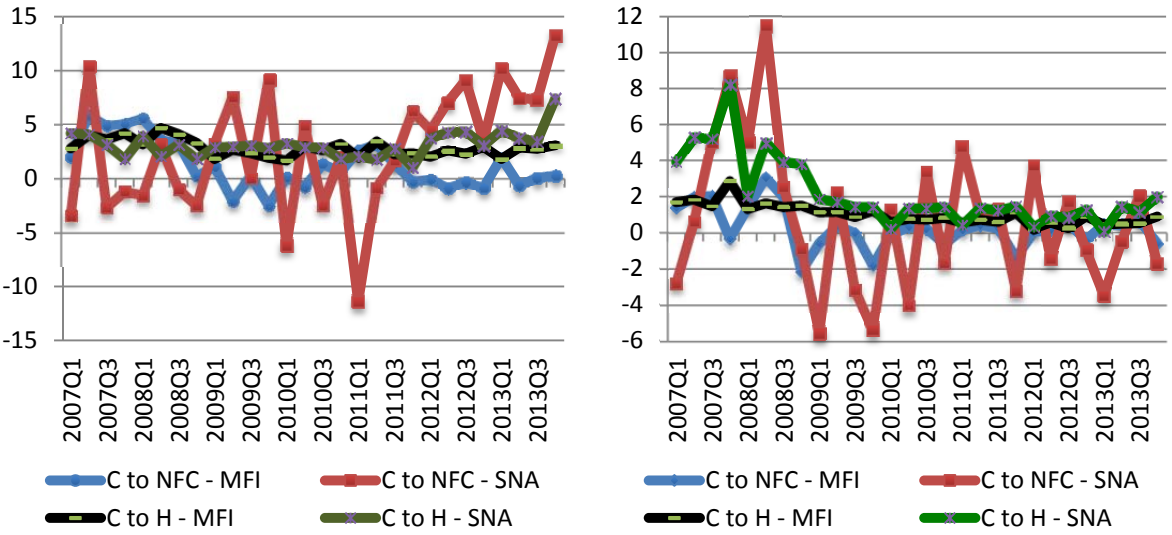
Figure 4 Credit and portfolio shift in the sector of non-financial institutions and households in Slovakia (left figure) and in the Czech Republic (right figure) as % of GDP



Source: own processing, data NBS, CNB (2014)

The sector of households in both economies is a conservative entity, i.e. share of other financial assets is relatively small to that form of liquidity, which enters into the structure of M3. Moreover, in both economies the household sector maintains position of the net lender. Despite some fluctuations in financial assets (transactions) there was no negative flow on this side of the balance. The development of household financial assets is related to the credit shift. On the other hand, the non-financial corporations sector in both economies got into a situation where the turnover of the financial assets had a negative value, so there was a portfolio shift present. This type of movement in liquidity occurred more frequently than in the whole money-holding sector.

Figure 5 Credit development in the sector of non-financial corporations and households in Slovakia (left figure) and in the Czech Republic (right figure) as % of GDP



Source: own processing, data NBS, CNB (2014)

Statistics from the financial accounts and the consolidated balance sheet of the banking sector for credit financing differs significantly in Slovakia and the Czech Republic, especially in the non-financial corporations sector. This observation can be explained by

the fact that data in the financial account statistics are not classified by individual creditors, i.e. the statistics includes loans from non-residents and other non-monetary financial and non-financial institutions.

With respect to that, we can observe that loans to households in Slovakia by monetary financial institutions decreased to approximately 2.5% of GDP compared to 2007, but since early 2011 the loans from other lenders have been on increasing trajectory. In case of the Czech Republic, this development is very similar in terms of its evolution, but in proportion to GDP the volume of loans to households is about a half (around 1% of GDP).

Regarding the situation of non-financial corporations sector in Slovakia, decrease in lending from monetary financial institutions was offset by loans from other lenders (especially since 2010). The same cannot be said in the case of non-financial corporations in the Czech Republic. The MFI lending activity stagnates and volume of foreign funds from other creditors declines, which corresponds to our initial finding that this sector turns out to be a net creditor in the last two quarter of 2013 (positive balance between financial assets and financial liabilities).

4 Conclusions

Increase in the money stock is, contrary to expectations, only gentle (around 5% of GDP) in both Slovak and Czech Republic. This increase is predominantly due to the growth in the transaction demand for money. The net financial position of individual economic sectors has somewhat improved over the last three years, but the development is not yet stable as these economies continue to maintain their net debtor position. The threat to the positive development is in fact the paradox of thrift that claims that if the individual sectors are striving to increase their savings ex ante this does not lead to higher savings for the economy as a whole but only to a reduction in GDP (Cour-Thimann and Winkler, 2013). Low interest rates in an environment of low inflation (in both Slovak and Czech Republic) narrow the room for maneuver for central banks in their goal of supporting the economic recovery.

The changes in liquidity in money-holding sector are induced by credit shifts in both economies. The same kind of movements occurs in the sector of non-financial corporations and in the sector of households. Certain risk can arise from the growth of loans of other creditors than domestic monetary financial institutions.

To overcome the economic growth stagnation the intensification of the process of stimulation of banking activities to real economy is desirable. On the other hand the increase of financial literacy of economic entities in usage of supplied financial tools is crucial.

Acknowledgments

This contribution is the result for the project implementation VEGA 1/0613/12 The intensity of the relationship between financial sector and real economy as a source of economic growth in Slovakia in the post-crisis period.

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Analysis of Differences of Current Liquidity Indicators across Sectors

Petra Kozáková

The College of Polytechnics Jihlava
Department of Economic Studies
Tolstého 16, 586 01 Jihlava, Czech Republic
E-mail: petra.kozakova@vspj.cz

Abstract: *This paper processes values from the database of the corporate data Albertina from which calculates the current liquidity indicator for companies representing individual sectors of the national economy in 2004 – 2011. The goal of the paper is to introduce the development of current liquidity in monitored period and sectors, to point to differences among represented sectors and especially to analyse differences in development of current liquidity. Current liquidity indicators point to dominant position of the sector of Agriculture, Forestry and Fishing and Water supply and Activities in waste management. On the contrary, the sector of Accommodation and Food service and activities appears as below-average. Development of monitored indicators in individual sectors also disproves guess of negative impact of the global crisis on the value of current liquidity. In most cases, development of indicators is more influenced by development (respectively by growth) of short-term current assets.*

Keywords: current liquidity, sector, crisis, analysis of differences

JEL codes: G3

1 Introduction

One of the major areas of financial management is the area of liquidity, which means ensuring of "the enterprise's ability to convert its assets to cash and use them to cover due debts in time, in required form and in the desired location". (Scholleová, 2012) Liquidity is a precondition for long-term existence of the company because the company must be able to meet its needs. Liquidity indicators measure the firm's ability to meet its current due debts from current assets. Current assets produce almost zero profit while they absorb a large part of enterprise resources itself. There is therefore a conflict of two opinions. On one hand there is the effort to maintain the lowest possible liquidity to avoid unnecessary absorbing of financial funds in assets that don´t generate profit. On the other hand there are tendencies that liquidity is as high as possible, which has a positive effect for creditors. (Kislingerová, 2010) It is necessary to find a compromise that ensures increasing the value of firm´s funds as well as meeting of debts.

It can be stated that in the context of the economic crisis and information about the decline in sales of enterprises, about the number of redundancies etc. we can not only expect declination of the competitiveness of companies across all business sectors but also decrease of their liquidity. (Felcman, 2011)

The aim of this paper is to introduce the development of current liquidity in represented sectors in the period 2004 – 2011, to point out the differences between the selected years and sectors and especially to analyze differences in the development of current liquidity and quantify the impact of changes in current assets and changes in short-term debts by using logarithmic method.

2 Methodology and Data

The source data file for analysis of the company's liquidity across sectors is based on the database of the business data – Albertina. In total, the basic data file includes 19,075 companies (each of them employ more than 20 employees), which is analyzed in the period 2004 – 2011. The table 1 shows the number of firms reporting results in a given year. On average the basic data file is represented approximately by 77 %; the structure

of the representation of the sectors, however, has not changed. The number of companies reporting results in individual years gradually increased and reached the highest representation in years 2007 – 2010, especially in 2009, in which 19,050 companies reported their results. Since 2010 the number of enterprises reporting data decreased and reached a significant decline in 2010 (14,370 firms stating their results). The table 1 also presents the representation of sectors in the basic sample in comparison with the representation of the number of registered units according to MIT (Ministry of industry and trade). E.g. the manufacturing sector is represented more, on the contrary sector of professional, scientific and technical activities less. Due to the insufficient number of companies represented in the sector O (Public administration and defence) only by 3 or 4 companies the further analysis of this sector is not indicated.

Table 1 Number of monitored companies by NACE classification in the period 2004 - 2011

NACE	Sector	Average number of companies	Repre-sentation of data file	Repre-sentation by MIT
A	**Agriculture, forestry and fishing**	764	5%	4%
B	**Mining and quarrying**	59	0%	0%
C	**Manufacturing**	5 295	35%	12%
D	**Electricity, gas, steam and air conditioning supply**	155	1%	0%
E	**Water supply; sewerage, waste management and remediation activities**	286	2%	0%
F	**Construction**	1 533	10%	13%
G	**Wholesale and retail trade; repair of motor vehicle and motorcycles**	2 731	18%	26%
H	**Transportation and storage**	753	5%	3%
I	**Accommodation and food service activities**	428	3%	5%
J	**Information and communication**	491	3%	2%
K	**Financial and insurance activities**	106	1%	1%
L	**Real estate activities**	267	2%	6%
M	**Professional, scientific and technical activities**	848	6%	13%
N	**Administrative and support service activities**	568	4%	2%
P	**Education**	178	1%	2%
Q	**Human health and social work activities**	306	2%	1%
R	**Arts, entertainment and recreation**	144	1%	2%
S	**Other services activities**	78	1%	7%
In total		14 993	100%	100%

Source: Own processing, www.mpo.cz

The analysis of liquidity did not proceed according to the methodology applied to determine MIT ratios of financial analysis. The indicators were calculated for each firm separately and subsequently further indicators have been derived for the representation of the sector as a whole. Descriptive characteristics as the arithmetic mean proved to be unsuitable because in all sectors there are extreme outliers and files are not symmetrically distributed, indicating the high value of standard deviations. Higher explanatory power has in this case the median value. Also, due to the high variability the MIT methodology was not used, because these extreme values are retained in the sum of the absolute parameters (needed to calculate the liquidity indicators). Each sector is

therefore characterized by the median of the total number of results in the sector and year.

Liquidity indicators shall detect the firm's ability to pay its current debt. The permanent solvency is one of the basic conditions of existence of all successful businesses. Although the indicators have certain shortcomings, they are considered an important indicator of the solvency of the company. First of all, changes for the worse or for the better condition raise questions for their causes. The stability of this indicator should become a priority for the company. (Růčková, 2008)

Indicator of current liquidity assumes covering the short-term debts from current assets, rather than long-term assets, see formula (1). Generally, a higher value means a better chance to maintain the solvency of the company. However it is not appropriate to consider a high value as a positive phenomenon under all circumstances. The company with high level of current liquidity (and it means together with high inventory/supply levels with long turnover, with many bad debts and with zero cash balance) could then be evaluated more favorably than those with a lower value of the indicator, but much more liquid asset structure. (Kislingerová, 2010)

$$Current\ liquidity = \frac{Current\ assets}{Short-term\ liabilities} \tag{1}$$

Differences in the development of current liquidity indicators in represented sectors are possible to analyze further by applications such as logarithmic method, which is based on the logarithm of the ratio of the index independent and dependent variables and the absolute change in the dependent variable, i.e. the current ratio, see formula (2) and (3). (Dluhošová, 2008)

$$Effect\ of\ current\ assetes = \frac{\ln I_{current\ assets}}{\ln I_{current\ liquidity}} * \Delta\ current\ liquidity \tag{2}$$

$$Effect\ of\ short-term\ liabilities = \frac{\ln I_{short-term\ liabilities}}{\ln I_{current\ liquidity}} * \Delta\ current\ liquidity \tag{3}$$

3 Results and Discussion

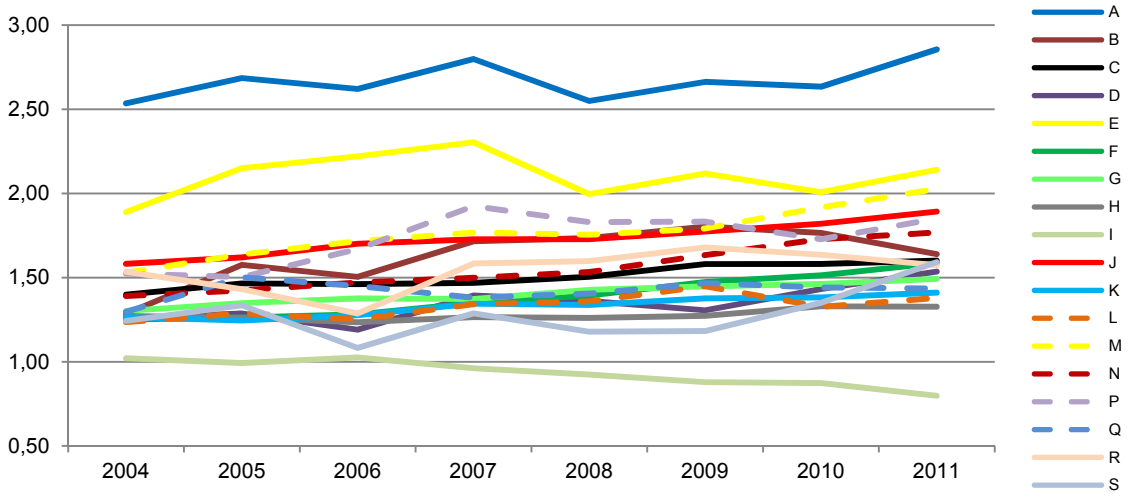
The resulting medians of liquidity indicators, determined for the individual represented sectors, show that values of current liquidity in some sectors are very similar as well as there are also sectors with very different values of current liquidity. Similarly, there are sectors that are characterized by higher or too low values compared with the values generally recommended. Comparison of the resulting values in the monitored period then points to the developing trend of current liquidity in companies sorted by sectors.

Current liquidity monitors in most sectors rather a growing trend throughout the period and it is very individual for individual sectors, see Figure 1. On the basis of the median of absolute changes in current liquidity it is possible to say that the growth of current liquidity is apparent in about half represented sectors in analyzed period. The most frequent decrease in the level of current liquidity we can see especially in the sectors of Arts, entertainment and recreation (R), Accommodation and Food Service Activities (I) and the Agriculture, forestry and fishing (A). Other cases of decrease of the current liquidity level have rather sporadic and random character.

The highest values of current liquidity throughout the period are reached in the sector of Agriculture, forestry and fishing (A). The level of liquidity even slightly exceeds the recommended range of 1.5 to 2.5. This high liquidity is caused especially by higher inventory as well as receivables, both in relation to lower level of short-term liabilities. Other sectors with higher levels of current liquidity include sectors of Water Supply (E), possibly Professional, Scientific and Technical Activities (M) or Education (P); current liquidity levels in companies of these sectors are within the recommended values. By contrast, the lowest and insufficient level of current liquidity reaches throughout the period sector Accommodation and Food Service Activities (I); it is unable to pay its short-

term debts from current assets and would be forced to sell long-term assets, excluding years 2004 and 2006.

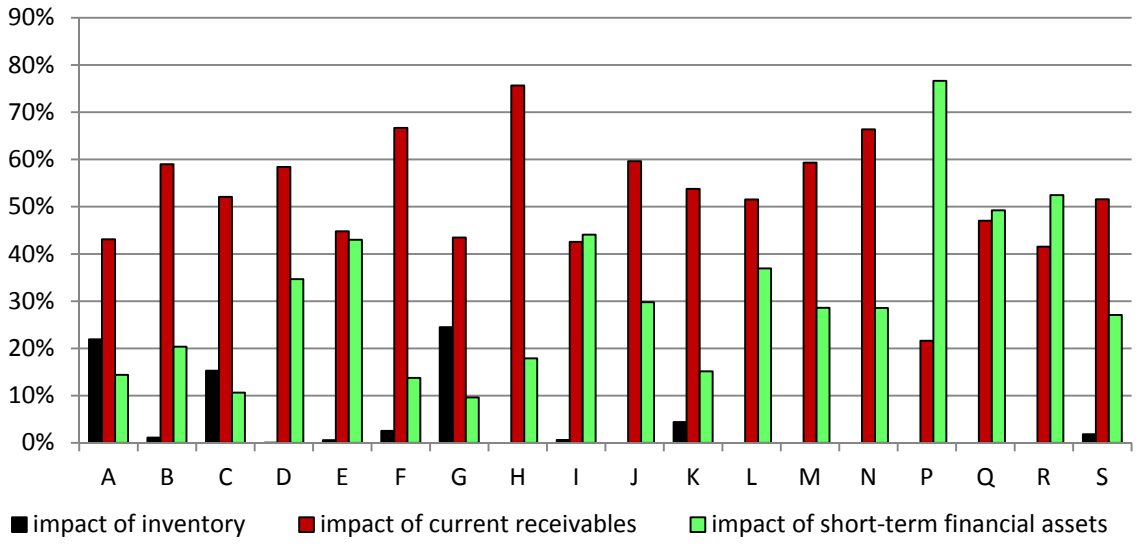
Figure 1 Current liquidity of monitored companies by NACE classification in the period 2004 – 2011



Source: Own processing

It is possible to estimate the biggest impact of the economic crisis in 2009. The decrease in current liquidity is evident especially in represented sector of Accommodation and Food Service Activities (I). It was caused by higher growth of short-term debts compared to almost zero change in the value of current assets. In 2011, when it came to the second wave of the crisis, liquidity decreased only very slightly in sectors of Mining and quarrying (B) and Arts, entertainment and recreation (R). Predominant growing trend of liquidity in 2009 can be explained by the higher increase of receivables in most cases. The impact of increase of receivables and financial assets has variable character in 2011. There is also a typical increase of inventory but only in the sector of Wholesale and retail trade (G) and Manufacturing (C) in 2009 and only in the sector of Agriculture, forestry and fishing (A) in 2011. Figure 2 represents more information about the impact of changes of individual current assets items on the overall change in current assets. This change is then reflected in the change of current liquidity.

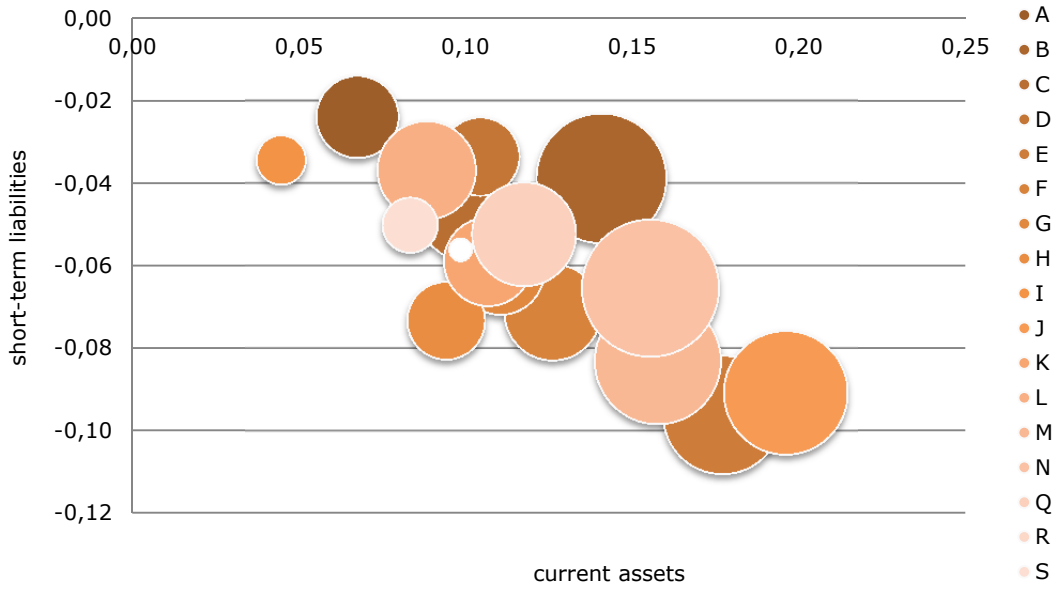
Figure 2 Average impact of changes in current assets items on change of current assets in observed companies by NACE classification



Source: Own processing

Change of concrete items of current assets and short-term liabilities has an impact on change of liquidity indicators. The average size of the changes in current liquidity in represented sectors in the selected period and the effect of these changes are shown in the bubble graph in Figure 3.

Figure 3 Average impact of component items on change of current liquidity in companies by NACE classification



Source: Own processing

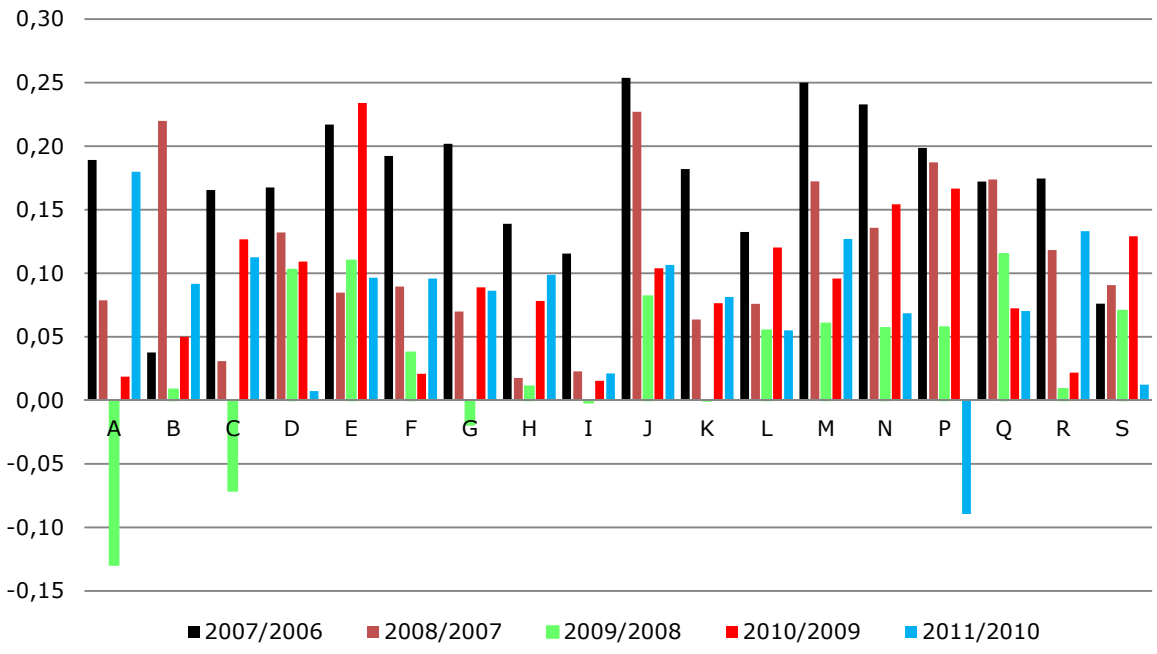
Bubble size indicates the size of the change of current liquidity. The figure 3 shows that the largest changes, being positive, occurred in the sector of Mining and quarrying (B), Water supply (E), Information and communication (J), Professional, Scientific and Technical Activities (M) and Administrative and Support Service Activities (N). Overall, change in current assets has a greater impact on the increase of the current liquidity mean. Positive change in short-term liabilities causes reduction of the current liquidity, but does not exceed the positive impact of change in current assets. That is why current liquidity shows a rising trend. The declining size of the bubble indicates just a stronger negative impact of short-term debts.

Results of the difference analysis by logarithmic method confirm the fact that most positive differences in current liquidity are caused by the prevailing positive changes in current assets of the negative effects of short-term debts (it means the growth of short-term debts). Figures 4 and 5 indicate the change of current liquidity which is caused by change of current assets and what change of current liquidity is caused by the change in short-term debts; both impact in years of 2007 – 2011 in represented sectors.

The largest differences in current assets, as well as in short-term debts, occurred especially in years 2007, 2008 and for particular sectors also in the year 2010. But this fact does not mean that significant differences in the current liquidity were present in these years; a significant positive impact of changes in current assets was eliminated by a significant increase in short-term debts. In contrast, in the above-mentioned periods of crisis in 2009 and 2011, the differences in the development of current assets and short-term debts have been smaller in comparison to other years. Especially the year 2009 shows interesting results, because in the sectors of Agriculture, forestry and fishing (A), Manufacturing (C) and partly Wholesale and retail trade (G) even the decrease of current assets occurred. The crisis had an impact on reducing inventories, receivables declined due to lower sales, etc. But at the same time there was also a decrease of short-term debts and not only in the sectors mentioned. The total impact on change of current liquidity was positive because the negative impact of change in current assets was

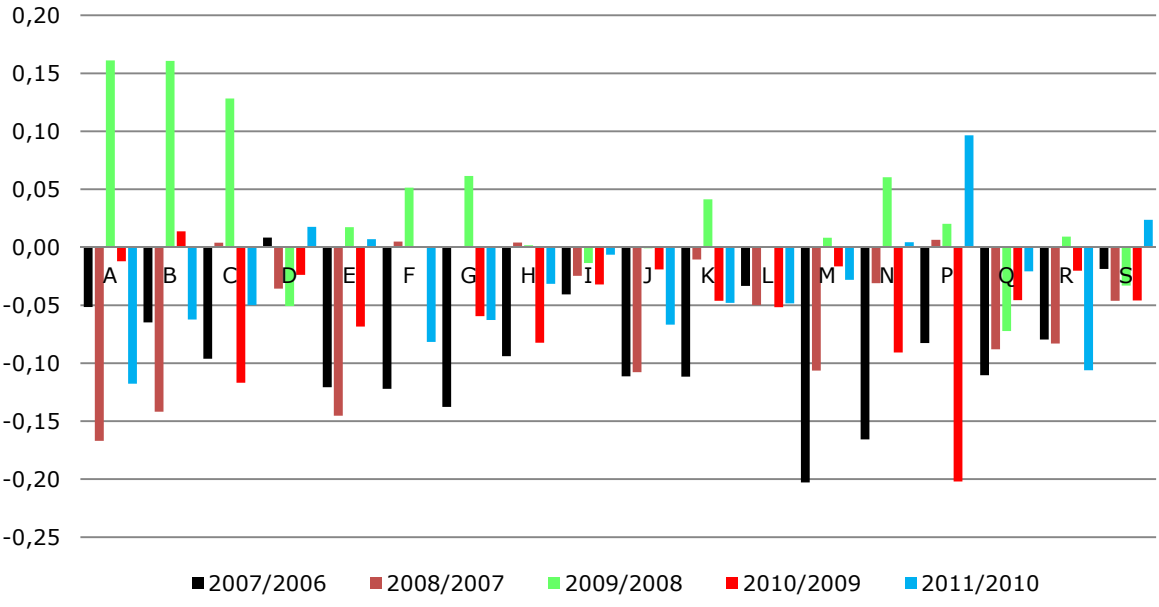
exceeded by the positive impact of decrease in short-term debts. A similar situation occurs in 2011 in the sector of Education (P).

Figure 4 Impact of change in current assets on current liquidity by NACE classification in the period 2007 – 2011



Source: Own processing

Figure 5 Impact of change in short-term liabilities on current liquidity by NACE classification in the period 2007 – 2011



Source: Own processing

4 Conclusions

This paper processes the values of the corporate data from the Albertina database and calculates the current liquidity indicator for companies representing different sectors of the national economy in the years 2004 – 2011. Each of the represented sectors is

characterized by a median level of liquidity and its differences in the companies in the years 2004 – 2011.

The resulting values of current liquidity point to the fact that the trend of this indicator is rather increasing. In the mid-represented sectors the increase of current liquidity throughout the whole period can be noticed. The most frequent current liquidity decrease, but not permanent, occurs in the sectors of Agriculture, forestry and fishing (A), Accommodation and food service activities (I) and Arts, entertainment and recreation (R). Current liquidity indicators point to a dominant position in the sector of Agriculture, forestry and fishing (A) and Water supply, sewerage, waste management and remediation activities (E). On the contrary, the sector of Accommodation and food service activities (I) appears as s substandard sector from the liquidity point of view. Values of indicators are lower than 1, short-term liabilities represent the prevailing negative contribution to the creation of liquidity.

Development of indicators in the represented sectors also does not confirm the negative impact of the global crisis on the value of current liquidity; except i.e. mentioned section of Accommodation and food service activities (I), where short-term debts grew faster compared to increase of current assets. In contrast with expectations, rather growth trend of current liquidity can be seen as expected due to the increase in receivables and also in financial assets in 2011. The sectors are characterized by different activities and thus by different inventory, which is confirmed by the results especially in the sectors of Agriculture, forestry and fishing (A), Manufacturing (C) and Wholesale and retail trade (G); in these sectors, the increase of current liquidity is influenced also by increase of inventory. In general, growth of short-term debts lagged behind the growth of current assets. That is why negative impact of changes in short-term debts did not exceed the positive effect of increase in current assets; this fact leads in most cases to increase the level of current liquidity. Only in the sectors of Agriculture, forestry and fishing (A), Manufacturing (C), Wholesale and retail trade (G) and Education (P) we can notice not only the decrease of current assets in the time of crisis, but also even more significant decrease in short-term debts. It means that development of current liquidity was positive in this time also in these sectors.

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Modern Products in Corporate Banking

Jan Krajíček

Masaryk University
Faculty Economics and Administration, Department of Finance
Lipová 41 a, 602 00 Brno, Czech Republic
E-mail: krajicek@econ.muni.cz

Abstract: *The paper is devoted to the Cash Management and the conditions of its creation. Banks to retain significant clients create new, sophisticated banking products that provide the bank at the cost of lower profits, if these clients to remain with her, she will make a profit through economies of scale and creating competition with other banks. Behind them are considered especially Cash Management, Cash Pooling and Cash Collection. These products are in the last years an important position. Cash Management, and also cash flow management is one of the crucial tasks which have to deal with every business entity in order to optimize its management.*

Keywords: bank, cash management, cash pooling, client, profit

JEL codes: G210, G290, G390, M14, M21

1 Introduction

Banks to retain significant clients to create new, sophisticated banking products that provide the bank at the cost of lower profits if those clients with the remaining will be bringing her profit on the basis of economies of scale and creating competition with other banks. Behind them are considered especially Cash Management and its most important part in terms of clients Cash Pooling. These products are in the last years an important position. Cash Management, and also cash flow management is one of the crucial tasks which have to deal with every business entity in order to optimize its management of cash flows (Cooper, 2004).

The aim of this paper is primarily clarify the basic principles of banking products and options they offer. First of all it is a Cash Management and its different products.

2 Methodologies

The paper is mainly used practical orientation methodology that allows direct work primarily on specific use in practice. It is followed by analysis for the evaluation of specific benefits for practice.

3 Precondition of Modern Products

One from Modern Banks products is Cash Management and its application in practice, based on knowledge of the theory of banking, individual banking products and services, which are built on the basis of products and services in the banking sector and which are in the Cash Management interconnected so as to form a complex banking product. Knowledge of the banking system and its products is necessary to understand the status and function of the Cash Management (Baritsch, 2008).

The most frequent objective of the banking business provides a profit, which is a prerequisite to ensure a stable position of the bank in the market. Bank should not go solely to maximize profits at the moment (in the short term). The amount of the profits should respect the long-term perspective banks, and its sustainable competitive ability (Krajíček, 2012).

In addition, we can direct a profit goals banking business defined as follows:

- Maximizing the market value of the bank or to achieve and maintain a significant position in the market of banking activities, these objectives are closely linked to the achievement of maximum profit.

- As possible targets include bank stability, certainty for the client and the owner of the bank, but here translates the original objective of the banking business - profit.

The primary goal (making a profit) for the bank is necessary to align with other objectives (profitability, growth of the bank and its reputation). A necessary condition for achieving these goals is the security and liquidity of banks. Among the objective of profit and security (stability), the bank must find a compromise.

The emergence of the euro area has enabled organizations to centralize a significant portion of their cash and liquidity, not just in one country but also internationally. This allows for better control and supervision of the treasury operations not only in banks, but also in companies. Internationally, it is necessary to take into account the existence of a number of currencies, different legal environment, regulatory framework, payment systems and tax laws in various countries. In particular, tax regulations are highly autonomous in each member country as harmonizing taxes not currently among the main agenda of the European Union. All this puts pressure on the knowledge of all the above-mentioned legal conditions and their applications. Companies (both large multinational) have, in many cases, the possibility of them yourself fully aligned. As a result, the pressure on the use of sophisticated banking systems and products (Krajíček, 2012).

Especially for large multinational holding company operating in several countries is not a solution themselves to coordinate cash flows simultaneously in all subsidiaries. Above them are banks offer the Cash Management determined, since in large quantities can achieve the necessary savings that their applications arise. All this does not only affect multinational organizations, but this issue affects all medium and especially large organizations that have accounts in multiple currencies, or are broken down into several separate entities with their own accounts and different financial needs.

4 Deciding Condition for Cash Management

The integration of economies is the most important trend of the past 20 - years. For example, we can consider the most significant integration within the European Union. Integration of states involved in it and in particular brought into the financial systems, a number of significant changes. On the basis of international cooperation in the European Union created a uniform concept for controlling the money supply and monetary policy. An important and unifying element, although with its introduction of certain risks related to the EUR, the new currency, the European Union has brought to international markets. With the advent of EUR, the number of currencies in which most trading is conducted in the European Union. Under conditions of economic stability, the decrease in the number of currencies and their innings is reflected in the declining volatility of exchange rates, interest rates of individual countries adapt to each other, and yields in European financial markets tend to convert to a similar value, although in many cases, significant differences due to significantly different rating of the euro area. It leads in particular to speed up and simplify the payment system. With the single currency (and the European Union as a whole) also comes increasing international competition.

This is all while under the influence of information technology development in the last two decades of the twentieth century, followed by the twenty-first century. Share information technology on economic development continues to grow. Emerging technological capabilities create new opportunities, influence the future development of the company multiplied by the workforce and the like. The possibilities for use are endless.

Impacts of information technology in the banking sector are extremely important. When the use of information technology decreases transaction, personnel and administrative costs. Information technology to automate repetitive stereotyped activities, which may be replaced with new creative challenges. Changes to geographical boundaries in the provision of services and, together with the increasing productivity, efficiency and

flexibility businesses. As technology increases and the Company's dependence on readily available information.

Ability of enterprises to adapt to technological progress affects their competitive position. The use of information technology in the banking sector is reflected not only in job offers, but depersonalization banking transactions. Information technology enables processing unimaginably large volumes of transactions, evaluation and processing of information in real time, their results are also new electronic distribution channels for banking services. The processing of such amounts of data in real time it was practically impossible without the expansion of information technology. Data processing systems, particularly in the late 80 's of the last century only allow the processing of data within a single branch of significant technological benefit is the possibility of greater diversification of products within a single financial institution - the client is thus preferable to use a complex product of the bank than to refer to themselves specialized institutions.

Information technology also increases the awareness of all stakeholders. Sophisticated clients especially from the business and financial sectors, who are aware of the potential income from investments, the constant shifting their resources into profitable positions and as such requires the bank offer products that make them such behavior.

Another trend that is significantly influenced by information technologies, the strengthening of competition associated with globalization. The development of globalization allows foreign businesses to enter the market. On the Czech market are present and non-bank institutions such as insurance companies, audit firms, card companies and others. Competition in the markets exacerbate information technologies that provide instant and virtually unearned price comparison and increase the transparency of the banking sector and not only there.

Growing competition is also placed on the bank management requirements of the company. Banks seek to decrease costs, accelerate processes, and improve the quality of their products. All this with the aim of achieving increased efficiency, profitability and efficiency of their activities. Banks to the decrease of costs has to focus primarily on processes - Manage the quality, reach their maximum possible simplification and automation.

Decisive options to satisfy the requirements of management and owners, is to innovate banking products and services that their innovation will bring a new client - even at the expense of other banks.

This trend is evident in the financial and banking sector in recent years. Banks and financial institutions are forced to spend more and more time creating and developing new products and services. The client can thus better meet their needs - has the option to choose a product, a service that better meets their needs. Further development of the banking sector is currently mainly associated with the pressure to provide new banking services. The primary pressure here has a new technology that brings huge opportunities, particularly in international banking. One of the uses of technological progress in the financial sector bank Cash Management is a critical component of Cash Pooling. On the client side bank leads to cost savings and on the banks is an important marketing tool. In banking client is a crucial determinant of all activities. Anticipating the needs and satisfaction of its forms are the basic way to ensure profits and their subordinate activities of banks. In the Czech Republic it is possible from late 90s to observe significant changes in the business. Especially in the early 90s with cash transactions took place rather in the form of cash , management was decentralized enterprises , businesses do not suffer a significant demand for banking products and their sophistication (it was a remnant of the socialist style of management and follow-cash transactions were mainly caused by lack of trust in payment behavior between entrepreneurs). Political changes have brought new opportunities and trends. To achieve profit growth of company value and market share increase was necessary to centralize management, standardize and automate. Enterprises have begun to require banking

products that would support their efforts and streamline their efforts on saving procedure.

With the development of information technologies to accelerate information flows. The business sector has had to adapt to demands for speed, and therefore to require a bank electronic banking programs to automate and standardize the elements of the management company (e.g. standardization of reporting). The crucial change, however, the requirements for cooperation in the management of liquidity. Special attention is paid to internal financing and results on the central and automation efforts in this area has become one of the major products of Cash Pooling . Emphasis was also placed on effective planning cash flow and working capital. (Dvořák, 2005)

As a result of efforts to rationalize the management of the "Centralized service centers" It is the center that the company selects the banks offer. These centers are then centralized certain functions necessary to run a business - payroll, payments, etc. Bank, these centers equips products that streamline the conduct of operations.

A significant result of all the above requirements for effective management of the Cash Management. Definition of Cash Management is currently not uniformly given and, as already mentioned, Cash Management can be loosely defined as:

- Control the amount of disposable money in the right place at the right time and in the required time.
- Cash Management refers to the liquidity of the company and includes decisions about the management of cash flows in its planning and monitoring.
- Activities that are directly or indirectly aligned with the financial potential of the company.
- A set of measures and solutions resulting from short-term forecasting surpluses and deficits.

Cash expression is mainly used for solving complex business cash, bank balances, stocks of foreign currency, checks and other cash holdings is always influenced by an infinite number of motives that lead to holding cash. The theory provides at least three basic categories of these themes:

- Transaction.
- Security.
- Speculative (investments).

5 Products Involved in Cash Management

Cash Management is essentially the most part, a combination of traditional banking products. An important innovation is considered to be part of it and that is Cash Pooling. An important role also have service centers (or a shareholder service centers , which banks offer to their possibilities of other services - accounting, etc.), the use of banks offering as part of the Cash Management. This all leads to the conclusion that through the cross- linking and engaging traditional banking products to the final product offered to customers, Cash Management is to be considered as a sophisticated banking products. Within the Cash Management Bank offers:

- Maintenance of current accounts in CZK and local payments, cross-border and foreign.
- Maintenance of current accounts in foreign currency and cross-border payments and foreign.
- Cash transactions in the domestic currency and foreign currencies.
- Treasury operations - term deposits, savings accounts and savings deposits.
- Foreign exchange transactions.
- Operating loans.
- Investment loans.
- Cash Pooling- Debit cards.
- Payment by credit card.

- Management of employee accounts.
- The collection of cash (especially for companies).
- Use of service centers.

Deserves attention in addition to the Cash Pooling, is in practice already well known especially Centralized service centers, which represent the latest product offered Cash Management.

It is a service center, which bring additional efficiency especially corporate clients with international networks. The objective is to centralize the processing of certain items, similar to all organizational units of the company and achieve economies of scale. There are two basic methods of birth:

- Centralized service centers will establish the company itself and the bank has the role of advisor. The main task of the bank in this case, is to offer equipment required payment instruments and other banking products to its activity could be a hassle to simply harmonizing Company's operations.
- The initiator of the banks offer. This offer includes services as business partner to banks, and the banks themselves or their affiliated companies. Outsourcing certain services contributes to the general trend of automation of management processes. Automation brings to companies primarily time and money savings and human capital. By automating acquires treasury department (not only) of multinational companies greater visibility into processes, thus facilitating better control and contribute to the simplification process .

6 Meaning of Cash Management for Banks and Corporate sector

In relation to bank Cash Management are reflected two opposing tendencies. On the one hand banks are aware that they must offer their top clients from "blue chips" (designation for the best bank clients) the most interesting and innovative banking products and services. On the other hand, are aware that these offers reduced profitability from these clients. It is therefore in principle also a marketing strategy aimed at gaining and keeping clients - especially strategically important clients. Banks thus incurred costs perceive as the cost of retaining customers in an increasingly competitive and in order to achieve economies of scale. At the same time it is crucial for banks and a significant interest in maintaining the quality of clients and acquires new ones. In particular, clients that are linked to other clients of the bank and its potential clients.

The crucial practical conclusion from the survey in the business sector is nevertheless follows:

- If companies decide applications for Cash Management and Cash Pooling their application brings them savings.
- Cash Management Bank offered to some degree, regardless of company size.
- Awareness of the Cash Management and Cash pooling is in principle independent of the size of the company.
- Crucial for the realization of particular Cash pooling is dependent both large and small businesses to offer banks.

7 Conclusions

New banking products, especially Cash Management, mainly are the result:

- The pressure of large banks and decisive bank clients and their advisors in particular the use and creation of new and more sophisticated products that bring them cost savings.
- Marketing strategies of banks, which mainly focus on acquiring market and the needs of large and multinational clients who have them at low margins bring huge profits due to the low cost of their operation (on their operation is needed much less than the bank employees to achieve comparable volumes and profits for

smaller clients). This implies the need to offer these services to clients that are appealing to them.

- Deems it crucial question which direction will the banking Product A further develop their work. The question is whether there is room for the creation of other products that will benefit the customers of banks, or only the products that will be beneficial for banks.
- Centralized service centers are new banking products that banks can acquire new corporate clients.

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Notes to the Methods of the Medieval Numismatics

Tomáš Krejčík, Petr Valouch

Masaryk University
Faculty of Economics and Administration, Department of Finance
Lipová 41a, 602 00 Brno, Czech Republic
E-mail: krejcik@econ.muni.cz, valouch@econ.muni.cz

Abstract: *The paper focuses on the assessment of the problems and the usual methods of medieval numismatics (analysis of coin hoards, analysis of coin dies, style criticism and monetary geography). Furthermore, short attention is dedicated to the position within the medieval numismatics, especially in relation to other auxiliary historical sciences. The relationship between numismatics and economic history as a possible starting point for further interdisciplinary study is examined in the final part of the paper.*

Keywords: numismatics, money, Middle Ages, methods

JEL codes: N01

1 Introduction

Money accompanies the human society in various forms for thousands of years, therefore the numismatics can be divided based on chronological aspects (into ancient, medieval numismatics and numismatics of the modern period) or cultural and civilization periods. (Grierson, 1991)

Nowadays, the numismatics is placed among auxiliary historical sciences and in light of that its basic task is the analysis of numismatic sources (Hlaváček and Kašpar and Nový, 1988). It has gradually expanded its resource base and multiplied its working methods (Nohejlová-Prátová, 1956).

Its development was, however, complicated. At first, the numismatics was rather a collecting activity and acquired a character of a scientific discipline having its stable place in the complex of the historical sciences only in the course of the 18th and 19th centuries (Nohejlová-Prátová, 1984).

The numismatics has no specific and universally applicable numismatic methodology (Kluge, 1997) and its methodology is generally historical. It often borrows practices from other disciplines as mentioned in another part of our contribution. Here, those sciences are mentioned that are in respect of their content very close to numismatics, epigraphics - a science of inscriptions and historical metrology within which we can define the mint metrology (Nový, 1988, p. 382 etc.).

Important methods of medieval numismatics on which our present contribution is focused are the assessment of the coin hoards, coin dies, style criticism and monetary geography.

2 Methodology

Now we will deal with the individual methods. The assessment of the coin hoards stands at the forefront of the numismatic work. The first step is the processing and description of found coins that includes covering the situation of the finding and coin preservation.

The coin hoards can be structurally assessed according to the following three factors. 1. The regional structure, it is represented by coins in the finding according to their place of origin in the mints. 2. The time classification of the individual coins in the finding.

3. Based on the composition of nominal values represented, which helps to identify the value of the finding.

Ad 1. The regional structure gives a picture of the spatial placement of the mints (countries) represented in the finding. This is vital for further assessment whether the

finding belonged to the regional or supraregional exchange. It helps us to pronounce the assumptions about the foreign currencies penetrating or about bans on coin imports, etc., in certain periods.

Ad 2. While determining the time horizon especially the youngest coin is observed as it determines terminus ante datem which is the period after which the finding could have been hidden. The assessing of the coin may not be simple taking into consideration that most of the medieval coins do not carry the year in which the coin was minted. In this case, we must rely on the results of relative chronologies of the relevant mint production. The other equally important part of the time analysis is defining the time interval that determines the origin of most of the coins (called body of the hoard). The oldest and the youngest coins in the finding are mostly rare pieces, whereas the majority of the coins come from a shorter period. This period may, however, be as long as several years or several decades. Similar analysis can recognise hoards that had been stored for a long time by the owner, sometimes even over one or two generations. (Němečková and Sejbal, 2006)

Ad 3. Nominal value representation. The coin hoard can contain hundreds of various nominal values but the findings with thousands of coins of one nominal value prevail in the Prague groschen period - the Prague groschen (even if coming from periods of several rulers). The denomination composition lets us learn with certain probability to which social or professional circle the original owner of the discovered coins belonged. Some findings contain unminted silver and fractional silver, both being the components that can be quite crucial to determine the character of the finding (Němečková, 2008).

Naturally, these basic aspects are to be combined and completed by further data. The researcher's effort is definitely to map the circumstances that led to storing of the hoard in most complex manner. From this viewpoint, we can divide the findings into:

A. Treasures that originated by a conscious activity to store valuable coins. Then we can expect a higher percentage of gold or coarse silver coins. The stored coins can originate from a wider territory and a longer time span. In such cases we can have – if we gain the additional data from other sources – a real ancestral treasure before us that had been gradually refilled over a longer period of time. The extent of the treasure varies greatly in these cases. From a purely economic point of view, these are the coins that were withdrawn from the circulation to serve as a reserve or prepared for greater investments.
B. Randomly concealed cash in the current situation in which the owner of the treasure found him/herself. A characteristic feature for this group of findings is usually a smaller overall value and a representation of a larger amount of denominations from the smallest coins to the golden ones. We assume that the owner did not have the time or interest to get rid of the less valuable coins, which they needed in everyday exchange. Assessing of these findings usually offers more conclusions but usually these findings reveal the immediate cash of the person who hid the treasure.
C. Findings of individual coins. With this name the numismatic literature refers to the findings of 1–5 pieces of coins. It can be one ducat or one penny, the nominal composition does not give much evidence. These coins are often called randomly lost coins. Their storing was not an intention as it can be rather attributed to the absent-mindedness of the owner. These findings can help determine the course of business trips in the relevant territory. Should such coins be discovered in a medieval town, they can spatially define the medieval marketplace (that is understood not only spatially but also as a place where specific legal laws and practices were applied). The individual coins are also found in in the waste pits of the medieval cities, where they were misplaced together with other rubbish or because they lost their validity.

When analyzing the coin dies, we proceed from the known fact that the majority of the medieval coins were stamped by two dies, the upper and the lower one (that was firmly anchored). One-sided coins have been formed by one die. While minting the coins,

stable pairs have not always been used - the minter had a few upper dies at their disposal and they could change them based on their wear. In this way, any pair of dies could be then used together. At the same time, the dies wore off in a different pace, they were damaged and repaired during the working process. Large amounts of used pairs of dies thus arose. Their determination and the determination of their amount brings interesting knowledge about the individual issues when there is a substantial number of coins preserved and at the same time it can help to determine the relative chronology within one coin type.

The analysis of coin dies also brings the knowledge about the counterfeits and imitations of medieval coins. Moreover, the analysis can provide more precise knowledge of the work organisation in the different mints.

Some researchers today consider the analysis of dies to be a method that will be increasingly applied in the future and will reveal more facts. The method is, however, dependent on the latest working practices and technical possibilities. This method has been implemented since the end of the 19th century and the last century, when the photography has reached the needed quality but the result has been limited by the subjective researcher's ability to assess and remember identical dies. At present, we can expect a considerable step forward if we manage the detailed scan of coins and there will be software that can bring the process of coin assessment to a new level. We can also use advanced microscopes.

The analysis of coin stamps has its limits. It depends greatly on the experience of the researcher to eliminate the slight deviations incurred during the minting process that were not caused by different dies. Small pfennig and heller mintage from the 14th and the 15th centuries can generally not be investigated in this way.

The opinions vary when defining the amount of the coins that a researcher should have at their disposal to give general validity to the conclusions about the number of the dies or pairs of dies. Each new finding can disrupt or completely cancel such conclusion. Also the collection and documentation of coins of one type, which are often distributed in numerous museums in several countries, is time and financially demanding. For example, when studying more than two hundred types of Moravian denars of Moravian appointed princes from the 11th–12th centuries, it was possible to analyse the stamps only of ten types whereas in one case the number of coins analyzed was larger than one hundred. (Krejčík, 1993)

Even a formula has been defined in the literature to estimate the total number of the coin stamps of coins of one type or one series.

$$D = n \times d/(n-d1) \quad (1)$$

Where D is the number of the original dies, n is the number of the coins researched, d is the number of the coin stamps found and d1 is the number of dies documented by only one discovered coin. (Kluge, p. 34)

Monetary geography, or spatial definition of the specific coin or specific type of coins circulation, is mainly based on the combination of the evidence of the findings and research of written sources. Medieval coins knew no boundaries and the pieces of gold or silver travelled throughout Europe according to the traders' and other users' interests. On the one hand, these were mainly valuable gold and silver coins. On the other hand, even a small coin could be surprisingly distributed if the specific nominal value complemented the specific type in the currency. The lamentations of the poor concerning the lack of small coinage were so influential that the state did not check this segment of the currency much. Although we know a number of bans on worthless coins, the findings prove that these bans were not very efficient. Names of coins and coin units used in a wide range of sources of narrative as well as official character, together with the analysis of the findings, help determine the territories, where the specific type of the coin or currency was used. Examples are the evidential books of Moravian towns providing ample evidence that allows us to know the territorial distribution of the coins that were

minted in the specific towns. The disadvantage is the force of habit concerning the names of the coins and the fact that we are not always able to reliably assign the coin names in the sources with the nominal values we know from the findings. In the literature we can, however, observe that these practices are getting more precise and the researchers can base their research on increasingly more comprehensive data sets.

The analysis of the coin style is a fairly widespread method but not well defined in the literature. The literature often mentions the coin factory and an experienced researcher can define the probable geographical origin or time relevance based on the character of the coin. An example of a prevailing uncertainty can be the mintages from the 13th century, which are sometimes attributed to Moravia or Silesia. The critical analysis of the literature leads us to the conclusion that the results of such a style analysis can be very different. With certain simplification this procedure can be compared with medieval codicology or diplomacy in which the researcher determines the anonymous scribe or the place of the origin of the manuscript based on the preserved piece of writing. In comparison to them, the numismatist has much less comparative material. In the absence of other sources the numismatics must do, however, with these conclusions; but it is obvious that they are very subjective in nature. However, a medievalist cannot usually select the sources.

The iconographic analysis is based on the style criticism, i.e. the comparison of themes, pictures on medieval coins and the related perception of the coin image. Here, we must distinguish two aspects. One aspect connects the numismatics with the history of arts and strives to understand the selection of the scenes on the medieval coins. This issue should be pursued elsewhere as it would go beyond the scope of our contribution. Therefore, we can only briefly mention that medieval coins were to demonstrate the basic principles of the medieval world. The coins demonstrated the positive qualities of the ruler and his tasks in the management of the state (Krejčík 1978, 1984).The coins were correctly referred to as "the massmedia" (Krejčík, 1979).

On the other hand, the coin issuers sometimes preferred another significance of the coin picture: they tried to imitate a successful coin, popular in a greater territory. Then the coin illustration does not bring much to the knowledge of his ideas but rather suggests what type of a coin was popular and appreciated in the pragmatic business. It implies that the iconographic connotations cannot contribute much to the dating and territorial origin of the coins of certain type. That is why some researchers do not include iconography in the list of analysis of medieval coins.

Researchers' views also differ a lot in the field of utilization of coin material analysis. The literature shows how optimistic opinions on the chemical and microchemical coin analyses have gradually been replaced with more cautious or even sceptical attitude. There are no doubts that the chemical methods of various bases have undergone a considerable expansion and have been used in various fields. The numismatics welcomed the possibility that there are methods available that damage just a small part of the researched coin. However, scepticism appears that the gained results carry information but only about the insignificant place on the coin. We have no precise knowledge about the homogeneity of the alloys from which the coins were minted. At the same time, we have to take into account the fact that the treatment of the coin surface was a part of the working method in the groschen period; therefore, the content of copper was reduced in the upper layer of the coin. We know nothing about the inside of the coin. Another source of scepticism is the knowledge that we usually know just very little about how the chemical composition of the coin was influenced by the environment where the found coins had been stored for centuries. It is certainly manifested in a coin that was buried in the forest thicket or a coin that ended up in the urban waste pit. While addressing these issues, the numismatics can use the knowledge and conclusions of the medieval archaeology. It is therefore evident that these analyses will be used in the numismatics even in the future and that the interpretation of the results thus obtained will be decisive.

The statistical methods became the weapons of the numismatist already in the 19th century. The numismatics mainly uses them for the analysis of the coin hoards and its advantages are indisputable. The benefits brought by the present computer technologies, which enable fast and reliable processing of large data sets, are undisputable and provide new knowledge. However, they lay higher demands on the accuracy of the input data, which may be quite difficult when describing the findings from the 19th century.

On the other hand, the numismatics has freed itself from the initial optimism of statistical assessments of the coin weight and size. The modern studies work with finer statistical procedures (Grossmannová and Štefan 2005), (Štefan, 1995). It is generally valid for the Middle Ages, perhaps with the exception of gold coins, that a coin was produced in the mint without any respect of the weight of the individual coins. We talk about the *al marco* production, i.e. the weight of the coins was checked within the coin units (pounds, hryvnias, etc.) Such a method of production brought significant deviations as to the weight of the individual denars and pfennigs. Therefore, when doing metrological investigations it is needed to use a median and standard deviations rather than the average weight. Generally, in the course of time the weight of specific coin types rather decreased. The example could be the Prague groschen. Those minted in 1300 contained 3.51 to 3.59 gr of silver, whereas the Prague groschen minted during the reign of Ludwig Jagellon weighed only 2.6–2.8 gr with fineness of 0.437 (Nový, p. 432) (Vorel, 2004). The state, the town or the traders on long journeys who did not count the coins but weighed them instead were affected only to a small extent. On the contrary, the people who were in touch with the coins only within a limited extent of few pieces or at maximum of hundreds of pieces and were involved only in a small everyday exchange were affected by the practices of the majority of medieval mints largely.

3 Results

For a deeper understanding of the methods of medieval numismatics it is necessary to mention its relation to other auxiliary historical sciences out of which we have mentioned the epigraphy and historical metrology. We have already dealt with some relevant questions when we showed the potential of the closer cooperation with the history of art and heraldry (Krejčík 1984). The numismatics can draw from the knowledge of diplomacy or the historical chronology and to a certain extent also from genealogy (Hlaváček and Kašpar and Nový, 1988).

For our meeting today it is naturally important to mention the relation of the numismatics to the economic and social history. The numismatics is sometimes perceived as a science on the border of historiography and economic sciences. The starting point of our considerations is the monetary economic concept of the numismatics as it started to form itself in the works of the German and Austrian numismatists (Luschin, 1912, 1926) (Loehr 1947), which were promoted and in studies verified by Gustav Skalský (Skalský 1931) already before World War II. After 1945 this direction was followed by Emanuela Nohejlová-Prátová (Nohejlová-Prátová, 1986) and Jiří Sejbal (Sejbal, 1997) and the circle of the like-minded researchers expanded. Even the Czech scientific community acknowledged the importance of the coin findings to learn about the function of the currency in the past. In the historical context of the development of historiography, the implementation of the opinions of K. Marx and his followers after World War II certainly played its role and led to a close connection of views on the development of medieval currency with the views of the Czechoslovak economists and experts in the field of economic history (Nohejlová-Prátová, 1956).

One of the first manifestations of this conception of money history was the extension of the scope of the discipline - in addition to coins also other types of exchange means started to be studied. In particular, the knowledge of banknotes underwent a great expansion in the last decades. However, in our contribution we remain in the medieval period.

An essential part of the study of the medieval coinage was the use of the results of the history of law, especially the mining law but also studies of the regulations on the coin

protection, coin counterfeiting prohibition and bans of worthless coins. The works of Jaroslav Pošvář in the 1960's and the 1970's were of a pioneering character and had the advantage of the deep knowledge of medieval written sources. (Pošvář, 1977) For the domestic numismatics it also meant deepening of the knowledge of the general legal issues that influenced the development of the medieval coinage (Grúň, 2009, p.99, etc.). Last but not least, the investigation of the theoretical ideas of usury and its concrete practical forms in the Middle Ages is still important (Urfus, 1975).

Currently, one of the key questions of the study of the medieval numismatics is the clarification of the general concept of the understanding of the medieval economic relationships (Grossmannová nad Krejčík, 2006-2007). This concept has brought many positive results particularly in clarifying the role of gold and silver in the medieval long-distance trade. The theory of value has contributed to the knowledge of the economic profitability of the medieval mints. (Spuffort)

This research line has undoubtedly its justification but it is apparently not the only possible view on the importance of money in the Middle Ages.

We cannot omit the fact that the other line of researchers, especially those in France, have based their theories on the conclusion drawn by Henri Pirrene. His hypotheses were in detail elaborated also by Jacques le Goff, who came to somewhat different conception of the function of money in the Middle Ages (Le Goff, 2012). His starting point was the concept of money as formulated by the medieval theologians and that reached its climax in The Summa by St. Thomas Aquinas. These principles were developed, besides other theologians, by Nicole Oresmus (1320–1382) in the 14th century (Nicole von Oresme, 1999) and influenced the coin practice in France of that time. His greatest contribution can be found in the rejection of currency depreciation by the mint masters themselves (Koderová and Sojka and Havel, 2008). The advantage of this concept is a closer understanding of the medieval man's mentality.

A properly managed medieval coinage is in this respect of the research understood as the service of the sovereign (Antonín 2013); the purpose of coinage was not profit but fulfilling the God's intention. According to these views, economic ideas created by the capitalism cannot be transferred in into the Middle Ages anachronically. The reasons for this negation can be found in recognized economic categories (lack of precious metals, great differences in the economic development in the diverse parts of Europe, a randomness of business contacts, political and religious conflicts) (Krejčík 2010). On the one hand, theological treatises continued to depict money as something suspicious, but the clerical authorities often contributed to the justification of those who manipulated with money (financiers, exchangers, usurers), of course with some condition. According to these opinions, the Middle Ages could not be the predecessor of capitalism. Money and economic power did not free themselves from the dominance of the universal ideological system for the entire Middle Ages. In the understanding of the medieval people the money, profit and wealth remained rather a moral than an economic category. Money was seen as a means not as the sense of human endeavour. It is very nicely captured in one ancient quote corresponding to the medieval ideas:

From the earth we mine the sources of our future troubles.
First, the deadly iron and then the gold,
even more deadly. (Ovidius, Metamorphoses I, 140-142)

4 Conclusions

The presented contribution might indicate selected issues that are dealt with within the scope of medieval numismatics in case it seeks to further deepen its research. Perhaps we can conclude that further study of these two opinions that, as we implied at the beginning, need to be examined by the analysis of medieval written and material sources. If it respects the working methods out of which we have mentioned only the basic ones, this approach can contribute i to the deeper knowledge of the Middle Ages and the role of money in this period of European past.

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Mergers and Acquisitions in the Selected Countries of Central and Eastern Europe

Zuzana Křížová, Jaroslav Sedláček, Eva Hýblová

Masaryk University
Faculty of Economics and Administration, Department of Finance
Lipová 41a, 602 00 Brno, Czech Republic
E-mail: krizovaz@econ.muni.cz, sedl@econ.muni.cz, hyblova@econ.muni.cz

Abstract: *This paper presents results of a research project which has the aims to identify the problems appearing during the preparation of mergers in compliance with valid Czech regulations and to analyze economic causes and consequences of mergers. The analysis of the development of mergers and acquisitions focuses on legal conditions in the selected countries CEE in the field of company combinations. These are mergers and acquisitions which are subject to approval by regulatory bodies. The second part of the article brings comparative analysis of the development M&A markets in the Central and Eastern Europe. The results of the analysis allowed us to describe and forecast the dependence of activities in the field of company mergers which took place in the Czech Republic in the past decade on the selected factors of the external environment.*

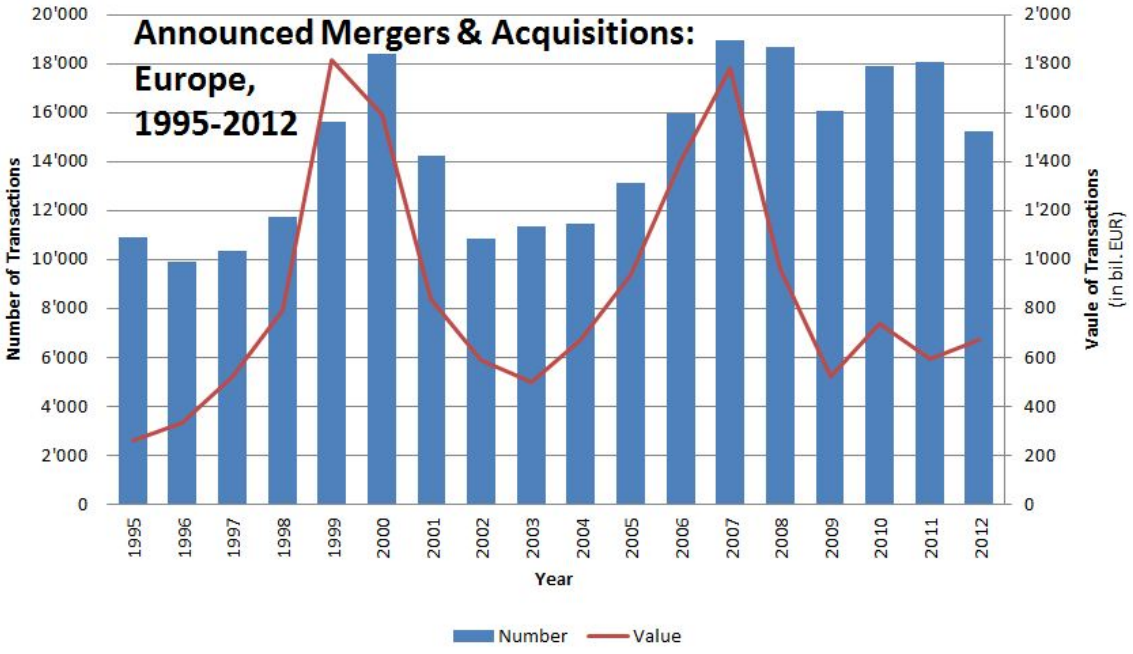
Keywords: company transformations, merger development, legal factors, M&A markets in CEE

JEL codes: G34

1 Introduction

Ever since the late 1990s, merger and acquisitions (M&A) activities have carried the strategic functions of maintaining the growth of enterprises and/or keeping competitive advantages (Tsao, 2007). The reason for this is mainly the assumption that company transformations have an improvement potential in comparison with current situation and that new form of the company will be stronger, more efficient and will employ its advantages in available markets (Cassiman, Colombo, 2006).

Figure 1 Number of M&A in Europe between 1995 - 2012



Source: imaa-institute.org

Our research has monitored activities of Czech enterprises in the field of mergers during the past decade. We are presenting theoretical arguments for the development of activities in the field of company transformations as well as empirical analyses. For the actual exploration a database of companies which implemented a merger in the monitored period has been created.
The conducted analyses allowed us to answer the questions regarding the relationships between company transformations and regulations, new methods of financing and the development of the economic and financial environment in the form of GDP indicator and PX index.

In agreement with conclusions of studies conducted by global auditing companies and legal and advisory organizations, a faster growth of M&A financed by private equity and the reduction of activities subject to regulation have been confirmed for the CR. The development of Czech mergers responds positively to the macroeconomic environment and it has been confirmed that a stable economic environment allows for an easier estimation of the behaviour of a potential merger target or an investor. In contrast to the information published in analyses, strong correlation between the price development in the Czech capital market and activities in the field of mergers has not been confirmed. To be able to judge the causes and effects of mergers in the Czech economy more deeply, it is necessary that the created database includes economic data of participating enterprises (Sedláček, Křížová, Hýblová, 2011).

At the first stage it was necessary to compile a basic dataset in a structure needed for a statistical analysis. The aim of the analysis presented in this paper is to ascertain how the external environment affected the development of mergers of trading companies in the conditions of the Czech economy. The covered period is the past ten years.

2 Results and Discussion

Allen & Overy's Global Law Intelligence Unit has carried out an international legal survey rating the complexity of undertaking private leveraged M&A transactions in 145 jurisdictions. It is the first time key issues have been analysed on such a large scale and distilled in such a manner. The survey draws upon the expertise of all of Allen & Overy's international offices and its huge network of relationship firms. A key finding is that the UK is one of the most favourable jurisdictions in the world to carry out these types of transactions. At the other end of the scale, stands Continental Europe where a series of obstacles curb private leveraged M&A: sacrosanct works council rules, tight merger control regulations, limited ability to grant security (which de facto restricts the financing options) and, to some extent, foreign direct investment restrictions.
Presently, all countries in the CEE region have an established merger control regime in place. According to Donathova and Majer (2012) the number of cross-border mergers and acquisitions in the Central and Eastern European region (the CEE region) is increasing. The transactions are not carried out only within one jurisdiction or in several jurisdictions separately but require a coordinated implementation in several jurisdictions. In such a case the parties should assess the necessity to obtain the approval of local competition authorities as well as to consider the most effective structure of the transaction. Although national competition authorities are moving closer to a "common competition culture", operating in these markets is not always easy and requires a comprehensive understanding of the local legal environment given the considerable differences in the regulatory frameworks discussed below.

Pre-closing notification is mandatory in all of the CEE countries if the applicable notification thresholds are met (even in the absence of a substantive overlap). A different procedure applies only in two countries of the region. In Russia an obligation to notify concentrations before their implementation applies only to substantial transactions when higher notification criteria are met. The post-closing notification is possible in case of less substantial transactions. In Hungary concentrations may be notified after they are implemented but in certain cases they may be implemented only after they are approved by the Hungarian competition authority.

Most of the CEE countries gradually established notification criteria (if the criteria are met, the relevant authority must be notified of the transaction) based exclusively on turnovers of parties to concentrations. Legislation in other countries, namely Russia and Ukraine, determines combined criteria and in addition to turnover of parties their assets and market shares are assessed, due to which the review of the potential notification may become more complicated.

The purpose of all the notification thresholds is identical: only concentrations of undertakings with substantial turnover, market share (and consequently sufficient market power), or assets are considered to be able to (potentially) distort competition in the market. The trend, however, is to replace the market share test by the turnover based thresholds (which may be clearly identified) given the difficulties in defining the relevant market. Consequently, in cross-border transactions the preparation of the notification may become more complicated and the increased difficulties of the parties have to be taken into consideration, including higher costs in jurisdictions where criteria other than turnover also apply, namely in Russia and Ukraine.

An obligation to notify transactions or completed transactions must be assessed independently in all the states concerned. The assessment must also reflect the fact that certain jurisdictions have an extensive approach to what may be considered a transaction subject to approval of the relevant local authority. This is mainly the case of the foreign-to-foreign transactions, which do not directly relate to any local structure in the state and the related notification thresholds are met only based on a certain volume of import sales into the state.

Once the notification thresholds are met, Donathova and Majer (2012) states, the parties to a transaction have a statutory obligation to file a notification to the respective competition authority in all the CEE countries. From the company's point of view, however, typically in cross-border transactions the parties often have a strong preference to limit antitrust filings to only those jurisdictions for which a filing is absolutely necessary.

Following the submission of a notification to a competition authority, the authority reviews the submission in order to assess whether the notification is complete. Only a complete notification may trigger the statutory review periods to begin. Consequently, any other requests for information from the competition authority during the merger procedure stop the clock until receipt of the requested information. Unfortunately, authorities in certain states of the region quite often use this approach in practice and the risk of additional questions from the competition authority may, despite goodwill and best efforts, not be excluded. This local practice must be taken into consideration when scheduling the transaction. On the other hand, on a case-by-case basis, the competition authorities may be willing not to stop the clock, provided that the requested information is provided as soon as possible.

The statutory review periods vary considerably in the CEE countries - the parties to a transaction have to be aware and well prepared that the scrutiny may take time and plan ahead to receive the appropriate regulatory approvals. The parties should be also aware that certain jurisdictions may be more formalistic than others and try to provide notifications as complete as possible.

In Bulgaria proceedings in the first phase take a minimum of 25 business days from receiving the complete notification, and this time limit may be extended by an additional 20 business days. If the competition authority believes that competition might be substantially distorted, the second phase of proceedings follows which may take up to four months from the publication of the decision to open in-depth investigation. Phase two may also be extended by another 25 business days.

In the Czech Republic the Office issues a clearance decision within 30 calendar days. The Office shall prohibit implementation of concentrations that would significantly impede competition in the relevant market. A significant impediment to competition can be caused by the creation or strengthening of a dominant position. If the Office identifies

serious competition concerns, it continues with the proceedings and is obliged to issue a decision within five months from the date of opening an in-depth investigation.

Table 1 The statutory review periods

Country	Number of days	Business (B) or calendar (C) days	Notice
Bulgaria	20	B	
Czech Republic	30	C	
Hungary	35	C	
Poland	60	C	Exactly 2 month
Romania	45	C	
Russia	30	C	
Slovakia	60	B	
Ukraine	30	C	

Source: authors

In Hungary, the competition authority assesses the effects of concentrations within 35 business days of receiving the complete notification and this time limit may be extended by an additional 15 business days. If the competition authority concludes that the proposed concentration might result in a substantial distortion of competition, it commences the second phase of proceedings. The authority must issue the final decision on concentration within four months of commencing the proceedings. In addition, the proceedings in the second phase may be extended by 45 business days.

In Poland proceedings concerning the assessment of a concentration do not exceed two months of receiving the complete notification and are not divided into partial stages. If concentrations in Romania are subject to the approval of the competition authority, the authority reviews the transaction within a maximum of 45 calendar days and the final decision on the concentration must be issued within five months of commencing the proceedings.

The Russian competition authority has 30 calendar days to assess the concentrations. If it concludes that the proposed concentration may result in a substantial distortion of competition, it commences the second phase of proceedings and must issue the final decision within two months of commencing the second phase. In Slovakia the review period is set at 60 business days from submitting a complete notification. The competition authority may extend this time limit by a maximum of 90 additional business days if it considers that the transaction raises significant issues on the merits. The first phase of assessment of concentrations in Ukraine takes 30 calendar days. If the parties receive a notice from the competition authority on the opening of in-depth investigation, the proceedings may be extended by an additional three months.

Numbers of notified concentrations and the enforcement of the rules concerning concentrations in practice significantly differ in the states of Central and Eastern Europe. For example, in 2010 40 decisions on concentrations were issued in the Czech Republic, 52 in Slovakia, 35 in Bulgaria, 40 in Romania and 188 in Poland. In 2009, 480 decisions were issued in Ukraine. Except for Poland and Ukraine, the number of decisions on concentrations decreased compared to the previous years. In 2008, for example, 83 decisions on concentrations were issued in Slovakia, 57 in the Czech Republic, 83 in Bulgaria and 87 in Romania. On the other hand, 177 decisions were issued in Poland and 815 in Ukraine in 2008. It is interesting that in none of the jurisdictions mentioned above did the competition authority prohibit any concentration in the last three years, except for Poland, where three concentrations were prohibited in 2009, and Romania, where the local competition authority prohibited 14 concentrations in 2008. The Ukrainian competition authority prohibited one concentration in 2009.

A trend in enforcing competition rules in this region is an increased compliance with the statutory bar on closing before receiving clearance decision from the competition authority. The regional statistics on fines imposed for this competition offence are also interesting. For example, the Slovak Antimonopoly Office imposed total penalties of

€5,650 (approximately CZK 141,000) in 2010 and €36,660 (approximately CZK 880,000) in 2009. The Bulgarian competition authority imposed penalties of BGN 419,379 (approximately CZK 5.5 million) in 2010 and BGN 1,833,710 (approximately CZK 24 million) in 2009. For failure to comply with the prohibition of concentration before issuing the respective approval the Polish competition authority imposed only one penalty of PLN 65,000 (approximately CZK 372,000) in 2010 and two penalties totalling PLN 140,000 (approximately CZK 800,000) in 2009. The question is whether the penalties imposed for this offence may be a sufficient deterrent for merging companies.

Despite legislation and the decision-making practice gradually levelling in all the CEE states, it is often uneasy without knowledge of the basic principles of the local regulation, environment and practice to prepare cross-border transactions and implement them in the shortest time and the lowest risks possible and difficulties.

According to Žárová and Skálová (2012) European Commission has been concentrated on cross-border mergers treatment during last seven years. Commission´s activity has brought Member States obligation to transpose EC Directives on cross-border mergers into their law systems. Cross-border mergers are cross disciplinary topic as concerns business law, accounting legislation and tax legislation. Their article investigates empirical data concerning cross-border mergers in the Czech Republic and brings criticism of the European Commission´s activity in this field. Criticism is supported by the very small number of realized cross-border mergers. Futher, the article demonstrates obstacles in cross-border mergers realization. Using comparative analysis, the article brings analysis of conditions in ten selected European countries in which cross-border mergers are realized. The analysis of conditions brings answers to improve present situation. Conclusion from the analysis provides good solution for the Czech Republic including legislative changes. Based on the results from investigation, authors believe that legislative changes would help Czech companies to realize cross-border merge in higher scale.

3 M&A Trends in CEE

Study *M&Aactivities in CEE/SEE in 2010* describes shift towards emerging markets: in 2010, the global M&A value reached USD 1,894 bn and stagnated with a slight overall growth of 2.5%. While the value decreased in Europe by -15% and in North America by -8%, it grew by 48% in the rest of the world. European M&A value is constantly decreasing since 2007 and is with EUR369 bn at around one third of the 2007 value. CEE makes up for around 10 % of total European M&A value which is the highest percentage ever. Within Private Equity, 52% of the global value is accomplished by North America as acquirer nation. Europe is number two with 30%. The total global PE value (acquirer nation) amounts to EUR256 bn European Private Equity deal value more than doubled in 2010 and reached 24.7% of overall European deal value, which is almost at all time heights which were reached in 2005/2006

Stabilization of pricing in M&A markets since 2009 - M&A activities in CEE by value had their peek in 2007 and after two years of decline are rising in 2010 again. It can be said that CEEas acquiring nation is growing at a fast value pace of 16 % p.a. Deal sizes in CEE have decreased by around two thirds since its peek in 2007 and have lost some value in 2010 as well. Only one 2010 CEE deal is within the top 15 deals of the past decade (Vimpelkom'stake over of KyivstarGSM). Russia's dominance: while Russia accounts for 57 % of total CEEdeal value as a target country over the period of 2000 to 2010, it accounts for 79 % of total CEE deal value as an acquirer nation in CEE. Hand in hand with this finding, most of the investments (i.e. 43%) went into the Energy and Power sector. The industrial sector is growing on importance.

The number of M&A deals in Emerging Europe countries in 2012 decreased by almost 40 % from the previous year, with a total of 2,265 transactions. These numbers content Emerging Europe: M&A Report 2012. According to this report M&A activity in the region was hampered by the drawn-out debt crisis in the Eurozone, the region’s main trading partner, political turmoil in some states and tough austerity plans introduced by local

governments. The value of announced deals above the €1m threshold recorded a 19% annual drop with a total deal value of €121bn. Rosneft's acquisition of TNK-BP, Russia's largest-ever takeover deal, accounted for more than a third of the overall value. The most active sector by deal numbers in 2012 was manufacturing with 395 deals representing nearly 18 % of all transactions.

Mining (including oil & gas) was the leading sector in terms of deal value, with over €58bn accounting for nearly half of the overall market. The largest deal in Emerging Europe in 2012 was Rosneft's acquisition of Anglo-Russian oil firm TNK-BP, which it bought from BP and a consortium of Russian investors for around €43bn. M&A in Russia accounted for 39% of all CEE deals and 82% of the total deal value in 2012. Poland came second with a 15% share in deal number and a 7% share in total deal value. Russia's intensifying economic slowdown and the central bank's measures to clamp down on inflation and volatile markets hurt deal making in the country in 2012 and forced many companies to put off plans to list or make acquisitions. State-owned corporations continue to be active and are increasing their share of overall M&A deal activity. In 2013, we expect to see significant activity in Russia's natural resources, infrastructure, high-tech and consumer sectors.

In Poland, consumer goods, retail, health and pharmaceuticals are among the sectors that remain very attractive for potential buyers. In the financial sector, the pressure on European banks from the region's debt crisis could force more of them to sell their local units.

Poland also plans to complete its 20-year privatisation program by selling stakes in around 160 companies in 2013. The sell-off list includes stakes in Poland's top bank PKO BP, utility firm PGE, insurer PZU, chemical group Ciech, real estate holding company PHN, coal mining company JSW and gas monopoly PGNiG.

M&A activity throughout CEE in 2013 will largely hinge on the availability of bank liquidity for deal financing, the implementation of austerity measures and the path of the Eurozone sovereign debt crisis.

The Czech Republic has been one of the more upbeat recent economic stories in the Central and Eastern European (CEE) region. The country's economy expanded for the second successive year in 2011 on the back of a strong recovery in its export sector, although 2012 looks gloomier. Its banks are well capitalized, with low reliance on external funding. This may help the Czech economy avoid a credit crunch triggered by ongoing problems in the Eurozone. Its workforce is large and its assets are seen as particularly attractive to investors. All of these factors have helped put the Czech Republic in a higher position in the *M&A Maturity Index* than any of its CEE neighbors. Yet, the country still has work to do to improve its economic and regulatory performance.

According to The M&A Maturity Index 2012 Czech Republic is strongest in the area of infrastructure and assets. It scores 80% for its railway network, 100% for roads and also scores highly (90%) for the number and quality of potential targets available for investment.

Weaknesess are regulatory and political categories. Although its economy is large scoring 75 %, it receives only 20% for its GDP growth. While the country scores 82 % for political stability, it receives a score of just 8 % for ease of tax administration and 44 % for the ability to complete contracts with a minimum of interference.

M&A bid volumes in the Czech Republic recovered in the second quarter of 2012 up 84% from the previous quarter and 2% higher on the year, although well below their peak in the fourth quarter of 2010 (– 49%).

While some of this decline is no doubt caused by ongoing uncertainty in the Eurozone, erratic movement in valuations over example, the average deal value increased from US$28 million in Q1 2012 to US$1.6 billion in the second quarter of 2012. Cross-border and cross-regional deals were both at 75 % of all Czech M&A transactions in the same quarter.

The Czech Republic should be an obvious destination for M&A investors, and the quality of its potential targets for investment is the most clear sign of its maturity as an M&A market. Yet a failure to address regulatory shortcomings could be holding the country back.

4 Conclusions

Despite legislation and the decision-making practice gradually levelling in all the CEE states, it is often uneasy without knowledge of the basic principles of the local regulation, environment and practice to prepare cross-border transactions and implement them in the shortest time and the lowest risks possible and difficulties.

2012 was an unpredictable and turbulent year - a feared Greek exit from the Eurozone, widespread economic turmoil and threats to the single currency's survival - all scenarios looked very possible. The uncertain situation was reflected in the number of deals, which dropped to its lowest level since 2009.

The outlook for CEE for 2013 continues to be dominated by the uncertain evolution of the debt crisis in Europe. The Organization for Economic Cooperation and Development has lowered its growth forecasts for 2013, warning that the world economy could easily slip into recession if the US and the Eurozone's fiscal problems are not resolved quickly.

The CEE region remains attractive to investors. It has been reflected in the growing interest from China which has opened a $10 bn special credit line for joint investment projects in east European infrastructure and technology and a $500 m investment co-operation fund.

5 Summary

The subject of the analysis is company transformations which lead to their combinations or takeovers. The growth of the global economy supports efforts at capital concentration and implementation of acquisitions and mergers on an international scale. A transformation can lead to a higher economic potential from the perspective of competitiveness than reinvestment of profits into internal changes, building new plants, implementation of advanced technologies, etc.

Therefore, one of the goals of our research was exploration into the effect of the external environment on M&A activities in the CR in the past decade. The comparative analysis included the effect of legal conditions and regulation on the number of announced mergers and acquisition, the effect of fund financing on the number and volume of implemented M&A and the effect of economic and financial factors on implemented mergers. To express the last mentioned effect it was necessary to create a database providing an overview of the implemented mergers only in the Czech territory. The database contains identification data of companies which participated in a merger, further, time, legal and economic information necessary for the evaluation of the economic situation of a successor company. The analysis of the development trend of M&A subject to regulation has confirmed the existence of a negative correlation of a medium size between the number of announced combinations in the EU and the CR. The analysis of the development of mergers and acquisitions focuses on legal conditions in the selected countries CEE in the field of company combinations. These are mergers and acquisitions which are subject to approval by regulatory bodies. The second part of the article brings comparative analysis of the development M&A markets in the Central and Eastern Europe.

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Applying Benford's Law

Zuzana Kubaščíková, Renáta Pakšiová

University of Economics in Bratislava
Faculty of Business Informatics, Department of Accounting and Auditing
Dolnozemska 1, 852 35 Bratislava, Slovakia
E-mail: zuzana.kubascikova@euba.sk, renata.paksiova@euba.sk

Abstract: *Benford's Law is used not only to detect electoral fraud but also to detect manipulation of numbers especially in accounting. Benford's Law can recognize the probabilities of highly likely or highly unlikely frequencies of numbers in a data set. The probabilities are based on mathematical logarithms of the occurrence of digits in randomly generated numbers in large data sets. The objective of this paper is to describe and interpret the results applying Benford´s Law on a set of accounting records – journal entries in several companies. The paper examines the following hypotheses: H1: Benford´s Law is held true in companies whose accounting data have not been manipulated. Benford´s Law does not apply in companies in which some accounting entries have not been recorded. Benford´s Law does not apply in companies in which all accounting entries have been recorded but some items have been modified. H2: Benford´s Law can detect the type of the bias. H3: Benford´s Law does apply only for whole accounting period. Despite its limitations, Benford's Law is effective in detecting data bias in journal entries but ineffective in detecting the type of the bias. Benford's Law is also applicable for shorter periods as they have comparable results as one whole accounting period and can be used for special examinations by state authorities as an effective tool to spot anomalies in VAT control statement.*

Keywords: fraud, Benford's law, journal entries analysis

JEL codes: M49

1 Introduction

Fraud examination is a methodology for resolving fraud allegations from inception to disposition. More specifically, fraud examination involves obtaining evidence and taking statements, writing reports, testifying to findings and assisting in detection and prevention of fraud.

Fraud means that somebody who deliberately acts dishonestly and deceptively for his or somebody else´s advantage and therefore causes small financial loss, shall be imprisoned for up to two years (Criminal code, §221).

According to the ACFE (Association of Certified Fraud Examiners) fraud examination method approaches:

- Analysis of available data,
- Creating a hypothesis,
- Testing the hypothesis,
- Refining and amending the hypothesis.

The purpose of fraud examination is to prove or disprove the legal elements of the offence. There are many tools the IT auditor has to apply to various procedures in an IT audit. Almost all computer-assisted audit tools have a command for Benford's Law. This article will attempt to describe what Benford's Law is, when it could apply and what constraints to consider before applying it in an IT audit.

Benford's Law was published for the first time in 1881 by American astronomer Simon Newcomb, but it was rediscovered only in 1938 by physicist Frank Benford. Benford's Law refers to the probability of occurrence of numbers d (d = 1, 2, 3, 4, 5, 6, 7, 8, 9) on the first quantifiable features in any sufficiently large set of data.

Hal Varian suggested that Benford's Law could be used for the detection of possible frauds in the lists of socio - economic data submitted in support of public planning decisions. It is based on the assumption that people tend to fairly evenly create numbers in such a way that it is possible to compare the frequency of the digit on the first position with the division of the frequencies of the first digits using Benford's Law and based on potential differences it may be possible to indicate fraud (Hal Varian, 1972).

In the late 80s of the 20th century there were two studies on Benford's Law. The first study was performed by Carslaw. Carslaw applied Benford's Law to accounting data and his findings revealed also the importance of the 2nd digit position. He observed that the numbers reported by companies in New Zealand did not contain enough nines in the second digit position. In fact, most of those companies had zeros in this position. He found that New Zealand companies rounded earnings numbers to the next number. If a company had a profit, for example 1.9 million dollars, the numbers were rounded to 2 million dollars. (Carslaw, 1988). The second study was conducted by Thomas who discovered similar findings in the profits of American companies (Thomas, 1989).

Thomas Hill presented that Benford's distribution is a "second generation" distribution, or combination of other distributions. Accounting data represent a combination of numbers from different sources making these numbers suitable for the application of the Benford distribution as a test for error or fraud (Hill, 1995).

Mark J. Nigrini showed that Benford's Law could be used in forensic accounting and auditing serving as an indicator of fraud. In practice, Benford's Law is applied in fraud detection in data on more than just the first digit. Nigrini performed a study applying Benford's Law to taxpayer data. Based on his research he determined that low-income taxpayers participated in more than unplanned evasion of their higher income counterparts (Nigrini, 1996). Further studies, which may not even mention the dissertation by Nigrini, use analyses with numerals to help identify tax evasion.

A digit analysis using Benford's Law was also used as evidence of voter fraud in the 2009 Iranian election. In fact, Benford's Law is legally admissible as evidence in the USA in criminal cases at the federal, state and local levels. This fact alone substantiates the potential usefulness of using Benford's Law.

2 Methodology and Data

This research demonstrates that Benford's Law is effective in detecting data bias in the journal entries of companies. The purpose of this research is to determine if the journal entries of selected companies conform to Benford's Law. Tests were conducted in three companies over a three-year period:

- Company A: Data have not been manipulated.
- Company B: Data have been manipulated – not all accounting entries have been recorded.
- Company C: Data have been manipulated – all accounting entries have been recorded but some items have been modified.

Benford broke down these occurrences into percentages for each number, one through nine. The following table shows the actual percentages of occurrence for digits 1 - 9 occupying the locations 1 - 4 as described in Benford's Law.

Table 1 Percentages of occurrence for digits according Benford's Law

1	2	3	4	5	6	7	8	9
30.1	17.6	12.5	9.7	7.9	6.7	5.8	5.1	4.6

Source: Benford's Law

The data were analyzed using MS Excel and the software IDEA. MS Excel was used to organize the data into a more useable form. The Excel spreadsheet included journal entries to accommodate the three years of data for each company extracted from their

accounting software. The data compiled into the MS Excel spreadsheet were analyzed using the IDEA Software, education edition. Once imported into IDEA Software, the data were analyzed, using the command "Benford's Law."

3 Results and Discussion

The results are presented in the table form with the actual data percentages of occurrence compared to the expected percentages according to Benford's Law. The tables show the statistics for each individual number in the 1st digit location.

Table 2 Digit frequencies for first position in journal entries amounts - company A year 2012

	1	2	3	4	5	6	7	8	9
Expected frequency (%)	30.1	17.6	12.5	9.7	7.9	6.7	5.8	5.1	4.6
Observed frequency (%)	29.14	18.7	12.65	10.1	8.1	6.5	5.45	4.9	4.46

Source: Own processing

Table 3 Digit frequencies for first position in journal entries amounts - company A year 2013

	1	2	3	4	5	6	7	8	9
Expected frequency (%)	30.1	17.6	12.5	9.7	7.9	6.7	5.8	5.1	4.6
Observed frequency (%)	29.24	18.67	12.61	10.06	8.11	6.45	5.4	4.89	4.57

Source: Own processing

Table 4 Digit frequencies for first position in journal entries amounts - company A year 2014

	1	2	3	4	5	6	7	8	9
Expected frequency (%)	30.1	17.6	12.5	9.7	7.9	6.7	5.8	5.1	4.6
Observed frequency (%)	29.16	18.7	12.59	10.15	8.13	6.47	5.35	4.81	4.64

Source: Own processing

In company A accounting data were not manipulated. Manipulation would be indicated if digits 1 - 9 appeared in the first position significantly more or less often than expected. As presented in the tables 1 - 3, it is highly likely that the journal entries were not manipulated.

Table 5 Digit frequencies for first position in journal entries amounts - company B year 2012

	1	2	3	4	5	6	7	8	9
Expected frequency (%)	30.1	17.6	12.5	9.7	7.9	6.7	5.8	5.1	4.6
Observed frequency (%)	19.14	16.7	10.65	11.1	10.1	5.5	8.18	4.7	14.46

Source: Own processing

Table 6 Digit frequencies for first position in journal entries amounts - company B year 2013

	1	2	3	4	5	6	7	8	9
Expected frequency (%)	30.1	17.6	12.5	9.7	7.9	6.7	5.8	5.1	4.6
Observed frequency (%)	18.65	16.2	11.05	11.2	11.5	6	7.45	4.84	13.11

Source: Own processing

Table 7 Digit frequencies for first position in journal entries amounts - company B year 2014

	1	2	3	4	5	6	7	8	9
Expected frequency (%)	30.1	17.6	12.5	9.7	7.9	6.7	5.8	5.1	4.6
Observed frequency (%)	19.1	15.9	11.45	10.9	15.5	5.5	7.88	3.15	10.62

Source: Own processing

In company B accounting data were manipulated. Further forensic techniques were used to find that not all accounting entries had been recorded. As shown in the tables 4 - 6, it is highly likely that the journal entries were manipulated.

The tables 4 - 6 display the actual counts and frequencies of the digits 1 through 9 appearing in the first digit position of journal entries. For example, digit 1 appeared in the first position in 14.92% of the total. The tables provide the rates in which digits 1 through 9 are expected to occur in the first digit position of unmanipulated data, according to Benford's Law. For example, digit 1 should appear in the first position in 30,1% of the total. The tables reveal that the actual frequency of digits 1 - 9 occurring in the first position of the journal entries differs from the expected rate.

Table 8 Digit frequencies for first position in journal entries amounts - company C year 2012

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Expected frequency (%)	30.1	17.6	12.5	9.7	7.9	6.7	5.8	5.1	4.6
Observed frequency (%)	20.1	19.7	10.5	11.9	9.5	7	5.5	6.2	9.6

Source: Own processing

Table 9 Digit frequencies for first position in journal entries amounts - company C year 2013

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Expected frequency (%)	30.1	17.6	12.5	9.7	7.9	6.7	5.8	5.1	4.6
Observed frequency (%)	19.75	16.8	9.35	12.8	14.3	7.89	5.44	2.15	11.52

Source: Own processing

Table 10 Digit frequencies for first position in journal entries amounts - company C year 2014

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Expected frequency (%)	30.1	17.6	12.5	9.7	7.9	6.7	5.8	5.1	4.6
Observed frequency (%)	19.24	17	11.5	11.9	12.8	7.1	6.3	4.35	9.81

Source: Own processing

In company C accounting data were also manipulated. Using further forensic techniques it was found that some journal entries were modified in this company. As presented in the tables 7 - 9, it is also obvious that the journal entries have been manipulated.

In the companies where accounting data were manipulated, the validity of Benford's Law has been also confirmed. Using this experiment we have found that although Benford's Law indicates fraud in the companies, it cannot indicate the type of fraud. Despite the fact that in companies B and C significantly different types of fraud have been found, the deviations from Benford's Law have been the same and therefore based on the analysis by Benford's Law it is not possible to find out what kind of fraud has occurred in the companies. The results of analyses in the 3 years are comparable, despite the fact that the first two years were monitored throughout the whole accounting periods and the last year was monitored only during the first quarter of the year. Thanks to this fact Benford's Law can be also used by tax authorities to detect anomalies in control statement - a new form for cross-control evidence for all VAT taxable transactions that has been implemented in Slovak Republic on 1 January 2014.

4 Conclusions

Benford's Law explains that number frequencies are skewed more toward lower numbers. Benford's Law is sometimes referred to as the "first digit phenomenon" but it has also its limitations.

One of the enduring problems with Benford's Law is false positives (conclusion of nonconformity when the data are not biased, and therefore in conformity). False positives are more prevalent with smaller data sets.

Not all data sets conform to Benford's Law. For example, numbers that contain a maximum or minimum value and numbers assigned to a person will not conform to the law. The theory does not hold true for data sets in which digits are predisposed to begin with a limited set of digits. The theory also does not hold true when a data set covers only one or two orders of magnitude.

Examples of data sets that are not likely to be suitable for Benford's Law include:

- Bank Accounts,
- Birth Numbers, Social Security Numbers,
- Airline passenger counts per plane,
- Telephone numbers,
- Data sets with 500 or fewer transactions,
- Data generated by formulas (e.g. YYMMDDXX),
- Data restricted by a maximum or minimum number (e.g. human heights, human weights, intellectual quotient scores).

If numbers describe a similar phenomenon to accounting data, they will generally follow Benford's Law (Durtschi, Hillison, Pacini, 2004). However, some numbers from accounting data do not comply with Benford's Law, for example the numbers of orders and document numbers (generated by formulas), wages (since minimum and maximum is set) or prices which take into considaeration the psychological effect on the consumer (e. g. a price is not € 2, but € 1.99, etc.).

This research study has applied Benford's Law in randomly selected companies and demonstrates that Benford's Law is effective in detecting data bias in journal entries but ineffective in detecting the type of the bias. However, it is important to note that there are some limitations in Benford's Law. The probability that Benford's Law will detect fraud is highly likely and the inspector should apply further techniques to evaluate all possibilities before launching a full-fledged reexamination of the data and its sources.

The use of Benford's Law in audit or special examinations by state authorities is an important and effective tool to spot anomalies in data. Nevertheless, the results of the analyses performed in this study have not proved that Benford's Law can indicate the type of fraud. Based on the analyses it is obvious that Benford's Law is also applicable for shorter periods as they have comparable results as one whole accounting period.

Benford´s Law can be used for special examinations by state authorities as an effective tool to spot anomalies in VAT control statement.

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The Factors Affecting the Accuracy of Business Failure Prediction Models

Michal Kuběnka

University of Pardubice
Faculty of Economics and Administration
Institute of Business Economics and Management
Studentská 84, 532 10 Pardubice, Czech Republic
E-mail: michal.kubenka@upce.cz

Abstract: *A variety of methods can be used for evaluation of a firm financial health. Business failure prediction models have gained popularity for their objectivity and simultaneously a relative simplicity and a short time for conducting analyses. The firm rating inaccuracy caused by selected prediction model may be due to natural error of every particular business failure model (also called "financial prediction model"). Hypothetically, there are a lot of factors that could be eliminated in order to improve the prediction of a specific model, but practically their influence has not been statistically proven. Only several factors were taken into account in the process of model creation. Most of the existing models were created as "universal" ones based on a sample of firms regardless of their industry, size, period of existence, etc. This paper presents the results of research conducted on a sample of 594 Czech firms. The aim is to show the effect of a subject size on the accuracy of tested models. It can be deduced that the accuracy of the prediction would be higher if the model construction accepted the size of a tested subject.*

Keywords: financial prediction models, accuracy of prediction, factors of accuracy

JEL codes: G24, G32, G33

1 Introduction

The main advantage of technical-financial analysis, as well as all financial models for business failure prediction, is the speed of its calculation, its simplicity and last but not least the accessibility to source information from accounting (in the Czech Republic publicly available in commercial register). Data required for other complex assessment (e.g. methods EFQM or BSC (see Šulák and Vacík, 2005; Stříteská and Svoboda, 2012; Knápková et al., 2014), assessment of region (Myšková, 2013) or other partial assessments in the area of marketing, human resources or innovations (e.g. Lendel-Varmus, 2013)) are usually available only to the management of a specific firm (subject). Apart from the financial information, potential investors or banks have not enough data about firm processes for other complex assessment methods implementation. Also, it is important to emphasize the finances (or results of business failure prediction models) are reflection and results of all firm processes.

This article focuses on factors of prediction models accuracy. It is necessary to take into account a synthesis of the assumptions of the author of this article, which leads to the conclusion that the accuracy of the existing models (caused mostly by the author or users of these models) may be decreased for several reasons:

- the author created the model on a small sample of heterogeneous firms,
- the author failed to consider the differences and specificities of the sector in which the model should be applied,
- in determining the accuracy of the prediction model the author did not consider the possible disparity of the success of the prediction derived from the size of the analysed entities,
- both market conditions and legislation change with the passage of time, while some models are several decades old.

The research focuses on confirming or refuting the existence of one above mentioned factor. The objective of this paper is to demonstrate the effect of size of a firm on the

resulting scores of the selected bankruptcy and creditworthy-bankruptcy models. The research was carried out on a sample of firms whose activity is categorised as CZ-NACE 412 Construction of residential and non-residential buildings. The impact will be evaluated using the models Z 'score, Z'' score, IN01, and IN05. This leads us to the following hypotheses.

Hypothesis 1 (H1):
The score of each chosen model is affected by the size of the examined subject. [1]

Hypothesis 2 (H2):
Models achieve different accuracy depending on the analysed object size.

The aim of this article is the confirmation of these hypotheses and through this the confirmation of influence between size of company and model accuracy. Based on the confirmed hypotheses, a premise about possibility to increase the accuracy of contemporary models might be created if the models were modified according to the factor of the firm size.

2 The Analyzed Financial Prediction Models

Altman is one of the world's best-known personalities in the field of the creation and use of prediction models. He has created a number of them and they differ based on whether they were created for U.S. firms or firms in another country, whether they were created for firms whose shares are traded on the stock market, and whether they were created for manufacturing and non-manufacturing firms, etc. For the accuracy of the model the size of the sample, based on which the model was developed, is also important.

Z' Score - Private Firm Model

The author (Altman, 1993) of this model used 53 firms in distress and 58 in prosperity. It is important to emphasize that the author did not take into account the size of the analysed subjects. This model was created on a sample of U.S. firms but the model is used worldwide (as well as the following one).

$$Z´ = 0.717\,X1 + 0.847\,X2 + 3.107\,X3 + 0.420\,X4 + 0.998\,X5 \quad (1)$$

X1 = (current assets – current liabilities) / total assets
X2 =retained earnings / total assets
X3 = earnings before interest and taxes / total assets
X4 =book value of equity / total equity
X5 =sales / total assets

The rated firms can be situated in 3 categories. If the final Z´ value is 2.90 or more, the firm should be prosperous in the future, lower than 1.23 indicates bankruptcy. From the value 1.23 to 2.90 it is a gray area with uncertain conclusion.

Z´´ Score Model (Altman, 2006)

This formula was made primarily for emerging markets. In this case Z´´ <1.1 means a distress zone, Z´´ from 1.1 to 2.6 means gray zone a Z´´ > 2.6 means a safe zone.

$$Z´´ = 6.56\,X1 + 3.26\,X2 + 6.72\,X3 + 1.05\,X4 \quad (2)$$

X1 = (current assets – current liabilities) / total assets
X2 =retained earnings / total assets
X3 = earnings before interest and taxes / total assets
X4 =book value of equity / total equity

[1] In conflict with the most famous person in the area of bankruptcy models – professor Altman: „A frequent argument is that financial ratios, by their very nature, have the effect of deflating statistics by size, and that therefore a good deal of the size effect is eliminated." (Altman, 2002)

IN01 for Industrial Firms (Neumaierová and Neumaier, 2002)

The author analysed 1,915 industrial firms. There were 583 creating economic added value, 503 firms in bankruptcy and 829 of others. The threshold for classifying a business as being prosperous and creating the economic added value is 1.77, bankruptcy risk firms exhibit a IN01 lower than 0.75. Among these values is a gray area where you cannot make a definite conclusion.

$$IN01 = 0.13\ X1 + 0.04\ X2 + 3.92\ X3 + 0.21\ X4 + 0.09\ X5 \quad (3)$$

X1 = total assets / liabilities
X2 = earnings before interest and taxes / interest paid
X3 = earnings before interest and taxes / total assets
X4 = revenues / total assets
X5 = current assets / current liabilities

When IN01 is greater than 1.77 the firm produces a positive EVA value with a probability of 67 %. When IN01 is smaller than 0.75, the firm gets in financial distress ("bankruptcy zone") within a year with a probability of 86%. Firms with the value between these two extremes cannot be clearly determined, and they fall into a "gray zone".

IN05 Revisited (Neumaierová and Neumaier, 2005)

The authors (Neumaierová and Neumaier, 2008) state that IN05 "was created and tested on data from mainly medium and large industrial firms, so for these firms it will have the best explanatory power" but they also do not care about modification of the model separately for small, medium and large firms.

$$IN05 = 0.13\ X1 + 0.04\ X2 + 3.97\ X3 + 0.21\ X4 + 0.09\ X5 \quad (4)$$

This model has the same components as IN01 but it has different value intervals for final prediction. IN05 < 0.90 means distress zone, firms between 0.9 and 1.60 are located in the "gray zone" and more than 1.60 is a "safe zone" containing the firms with expected economic value added (EVA).

3 The Sample Used for H1 and H2 Confirmation / Rejection

To ensure maximum homogeneity of the sample all of the analysed firms are from the same sector, namely CZ-NACE[2] 412 Construction of residential and non-residential buildings.

Table 7 Structure of the sample

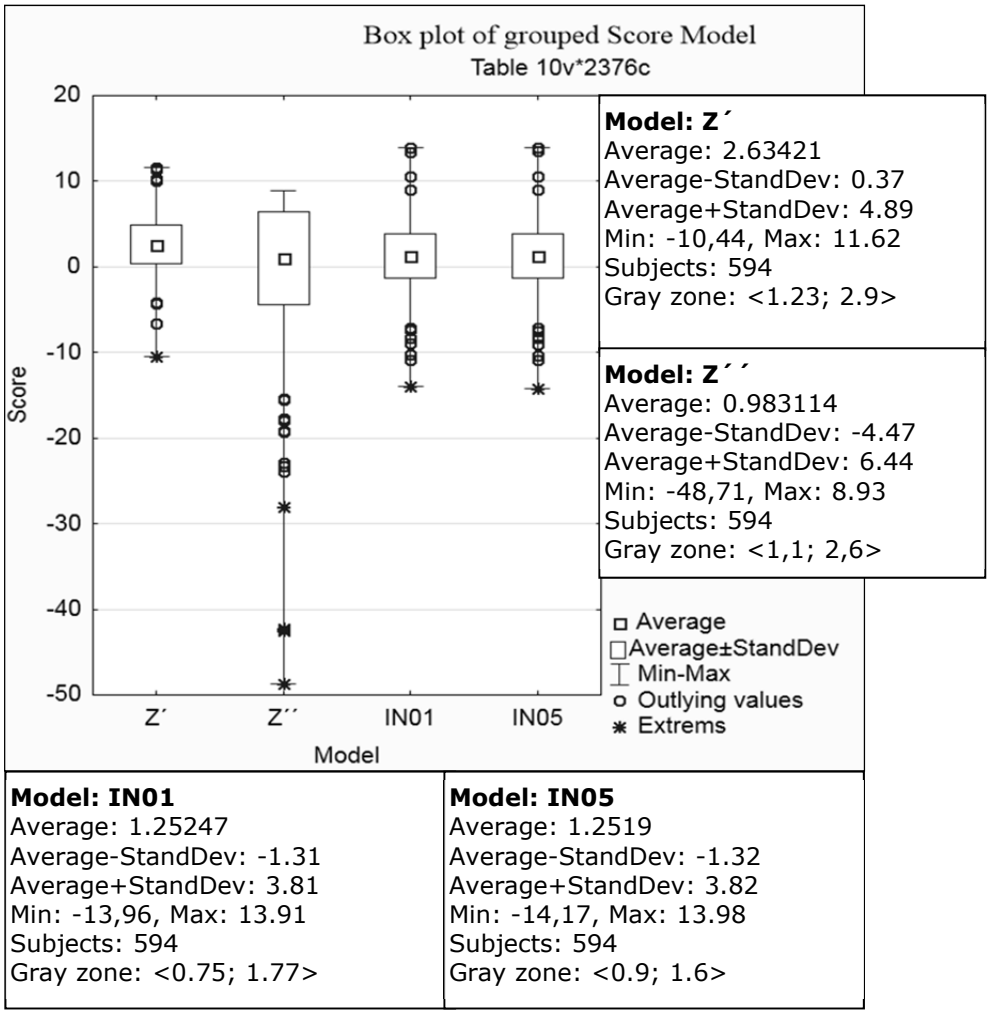
Category of firms	Small		Middle		Large		Total
Prosperous	342	61.62 %	188	33.87 %	25	4.50 %	555
Bankrupt	18	46.15 %	20	51.28 %	1	2.56 %	39
Total	360	x	208	x	26	x	594

Source: author

The selected models were applied to these firms and the basic characteristics of the set of the resulting scores of these models are listed in the following Figure 1.

[2] CZ-NACE is classification of economic activities created by the Czech Statistical Office used in Czech Republic.

Figure 6 Characteristics of the files of resulting scores of Z', Z'', IN01, IN05



Source: author

4 Verification of Hypothesis 1

To test H1 whether the finale score of different models depends on the size of firm a) ANOVA test, b) the KW test can be used.

A prerequisite for ANOVA test is the confirmation of normality and homogeneity of variances. Normality was verified using the Shapiro - Wilk test. The null hypothesis for this test states that the objects have a normal distribution. The hypothesis is rejected if the resulting value of the test is $p \leq \alpha$. A significance level of $\alpha = 0.05$ was chosen.

Because the Shapiro - Wilk test shows that all the results of application of the selected models do not have a normal distribution, the possibility of using ANOVA test has been eliminated and the Kruskal-Wallis test was chosen for further testing.

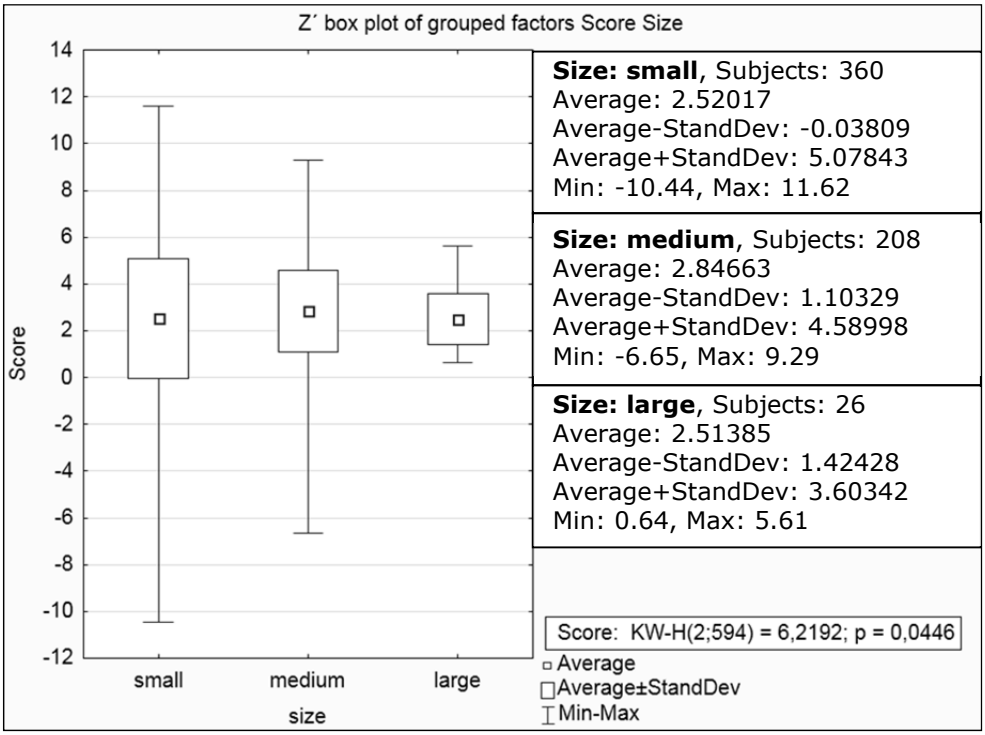
It is based on the null hypothesis, which states that the distribution function governing the distribution of probability of the values of ratio indicators is equal.

The following Z' box plot graphically represents and numerically describes the basic parameters of the tested group of firms including the results of the Kruskal-Wallis test (KW score).

A significance level of $\alpha = 0.05$ was selected for the test. If $p > \alpha$ the null hypothesis is rejected. In this case $p = 0.0446$, i.e. the null hypothesis is rejected and it is true that the size of the firm has an influence on the result of prediction of financial health using the Z' score.

Z´´ score p value reached 0.00006 and therefore the null hypothesis must also be rejected. The Kruskal-Wallis test showed that the Z'' score is also related to the size of the firm.

Figure 7 Box plot of Z´ score



Source: author

Table 8 Z´´ model application parameters

Parameter	Size of firm		
	small	medium	large
Average	0.314472	1.88798	3.00231
Average – Stand. dev.	-5.66147	-2.67947	1.16429
Average+Stand. dev.	6.29041	6.45543	4.84033
Minimum	-48.71	-42.21	-0.14
Maximum	8.93	8.12	7.38
No. of subjects	360	208	26

Source: author

In case of the IN01, the score KW-H (2; 594) = 19,4681 and p = 0.00006. The null hypothesis must also be rejected which means that the results of the evaluation using the IN01 model is also related to the size of the firm. The box plot of scores grouped according to the size of object is approximately the same as the following IN05. The parameters of group of IN01 model results are in Table 3.

Table 9 IN01 model application parameters

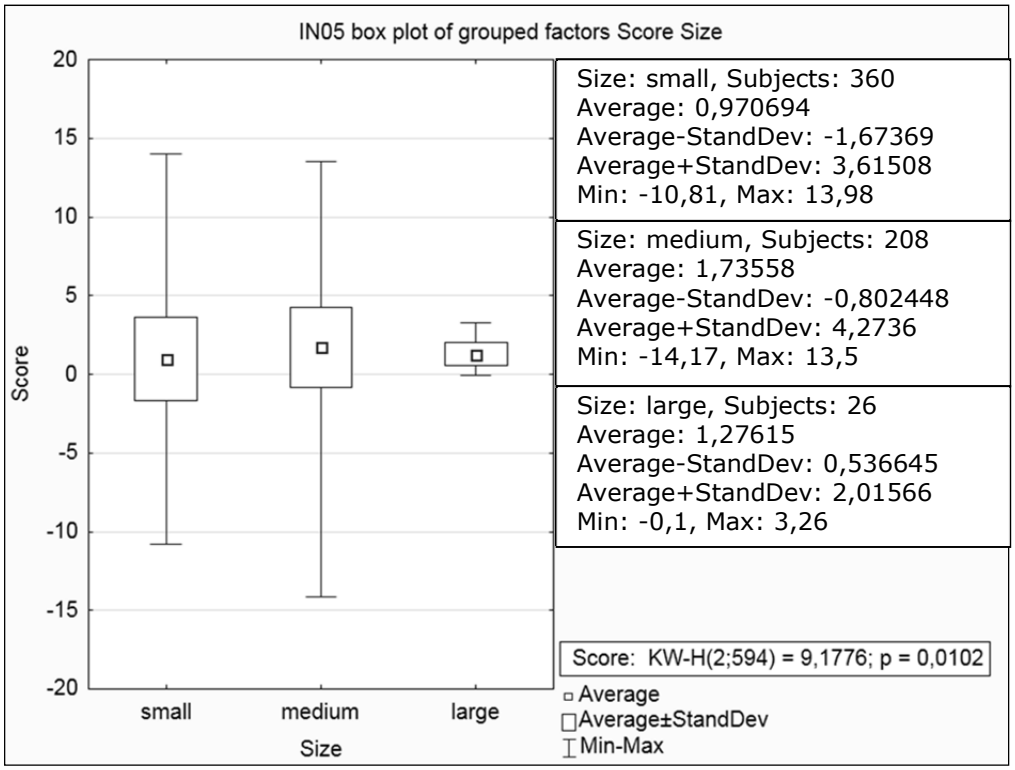
Parameter	Size of firm		
	small	medium	large
Average	0.972306	1.735190	1.270000
Average – Stand. dev.	-1.65804	-0.79169	0.535224
Average+Stand. dev.	3.60265	4.26207	2.00478
Minimum	-10.80	-13.96	-0.10
Maximum	13.91	13.47	3.23
No. of subjects	360	208	26

Source: author

Even in the case of IN05, the null hypothesis should be rejected, which means that the accuracy of the evaluation model IN05 is also different for different sizes of firms (see Figure 7 below where $p = 0.0102 < \alpha = 0.05$).

The result of this investigation is the confirmation of the fact that the size is a factor which statistically affects the final value of all four financial prediction models. Hypothesis 1: "The score of each model is affected by the size of the analysed subject." is therefore confirmed.

Figure 8 Box plot of IN05 score



Source: author

If the resulting averages for different sizes diverge, then it can be assumed that modifying the construction of the models, or the rating scales, may lead to further refinement of the predictions using these models. For a definite proof, a different accuracy of models in relation with object size (H2) must be confirmed.

5 Verification of Hypothesis 2

For purpose of the confirmation of different accuracy depending on analyzed object size the test of the ratios differences was used. Categories of the middle size and the large size were grouped together[3]. The sample was rated by Z´, Z´´, IN01, and IN05 models. In the category „small firms", 360 firms were rated, and in the category „middle&large firms" 234.

We tested the hypothesis that the selection ratio p1 equals selection ratio p2.

$$H0: p1 = p2 \qquad \text{against} \qquad H0: p1 \neq p2$$

The decision to reject the null hypothesis was based on the obtained p-value and the chosen significance level $\alpha = 0.05$. If the p-value $< \alpha$, it is possible to reject H0, i.e. the accuracy of models is different for various sizes of objects. The calculation of p-values was based on the relationship:

[3] Higher frequency in each size category is a prerequisite for the use of selected ratios differences test.

$$p = \frac{(p_1 \times N_1 + p_2 \times N_2)}{(N_1 + N_2)} \quad (5)$$

p1….. relative rate of the first sample
p2….. relative rate of the second sample
N1….. size (extent) of the first sample
N2….. size (extent) of the second sample

The following table 4 states final p-values.

Table 10 Test of the ratios differences

Size classification	Expression	Z´	Z´´	IN01	IN05
Small firm error I. + II.	absolute	83	125	115	137
	relative	**0.23**	**0.35**	**0.32**	**0.38**
Middle & Large firm error I. + II.	absolute	24	58	38	64
	relative	**0.10**	**0.25**	**0.16**	**0.27**
Confirmation / rejection of H2	p value	0.0010	0.0101	0.0000	0.0056
	$p < \alpha$	**rejected**	**rejected**	**rejected**	**rejected**

Source: author

In all four cases, the rejection of the null hypothesis confirmed that the models accuracy differs in evaluation of small vs. middle & large firms. It follows that the new model formation would help to increase the accuracy of models for different categories of firm sizes.

6 Conclusion

The business failure prediction models are useful for evaluation of both the potential or the present business partners, for investors of equity capital investment, for banks for debtor evaluation, and last but not least for managers of the analysed firm. Models can help to point out the impending bankruptcy in time and managers can take action to prevent the bankruptcy.

It is obvious that these models do not predict bankruptcy correctly in 100% of cases. They may incorrectly assess the firm financially stable, although subsequently it goes bankrupt in the future. Also, they may erroneously predict bankruptcy in the case of financially stable firm (as the future will prove).

In general there are two main ways how to increase the accuracy of prediction:

a) completely new or improved methods resulting in better construction of model,
b) work with more homogeneous sample of firms, i.e. input data leading to a model with greater accuracy but often with only limited use in accordance to the category of firms fulfilling the criteria of sample (factors of selection) used for development of model.

The article focused on the method b). There are many factors affecting the accuracy of prediction models cited in the scientific papers and journals, though many of these factors are hypothetical. Many of them are not statistically confirmed. The confirmation and the following new model construction can reach higher accuracy if it takes into account these new facts.

This article answers the question if the result of the prediction model can be improved by taking into account other factors – in this case the size of the firm. The research results showed that the size of a firm has a statistically significant effect on the resulting score of the models and also that the prediction ability of the individual models is different depending on the size of the firm. It means the accuracy can be improved by creation of varied models for varied sizes of firm. All of the analysed 594 firms operated in the construction sector in the Czech Republic in order to eliminate the branch factor. There were examined by Altman´s bankruptcy models Z' score and Z'' score and creditworthy-

bankruptcy models IN01 and IN05 designed by the Neumaiers specifically for Czech businesses. The hypotheses were confirmed in all four cases.

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Determinants of Mutual Fund Industry Development in Countries of Central and Eastern Europe

Oleksandra Lemeshko, Oldřich Rejnuš

Masaryk University
Faculty of Economics and Administration, Department of Finance
Lipová 41a, 602 00 Brno, Czech Republic
E-mail: lemeshko@mail.muni.cz, rejnus@econ.muni.cz

Abstract: *The rapid growth and development of mutual fund industry throughout the world stimulated vast contemporary studies focusing on wide range of issues predominantly of microeconomic character, such as fund performance, timing ability, fees and fund flows, thus leaving determinants and attributes of mutual fund industry development beyond their research. The rare relevant studies predict that development of mutual fund industry depends on a number of factors among which the predominant role belongs to development of economic and financial system, and quality of governance and regulatory basis. One essential condition of validity of this prediction is that it is based upon a sample of developed economies, thus leaving a space for the likelihood that under condition of developing or middle-income economies some expectations may substantially deviate from the predication. This paper aims to reevaluate by means of regressing the size of mutual fund industry over a number of independent variables the significance of impact of factors identified in previous studies in the sample of high- and middle-income economies of Central and Eastern Europe. Although chosen sample does not cover as large number of countries as previous studies, it provides a brief insight into CEE mutual fund industry, documenting important country and regional characteristics.*

Keywords: determinants, economic and financial system development, governance

JEL codes: G23, O16

1 Introduction

Currently asset management is one of the most fast growing segments of international capital markets. Its rapid growth and development throughout the world stimulated a vast contemporary studies on wide range of issues of mainly microeconomic character, such as fund performance and timing ability, fees and expenses, fund flows, exchange traded funds (ETF) and socially responsible funds (SRF). However despite the increasing significance of asset management there is an evident lack of studies on its development and growth attributes. The existing literature predicts that mutual fund industry is more advanced in countries with better developed and more stable capital markets and stronger regulatory basis (Beck et al., 2010; Čihák et al., 2012). The obtained results confirm that a number of factors influence the growth and development of mutual fund industry such as national income and capital market liquidity (Fernando et al., 2003), market returns and country openness (Klapper et al., 2004). All these studies on both microeconomic characteristics and macroeconomic determinants are structured upon developed economies, thus leaving the space for substantial likelihood that under condition of developing economies some expectations may substantially deviate from the predication. In this sense the mutual fund industry in Central and Eastern Europe (CEE) provides good opportunity for further research. Existing studies structured upon CEE economies are rather scarce and restrict their interest to banks and pension funds (Havrylchyk, 2009; Jackowicz and Kowalewski, 2012) rather than mutual funds *per se*. As for development determinants and growth attributes of CEE asset management, there is an evident gap in relevant studies.

The existing literature predicts that development of mutual fund industry depends on a number of factors among which the predominant role belongs to development of economic and financial system and quality of governance. This paper aims to reevaluate on the sample of high- and middle-income CEE economies the impact of factors identified

in previous studies. This study departs from previous ones by using a new database of more than 5000 open-end mutual funds operating in CEE during the last 14 years. Although chosen sample does not cover as large number of countries as previous studies, it provides an insight into CEE fund industry, documenting important country and regional characteristics. Following established practice, for evaluation of significance of particular growth factors and development attributes the size of the mutual fund industry, given by its market capitalization to GDP ratio is regressed by means of pooled OLS over a number of independent variables, data on which was collected for a sample of 11 countries for 13 years time span.

This paper proceeds as follows: Section 2 reviews the existing studies dealing with mutual fund industry in general and determinants of its development in particular; Section 3 reports data used and methodology applied; Section 4 discusses the significance of impact of chosen determinants of mutual fund development in CEE economies; and Section 5 concludes.

2 Literature Review

The rapid growth and development of mutual fund industry throughout the world stimulated a vast body of literature on wide range of issues of mainly microeconomic character, such as fund performance, fees and expenses, fund flows, ETF and SRF. All these studies are structured upon world samples. To evaluate mutual fund performance practitioners and academics frequently rely on various fund characteristics such past performance, fund size and age, inflows, diversification and turnover. In general, among assumed characteristics recent studies confirm the highest relevance of past performance and fund size (Agnesens, 2013), structure of management team and corporate culture (Karagiannidis, 2012). One of actively investigated issues today are fund cost efficiency and herding behavior of fund portfolio trading (Rakowski and Wang, 2009). Being recent and very successful financial innovations, ETFs and SRFs represent another frequent subject of modern research (Benson and Humphrey, 2008).

However despite the increasing significance of asset management there is an evident lack of studies on its development and growth attributes. The existing literature predicts that mutual fund industry is more advanced in countries with better developed and more stable capital markets and stronger regulatory basis (Beck et al., 2010; Čihák et al., 2012). The obtained results confirm that high-income economies experience higher growth rates of fund industries relative to their middle-income neighbors, reflecting investor confidence in market integrity and liquidity, and efficiency of local regulatory system (Fernando et al., 2003). As for other attributes there is empirical evidence of significant positive correlation between local mutual fund growth rates and market returns, country openness and common law (Klapper et al., 2004), wealth and education of local population (Khorana et al., 2005).

Here it is necessary to emphasize that all mentioned above studies provide evidence from world samples, which are made up mainly of developed economies. Thus the probability that under condition of developing economies some expectations derived from the evidence of developed economies may either not to fulfill or even have an opposite effect - such probability cannot be excluded. In this sense the growing economic significance and fragmentation of the European fund industry provides a good opportunity for relevant research. All studies on European fund industry can be conventionally divided into two groups – studies structured upon evidence from matured EU economies and studies structured upon developed and developing CEE economies. Another distinct feature is that: (1) all these studies have been conducted either at the individual country level, e.g. for funds that invest in Germany, UK or Italy (Cuthbertson and Nitzsche, 2013), or on the group country level, e.g. EU-15 (Bengtsson and Delbecque, 2011); (2) all these studies focus mainly on individual characteristics of European funds, e.g. on their performance (Banegas et al., 2013), and leave out of attention their development attributes. Thus on the basis of mapping of all existing studies on CEE asset management it is possible to conclude that there is a large gap in relevant research explaining its

impressive development and rapid growth during the last 14 years. Former communist and currently developed and developing market economies of CEE, having among themselves EU and non-EU members, provide an excellent opportunity to test whether the relationship between maturation of national economical and financial systems and mutual fund industry development also holds in less efficient markets. Relevant studies structured upon CEE economies are rather scarce and restrict their interest to banks (Havrylchyk, 2009) and pension funds (Jackowicz and Kowalewski, 2012) rather than mutual funds *per se*. As for determinants and attributes of CEE mutual fund industry growth, so far to our knowledge there is no a single study on this subject.

3 Data and Methodology

The existing literature predicts that development of mutual fund industry depends on a number of factors among which the predominant role belongs to development of economic and financial system and quality of governance. In particular, existing studies confirm that, on average, financial intermediaries are larger, more active and more efficient in high-income countries with lower income heterogeneity (Demirguc-Kunt, 2011). Further it is natural to assume that financial intermediaries will be larger in countries, where consumers are better educated and have better access to information, financial institutions and markets (Khorana et al., 2005). Besides overall economic development, openness to trade and capital flows, being an indicator of integration with international capital and goods markets, is particulary important for promotion country's financial system and asset management development (Čihák et al., 2012). In this context it is important not to forget that openness is closely interconnected with risk to cross-border financial contingency and crisis (Laeven and Valencia, 2012). In light of stated above it is expectedly that while analyzing determinants of asset management development it is necessary to operate with the following explanatory variables: GDP per capita and Gini index, literacy rate, average number of newspapers and internet users per capita, total trade to GDP ratio, sovereign debt to GDP ratio, FDI to GDP ratio, and financial crisis dummy variable.

Emergence and development of asset management can be viewed as further stage of financial system maturation. Thus while investigating fund industry development a number of explanatory variables referring to financial system development should be taken into consideration: size of capital market, given by market cap to GDP ratio, its turnover and liquidity, given by ratios of total shares traded to GDP and to market cap respectively, size of banking sector, given by total bank assets to GDP ratio, bank concentration, given by share of total banking assets held by top three banks, and its ability to transfer funds, given by ratio of total bank credits to total bank deposits, and, ultimately, size of insurance sector, given by total life and non-life insurance assets to GDP ratio, real interest rates, return of local exchange index and its volatility (Fernando et al., 2003; Klapper et al., 2004; Beck et al., 2010; Demirguç-Kunt, 2011; Čihák et al., 2012).

The ultimate group of factors the impact of which should be taken into consideration are the ones referring to quality of governance and regulatory basis. On the basis of studies by La Porta et al. (1998) and Kaufmann et al. (2009) it is natural to assume that demand for mutual funds will be higher, if legal system is stronger. Following La Porta et al. (1998) and Kaufmann et al. (2009) for evaluation the impact of quality of governance and regulatory basis on mutual fund industry development the following explanatory variables are used: (1) voice and accountability; (2) political stability; (3) government effectiveness; (4) regulatory quality; (5) rule of law; and (6) control of corruption.

This paper aims to reevaluate on the sample of developed and developing CEE economies the impact of factors identified in previous studies and presented above. For research design purposes and on the basis of World Bank income approach, 11 CEE economies have been divided into two groups – high-income CEE economies with $ 801.08 billion of total GDP or $ 13 517 per capita (Poland, Czech Republic, Slovakia, Hungary, Slovenia, Estonia), and middle-income CEE economies with $ 1 169.56 billion of total GDP or $ 6

199 per capita (Latvia, Lithuania, Russia, Ukraine and Belarus). This study departs from previous ones by using a new database of more than 5000 open-end mutual funds operating in CEE in the time-window of 2000-2014. Although chosen sample does not cover as large number of countries as previous studies, it provides an insight into CEE fund industry, documenting important country and regional characteristics. Following established practice, for evaluation of explanatory power of particular growth factors and development attributes the size of the mutual fund industry, given by its market capitalization to GDP ratio has been regressed by means of pooled OLS with 95% statistical significance over a number of explanatory variables mentioned above. The panel data used was of both raw and ready-made character and its was collected from various sources: (1) data for variables of capital market and fund industry development was partly derived from Bloomberg and partly provided by Investment Company Institute and European Securities and Markets Authority; (2) data for variables of economic and social development was derived from the World Development Indicators (WDI) and International Financial Statistics (IFS); (3) data for variables of quality of regulatory basis and governance was derived from database by Kaufmann et al. (2009). The applied approach comprised the following sequence of steps: (1) identification of full range of potential determinants and choice of representative variables (proxies) on the basis of empirical evidence and existing studies; (2) setting up and adjusting of database (especially it was the case of Bloomberg, raw data from which required manual corrections for outliers); (3) running pooled OLS regressions.

4 Results

Having $ 4 645.60 billion of assets under management (AUM) in EU-member and CIS-member states and growing at an annual rate of 35%, CEE fund industry along with Latin American counterpart occupies the leading position among the emerging mutual fund industries in the world having Islamic and Asian fund industries lagging behind.[1] A number of factors contributed to such outstanding growth, among which the prominent role was played by rapid economic and financial system development of CEE states: $ 1.97 billion of cumulative regional GDP and $ 1 069.15 billion of regional market capitalization, growing at an average annual rate of 5% and 27% respectively, which are nearly twofold of EU's average. Although such development is rapid and overall regional progress in building local capital markets is impressive, the development of fund industries within CEE varies from state to state: on the one hand, there are four EU-member states, which are most important in terms of industry development – Poland, Czech Republic and Hungary - whose funds value account for more than 75% of that of CEE; and on the other one there are CIS-member states, led by Russia, whose funds growth account for more than 80% of that of CEE. Thus taking into account the gradually growing importance of CEE fund industry for the world asset management and high heterogeneity inside the group this paper aims is to identify the key determinants of such rapid growth and variety of development patterns.

Before presenting the obtained results it is necessary to state that majority of factors, on the explanatory power of which many earlier existing studies insisted, did not confirm in our research. Among factors, whose impact at 95% significance has not proved itself, there are national income heterogeneity, literacy and mass media coverage rates, susceptibility to financial contingency and crisis, capital market turnover and degree of bank concentration and intermediation in transfer of funds – these variables were dropped from the constructed regression due to low level of their low explanatory power.

On the basis of obtained results, presented in Table 1, we find a strong positive relationship between mutual fund industry size, given by AUM to GDP ratio, and national income, openness to trade and national government indebtedness. This trend is common for all CEE economies - both EU-member states (especially strong cases are Poland, Czech Republic and Hungary) and CIS-members states (Russia) – and it is consistent

[1] Here and after according to authors' own calculations based on data from Bloomberg and WDI and IFS

with earlier findings by Klapper et al. (2004) and Demirguc-Kunt (2011). Further we find that such relationship holds within subsample of high-income CEE economies, but partly fails for their middle-income counterparts, whose asset management benefits from growth in national income, but suffers from increase in sovereign debts made by their national governments. This can be explained by the decreasing rate of return on fixed income assets hold by local mutual funds, which is the predominant type of assets among mutual funds in middle-income CEE economies. We also find that for the development and growth of mutual fund industry in the middle-income economies the important role play countries' openness to FDI and access to Internet, which is consistent with findings by Tulbure and Catarama (2009). This can be explained by low rate of people savings in such economies as Russia and Ukraine, and, thus, higher dependence on foreign investment inflows from abroad.

As for attributes given by development of financial systems in CEE economies, so we find a strong positive impact of growth in local stock markets liquidity and return, and bank assets to GDP ratio, which is common for all CEE economies. Further within both high- and middle-income subgroups we find a strong negative impact of growth in stock market volatility and real interest rate on development and growth of local mutual fund industries. All these findings are consistent with evidence provided by Beck et al. (2010) and Čihák et al. (2012) and it can be explained by the crucial roles of capital markets as the major targets and banks as major providers of investments for asset management in general and for CEE mutual fund industry in particular.

The ultimate group of factors, which could potentially explain the difference in growth and development patterns of mutual fund industry across developed and developing CEE economies, constitute the ones measuring development of regulatory basis and quality of governance. So we find that development and growth of local asset management across all CEE economies is strongly positively influenced by increase in freedom of expression and association, including free media, increase in quality of public and civil services provided by local authorities, and increase in formulation, implementation and long-term commitment to sound policies aimed at promotion of individual initiative and entrepreneurship. These results are consistent with evidence provided by Klapper et al. (2004) and Khorana et al. (2005). Surprisingly, but we also find the strongly opposite effect of political stability: on average, mutual fund industries grow faster in those CEE economies, where there is higher probability of unconstitutional overthrow and government takeover. This could be the case of Russian and Ukrainian asset management which under condition of abnormal political risk and risk of national government default offers high risk premiums, and, thus above-average local funds outperformance.

Table 1 Determinants of mutual fund industry size in CEE economies. pooled OLS

	All economies			High-income economies			Middle-income economies		
Intercept	521.77	2878.92***	635.30	7617.72***	2494.93	7525.95	454.14*	722.06*	
log GDP/capita (const. P. USD pc 2005)	37.050***	184.874**	577.681**	-39.472***	-11.303**	588.577**	46.175***	86.927**	209.737***
(Ex+Im)/GDP (%)	-1.978	2.711*	8.747**	-3.897*	7.480	4.278	0.349	-1.529**	0.344
Central government debt / GDP (%)	14.553***	15.285***	10.266*	16.533***	18.536***	29.571**	0.184	0.896	-4.138*
FDI net/GDP (%)	16.778***	0.566	-5.200	13.513**	-2.826	-9.516	12.060***	13.380**	22.017***
log Internet users (per 100 inhabitants)	6.046**	1.167	5.414	12.835***	3.776	-1.351	2.320***	2.126**	9.382**
Cap gross/GDP (%)		-0.001	-0.001		-0.002	0.017		-0.001	0.040*
Turnover ratio (Stocks traded/Cap)		0.020	0.032		0.030*	0.040		-0.001	-0.002
Liquidity ratio (Stocks traded/GDP)		0.033*	0.075*		0.228	0.001*		-0.017	-0.049
MSCI return		0.718***	1.017***		0.963***	1.110**		0.103	0.151*
MSCI volatility		-0.326**	-0.093*		-1.299*	-0.907*		-0.026	-0.111*
Real interest rate (%)		-0.552**	5.557**		-4.313*	-39.466**		-2.627	-7.313*
Bank assets gross/GDP (%)		4.476**	6.686**		5.304	8.654**		1.353**	2.173**
Insurance assets gross/GDP (%)		0.078	2.206		1.088	-2.711		0.024	0.124
Voice of accountability			22.813**			37.127***			8.371*
Political Stability			-17.093**			38.892***			-2.008**
Government Effectiveness			6.789*			25.283*			3.566*
Regulatory Quality			38.809**			89.239*			12.978*
Rule of Law			-15.967			-13.885			-18.822
Control of Corruption			-23.348			-20.898			7.868
R2. adj.	0.355	0.539	0.578	0.397	0.490	0.605	0.601	0.660	0.787
Number of countries	11	9	7	6	5	4	5	4	3

Source: Own computation. Table shows results for pooled OLS regressions with robust standard errors.

*. **. and *** show significance at 10%, 5% and 1%.

5 Discussion

The fast changing world of international capital markets and asset management industry during the last decade experienced emergence and rapid development of new players from the Central and Eastern Europe. These high- and middle-income CEE economies have all chances to become powerful competitors for their counterparts from developing economies in the world, and provide good investment opportunities for investors from developed economies.

The existing literature predicts that development of mutual fund industry depends on a number of factors among which the predominant role belongs to economic and financial system development and quality of governance and regulatory basis. This paper reevaluates on the sample of high- and middle-income CEE economies the impact of factors identified in previous studies. This study departs from previous ones by using a new database of more than 5000 open-end mutual funds operating in CEE during the last 14 years. Although chosen sample does not cover as large number of countries as previous studies, it provides an insight into CEE fund industry, documenting important country and regional characteristics. The obtained results have two dimensions. First of all, many factors, the high explanatory power of which was stressed by earlier studies, turned out to be insignificant in our research. Among factors, whose impact at 95% significance has not proved itself, there are national income heterogeneity, literacy and mass media coverage rates, susceptibility to financial contingency and crisis, capital market turnover and degree of bank concentration and intermediation in transfer of funds. This can be explained by the earlier stated fact that relevant studies were structured mainly upon mature economies and, thus, their generalizations and prediction may not work in environment of developing economies. The second dimension is confirmation of significance of a rather small number of factors, whose role in development of asset management works in both developed and developing economies. In particular, there was found a strong positive relationship between mutual fund industry size and national income, openness to trade and national government indebtedness. Further there was found a strong positive effect of growth in local stock markets liquidity and return, bank assets to GDP ratio, and indices referring to voice and accountability, government effectiveness, regulatory quality, and a strong negative impact of growth in stock market volatility, real interest rate and political stability on development and growth of local mutual fund industries. These results might be extended by further study of CEE funds risk-adjusted ability to beat the market and, if any, determinants of it.

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Using Correlation Structure to Analyse Relation between ETFs with Particular Index as an Underlying and These Indices

Dagmar Linnertová

Masaryk University
Faculty of Economics and Administration, Department of Finance
Lipova 41a, 602 00 Brno, Czech Republic
E-mail: Dagmar.Linnertova@mail.muni.cz

Abstract: *The paper examines dependability and connectedness in the world ETFs market. Respectively, what are similarities and differences between world indices and particular index ETFs. The usage of network structure helps to fully identify relation between particular ETFs and indices that represent the underlying assets of these ETFs. The application of the graph theory contributes to particularized understanding relations in ETFs market. Network modelling of capital market offers a powerful tool, because it provides another view on dependences in a market.*

Keywords: ETF, network structure, index, correlation, graph theory

JEL codes: G10, G17, G 19

1 Introduction

The aim of this paper is to analyze the similarities and differences, respectively, between correlation structure in world market indices and ETFs with underlying asset of one of these world indices. The graph theory is useful tool for understanding relations in the ETFs market and obtaining the survey about the situation in this market. This theory becomes very popular in the last year and it is used in biology, sociology or other fields of science including finance.

ETFs are open-end mutual funds which shares are individually traded in particulars stock exchanges. ETFs use a specific creation mechanism called in-kind mechanism that represents exchange of the basket of underlying securities with a large block of ETFs shares. These baskets of securities should be thematically focused (sector, industry) or very often represent a particular market index. There existed thee ways how ETF mimics underlying assets – full replication, sampling or synthetic replication. The difference between performance of underlying asset and ETFs is measured by so called tracking error. Tracking error is defined as a volatility of price-based weekly excess returns over benchmark. Continual daily trading make ETFs more flexible compare to other passive form of investment because they are traded generally like individual stocks.

2 Methodology and Data

For analysis was used Bloomberg data for 18 main world indices and U.S. ETFs that have as an underlying asset one of these indices. Because there are more ETFs with the same underlying asset, thus the ETF with the highest asset value was chosen. The network analysis is based on daily observation from 1st January 2009 to 31st December 2013 it means 5 years. This period represents 1.825 daily observations.

Table 1 List of analyzed indices, ETFs, respectively

	Index	**Ticker**	**ETF/ Replication strategy**	**Ticker**
America	Dow Jones Industrial Average	INDU	SPDR DJIA Trust/ Full	DIA US Equity
	S&P 500, New York SE	SPX	ProShares Ultra S&P500/ Derivative	SSO US
	S&P 500/ TSX, Tokyo SE	SPTSX	iShares S&P	XIC CN

			500/TSX ETF/ N.A.	
	Ibovespa Brasil Sao Paulo SE	IBOV	1325 TT ETF/ N.A.	1325 JP
Europe	EURO STOXX 50	SX5E	KSM EuroStoxx 50 ILS/ N.A.	KSMSX5E IT
	FTSE 100, London SE	UKX	KSM FTSE 100/ N.A.	KSMFTSE
	CAC 40 Paris SE	CAC	Amundi ETF CAC 40/ Full	C4D FP
	Deutsche Boerse AG German, Frankfurt SE	DAX	iShares DAX/ Full	DAXEX GR
	IBEX 35, Spain SE	IBEX	BBVA Accion Ibex 35 ETF/ N.A.	BBVAI SM
	FTSE Mib, Boersa Italia	FTSE MIB	db x -tracker FTSE MIB ETF/ Full	XMIB GR
	AEX, Amsterdam SE	AEX	Think AEX ETF/ Full	TDT NA
	OMX Stockholm 30	OMX	KSM Scandinavia/ N.A.	KSMOMX IT
	Swiss Market Index	SMI	db x -tracker SMI ETF/ Full	XSMI GR
	Russian Trading System Cash, Moscow SE	RTSI$	NEXT FUND Russia RTS Lined ETF/ N.A.	1324 JP
Asia-pacific area	Nikkei 225, Tokyo SE	NKY	Nomura ETF Nikkei 225 ETF/Full	1321 JP
	Hong Kong Hang Sheng, Hong Kong SE	HIS	Tracker Fund Hong Kong Ltd/ Full	2800 HK
	Shanghai SE, Shanghai SE	SHCOMP	Fullgoal SCI Index ETF/ Full	510210 CH
	S&P 500/ ASX, Australia SE	AS51	Psagot Sal Australia D2/ Full	MAS5168 IT

Source: author, based on Bloomberg categorization

For identification of relations between individual indices, resp. ETFs is used correlation-base procedure. The advantage of using correlation network is that it offers general view on overall connectedness between analyzed elements.

Mantegna (1999) suggests hierarchical arrangement of stock traded in a financial market based on daily time series of logarithm of stock prices. Onella et al. (2008) propose new methodology for construction a dynamic asset graph. But this methodology does not create a tree but a disconnected graph. Bonanno et al. (2004) show that correlation matrices contribute to understanding of economic information. Huang et al. (2009) applied network analysis on Chinese stock market. Kajurova & Deev (2013) apply network structure to credit default swaps market. Correlation structure is used to identify relations between CDS spreads. The investigation will be executed in three parts:

- Individual correlation network structure for 18 world indices.

- Individual correlation network structure for 18 ETFs with underlying assets corresponds with world indices, in this case it is expected same or very close results as in the previous part.
- And network structure for both it means individual indices and ETFs.

In the Table 1 are introduced analyzed indices and particular ETF with corresponding underlying asset.

The correlation network is obtained by filtering the relevant information present in the correlation matrix of the original time series. This is done in three steps. (Bonnano, at al., 2004)

- Determining of synchronous correlation coefficient of the difference of logarithm of stock price computed at a selected time horizon.
- Calculation a metric distance between all the pair of stocks.
- Choosing the subdominant ultrametric distance associated to the considered matric distance. This subdominant ultrametric is structure closest to the original metric structure (Rammal, at al., 1986).

For the analysis are used logarithmic returns because the normality assumption makes them more suitable.

Calculation of logarithmic return is based on formula:

$$r_i = \ln P_i(\tau) - \ln P_i(\tau + 1) \tag{1}$$

Where $P_i(\tau)$ stands for daily close price at time τ and $P_i(\tau + 1)$ stands for daily close price at time $\tau + 1$.

These logarithmic returns are used for calculation of correlation coefficients between all possible pairs of indices, resp. ETFs in the dataset. The correlation coefficient is defined as:

$$\rho_{ij}^{t} = \frac{\langle r_i^t r_j^t \rangle - \langle r_i^t \rangle \langle r_j^t \rangle}{\sqrt{\left[\langle r_i^{t^2} \rangle - \langle r_i^t \rangle^2\right]\left[\langle r_j^{t^2} \rangle - \langle r_j^t \rangle^2\right]}} \tag{2}$$

Where, r_i resp. r_j stands for a particular return of index, resp. ETF and *j*, resp. *i* stands for an individual index, resp. ETF. The number of correlation coefficients corresponds with *n(n-1)/2,* where *n* is number of indices, resp. ETFs. Individual correlations are transforming into matrix **D** based on Gower's distance:

$$d(i,j) = \sqrt{2(1 - \rho_{ij}^{t})} \tag{3}$$

The correlations must fulfil matric axioms to be used as matric:

- Non negativity: *d(i, j)≥0,*
- Coincidence: *d(i, j) = 0,*
- Symmetry: *d(i, j) = d(j, i),*
- Subadditivity: *d(i, k)≤ d(i, j)+ d(j, k).*

This distance matrix can be used to look for a hierarchical structure of this matric. It is used to determine MST (minimal spanning tree) connecting the *n* indices, resp. ETFs. The MST provides an arrangement of instruments which selects the most relevant connections of each point of the set. Further, the MST gives the subdominant ultrametric hierarchical organization of the points (instruments) of the investigated portfolio (Mantegna, 1998).

In the graph theory the MST is the spanning tree of the shortest length. A spanning tree is a graph without loops connecting all the *n* nodes with *n – 1* links. The original fully connected graph is metric with distance $d_{i,j}$ which is decreasing with ρ_{ij}^{t}. Thus, MST selects the *n* – 1 stronger (shorter) links which span all nodes. The MST allows to obtain the subdominant ultrametric distance matrix **D** and the hierarchical organization of the

instruments (indices, ETFs) of the investigated data set. The subdominant ultrametric distance between objects *i* and *j*, is the maximum value of the metric distance $d_{(k,l)}$ detected by moving in single steps from *i* to *j* through the path connecting *i* and *j* in the MST. The method of construction a MST linking a set of *n* objects is direct and it is known in multivariate analysis as the nearest neighbour single linkage cluster analysis (Bonnano, at al., 2004). The straightforward choice for solving MST problem is Kruscal's algorithm (see Kajurova & Deev, 2013).

3 Results and Discussion

In the Figure 1 is introduces the correlation network for main world indices. Size of the nodes reflects volatility; links between nodes represent correlation (shorter link means higher correlation). We can see that the European market is very strong correlated. The hubs of this correlation represent index Euro Stoxx 50 and index DAX (with correlation coefficient 0,95 between them). Further, the other European indices have strong correlation to them. So we can see some form of cluster in the European market. Only the index OMX (OMX Stockholm 30) is isolated from this cluster. The relation between European and American capital market is intermediate by the relation between DJIA and DAX with correlation coefficient 0.70. The main U.S. indices DJIA and S&P 500 represent the hub for other American indices and again these two indices are very strongly correlated with coefficient 0,98. The relation between European and Asian-pacific capital market is via relation between RTSI$ and HSI Index with correlation coefficient 0.46. Again the HSI represents the hub of Asia Pacific region.

The same correlation network like in Figure 1 but with the value of correlation coefficient is presented in Figure 2.

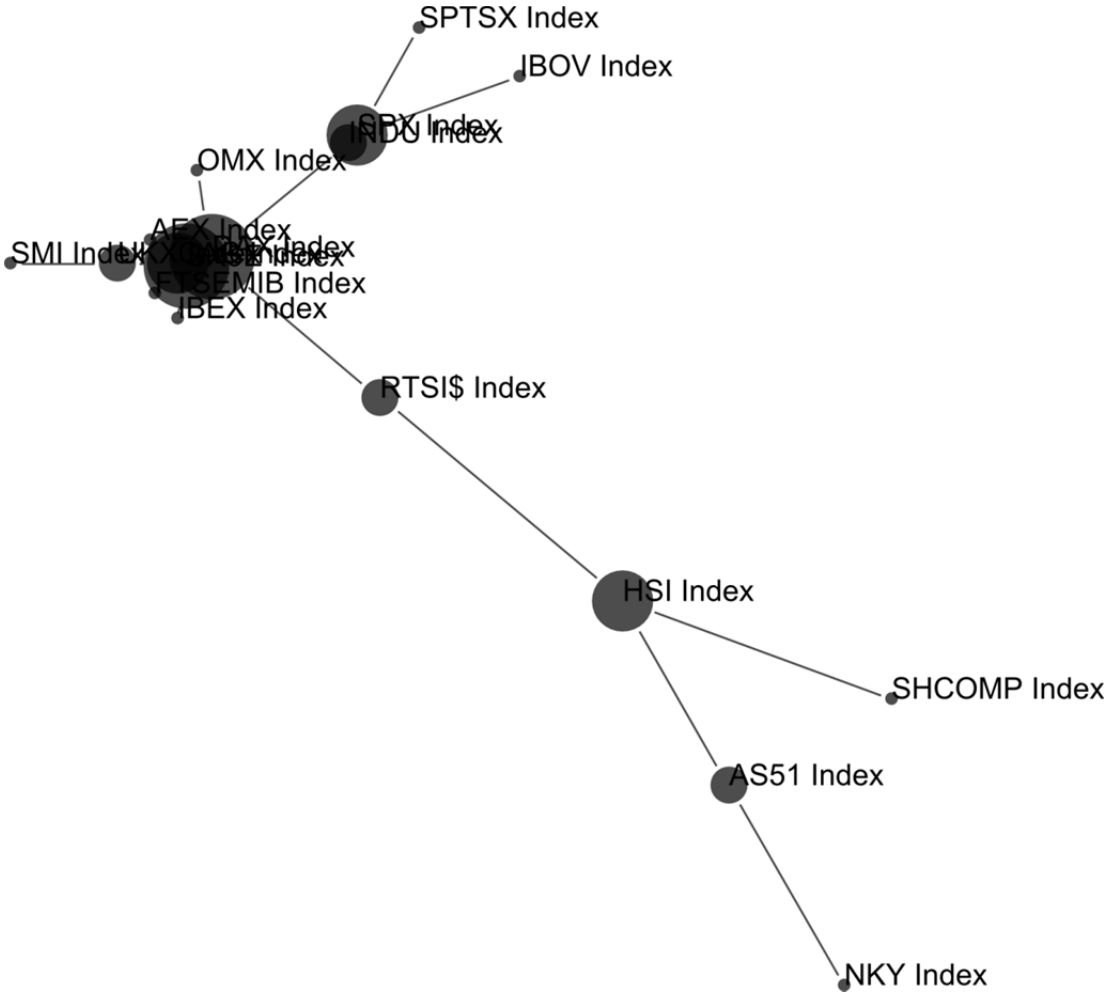
The Figure 3 represents correlation network for ETFs with underlying asset of market index. We expected that the correlation structure will be very close to previous because ETFs in the fact represent way how to participate in a particular index performance. But we can see that the structure is absolutely different. We are not able to get any tree in this market. The ETFs deals more like independent securities with limited number of relation to other ETFs. We do not find any clusters or hubs like in the previous example (Figure 1).

The most links between ETFs are three and in the whole networks are only four of ETFs with tree links. Three of them represent European indices (DAX, FTSE Mib and Euro Stoxx 50) and one ETF represents U.S. index S&P 500. In the whole structure the strongest correlation exists between ETFs represent DJIA and S&P 500 index (correlation coefficient is 0,98). In the ETFs market does not exist any relation between two main European indices Euro Stoxx 50 and DAX that was found in the analysis of individual indices.

Four ETFs are absolutely uncorrelated without relation to the others. These ETFs represent Hang Sheng Index (ETF 510210 CH Equity), Australian Index (ETF MAS5168 IT Equity), CAC 40 Index (ETF C4D FP Index) and Amsterdam Index AEX (ETF TDT NA Equity).

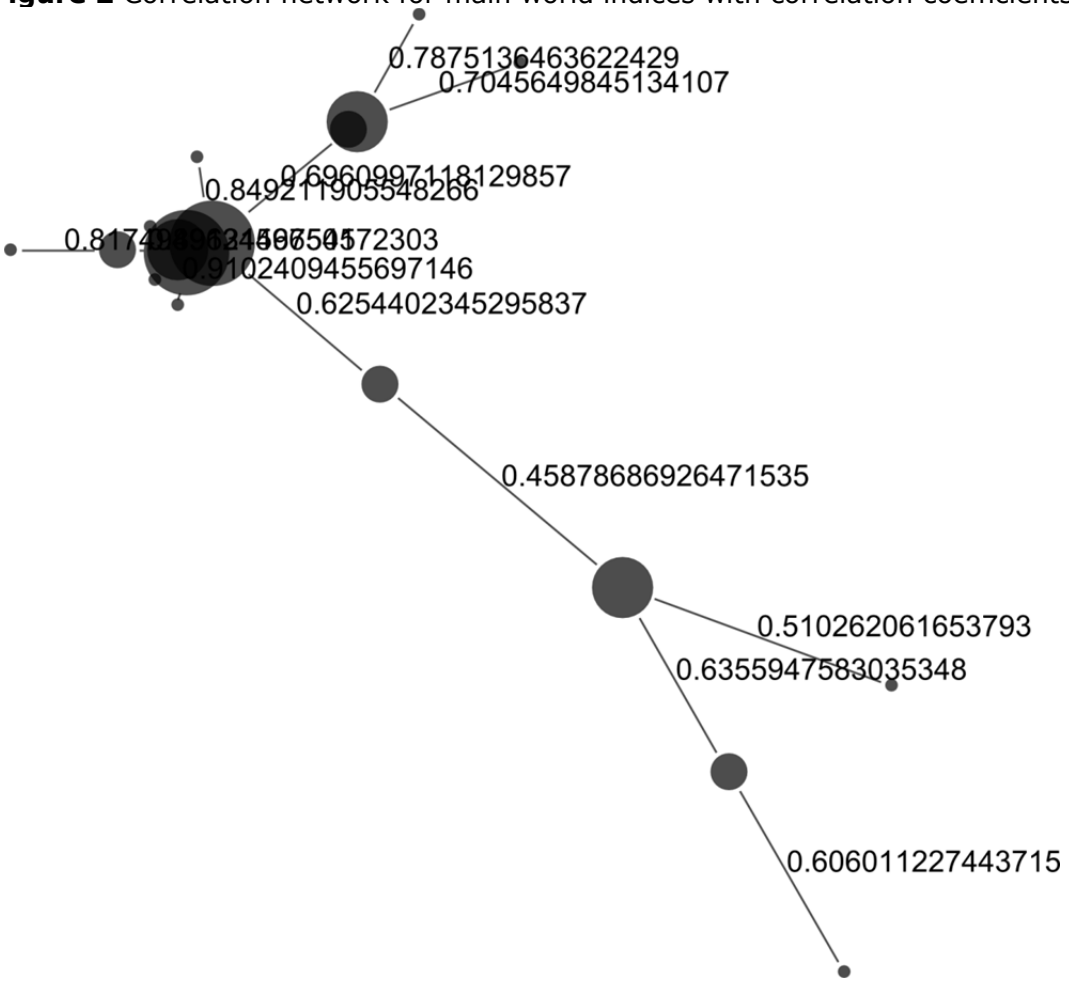
Further, we can see in the ETFs market that exist relations between ETFs that belong to a particular family based on provider. For instance, there are three ETFs provided by the Investment Excellence LTD. These ETFs are named KSM (KSM SX5E IT, KSM FTSE, KSM OMX IT) and we can see strong correlation between them where ETF with underlying Euro Stoxx 50 represent the intermediary of this relation.

Figure 1 Correlation network for main world indices



Source: authors' work

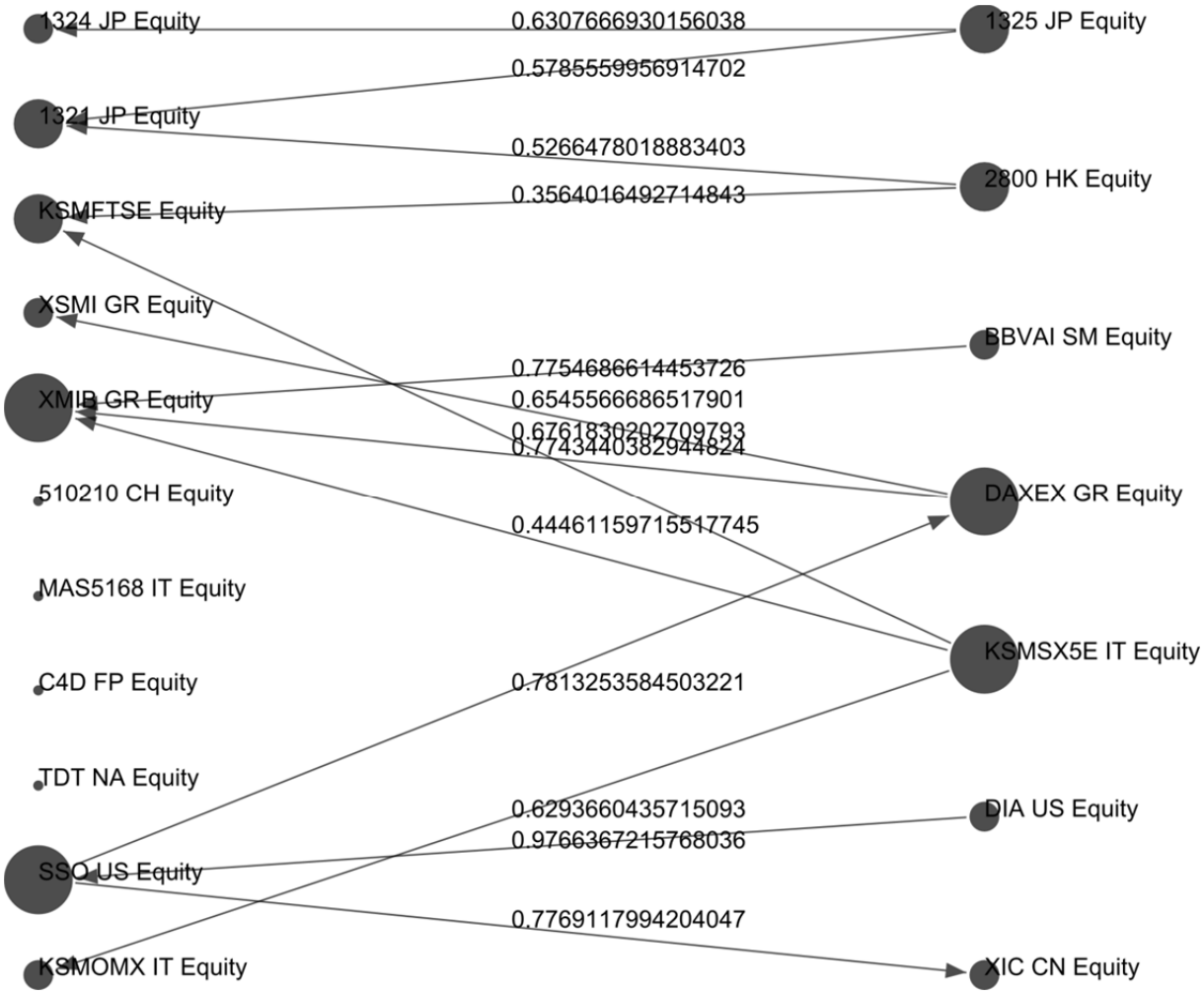
Figure 2 Correlation network for main world indices with correlation coefficients



Source: authors' work

The same works for ETFs provided by Nomura (1325 JP Equity with underlying Ibovespa, 1324 JP Equity with underlying Russia SE index and 1321 JP Equity with underlying Nikkei 225). In the family of Nomura ETFs Ibovespa works like intermediate between the rest Nomura ETFs. Thus, here we can see baseless relation between indices of Brazil, Japan and Russia that does not exist in the structure displayed in Figure 1.

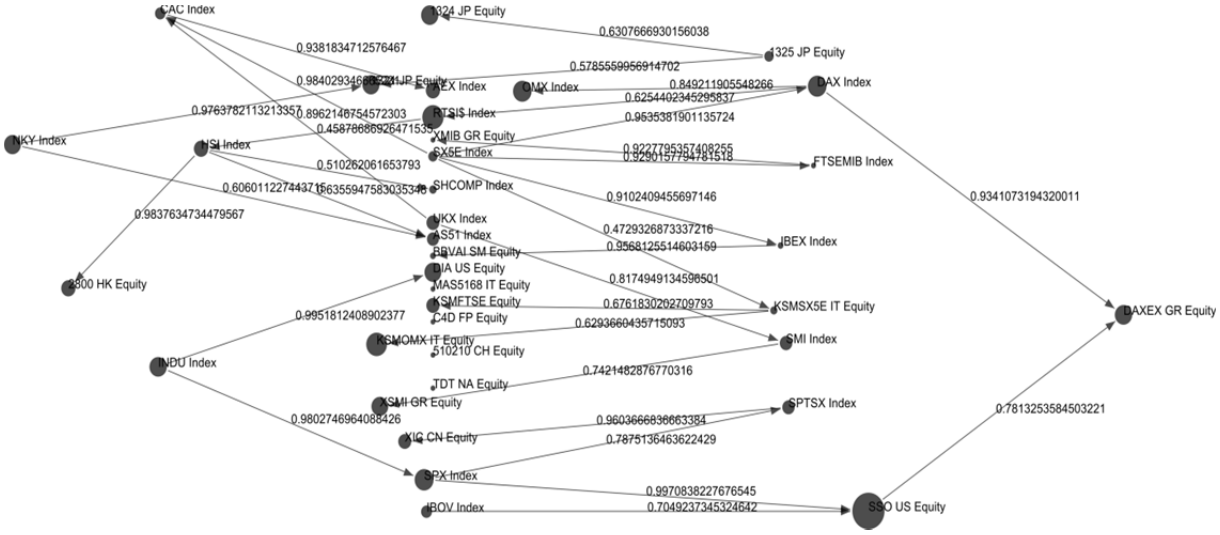
Figure 3 Correlation structure for main ETFs with a particular world index as an underlying



Source: authors' work

The Figure 4 represents correlation structure if ETFs and indices are taken into consideration. Also in this case we are not able to get the tree. Surprisingly we can see that in this structure some of ETFs are not connected with an appropriate in index (C4D FP Equity, TDT NA Equity, 510210 CH Equity and MAS5168 IT Equity). On the other hand other ETFs embody very strong correlation to underlying (e.g. between INDU and DJIA with correlation 0,995 or DAX and DAXEX GR with correlation 0,934). Also in this network we can see that for some ETFs is its relation to a particular provider family more important than the relation to the index (family of Nomura ETFs or KSM ETFs with correlation to each other but without relation to underlying indices).

Figure 4 Correlation network for main world ETFs with underlying asset of particular index



Source: authors' work

4 Conclusions

The analysis of market topology is a useful tool to find out meaningful information from correlation coefficient matrix. The MST offers opportunity for dynamics of market with particular instruments. The aim of this paper was analyzed similarities, resp. differences between main world capital market indices and ETFs with these indices as underlying assets. The investigation was based on using of correlation network. We found out significant differences in correlation structure of indices and ETFs. The structure of indices is in accordance with expectation. In the correlation structure of ETFs we discovered that some ETFs existed independent with no relation to other. Also between some ETFs exists correlation relation because these ETFs have the same provider. Thus, the provider is more important aspect rather than relation to the underlying asset. If we analyzed indices and ETFs in one correlation structure we found out that some ETFs have no relation to their underlying asset.

Acknowledgments

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Optimal Decision for Convertible Debt Financing - Some Observations from the American Market

Jakub Marszalek

University of Lodz
Faculty of Management, Department of Business Management
Matejki Street 22/26, 90-237 Lodz, Poland
E-mail: jakmarszalek@gmail.com

Abstract: *Choosing an appropriate proportion between debt and equity is one of the most important decisions in a financial management. A convertible bond may be an attractive financial instrument that helps to achieve the optimal capital structure of a company. In this paper, we analyze 562 issues of the bonds from the American market between 2002-2013. The financial sector companies were excluded from the sample due to a different financial statement structure and different motives of the hybrid debt issuance. Using the regression trees analysis, we give some hints, what is the main goal of the paper, for the optimal convertible debt financing, considering the most important characteristics of the issuers' financial standing and the parameters of issued convertibles. Our research let us to formulate a few conclusions. Firstly, we find some relationships between a conversion premium, a conversion period and a conversion ratio. Secondly, it turns out that most of the issuer's financial characteristics were not statistically significant for the issued convertibles. Finally, it was proved that a participation of fixed assets in a balance sheet seems to be one of the most important factors determining the internal structure of issued hybrid instruments which supports the assets substitution theory.*

Keywords: capital structure, financing, convertible bond, American company, assets substitution theory

JEL codes: G12, G30, G32

1 Introduction

The issuance of hybrid financial instruments, particularly convertible bonds, has been a subject of research for more than four decades. The result of previous analyses lead to formulate several theories associated with the financing structure concept. One of them, the asset substitution hypothesis, argues that shareholders may increase debt due to the unbalanced distribution of the benefits and risks around investment projects financed by the outside capital (Jensen and Meckling, 1976). When a project ends up with success, shareholders obtain a higher rate of return from creditors. By contrast, if an investment fails, they lose only a potential value of their shares, while creditors risk the entire capital they have invested so far. According to the asset substitution hypothesis, a company may issue hybrid debt in order to reduce the conflict between shareholders and creditors. A conversion option built in a convertible bond may help to restrict a shareholders' incentive to take an excessive risk (Green, 1984). When a price of underlying shares is high, which increases a probability of conversion, shareholders avoid taking an additional risk in order not to lose a benefit from a future growth of a company's value. Such a mechanism protects creditors from an excessive risk. It means that a use of hybrid debt is particularly profitable for low-value companies, especially when their value achieves such a low level after a long period of recession. Because a likelihood of an increase in underlying share price is fairly high, it secures the interests of creditors until a debt maturity and also gives them an opportunity to benefit from a possible conversion. There are a lot of studies validating the notion of the asset substitution hypothesis. E. Essig notes that companies exposed to a high financial risk are more likely to issue hybrid debt (Essig, 1991). He finds the relationship between a level of debt and a degree of a financial leverage versus a level of hybrid financing (Lewis et al., 1999). His study also proves a better long-term performance for the firms which decided to issue hybrid instruments (Loncarski et al., 2006).

A back-door equity hypothesis considers a hybrid capital financing in a different way. According to this concept, a use of convertibles is associated with an equity financing, because conversion into shares results in increase of an equity participation in the whole capital structure of a company. Therefore, a convertible capital may be perceived as a deferred equity (Stein, 1992). Enterprises may use convertible instruments in order to, firstly, avoid the costs of financial distress or, secondly, to mitigate adverse selection problems and reduce negative effects of an information asymmetry due to an issue of overvalued equity. It may raise a cost of capital and cause that companies forego profitable investment opportunities. The lower coupon which, is usually associated with the convertibles issues, and the lower probability of bankruptcy, may also diminish a risk of a hostile turnover. It is particularly important during unfavourable economic conditions, such as recession (Dann and Mikkelson, 1984). However, several research proved that issues of convertible debt may lead to a bigger depreciation of underlying shares in comparison to ordinary bonds (Ammann et al., 2006). This may hinder the low-valued firms to avoid a hostile takeover (Elbadraoui et al., 2010; Zeidlera et al., 2012).

Most of the presented theories assume that an issuance of convertible bonds is more profitable for companies whose shareholders are sensitive to risk changes or which can relatively easy change such a risk. Obviously, it is not simple to measure the level of propensity to increase the risk of shareholders. However, several research indicate certain circumstances where risk aversion may be lower, for example highly leveraged companies (Myers, 1977). Moreover, D. Galai and R. Masulis, using the Black-Scholes model, demonstrate that the higher the level of indebtedness, the higher the risk of equity (Galai and Masulis, 1976). Furthermore, a high level of debt may cause that managers undertake risky investment projects which potentially may turn out very profitable, but also have a high probability of failure. Such a strategy may be an attempt to rescue the superior position of managers in a firm. On the other hand, companies involved in high-risk projects may prefer a hybrid debt financing compared to other means of financing due to the lower cost of capital.

Many other studies show a positive relationship between the size of issued debt, degree of financial leverage and tendency for issuing convertible bonds (Loncarski et al. 2006). However, several hypotheses do not allow for a positive verification. Hu and Mao exhibit that Chinese listed companies which issued convertible bonds are characterized by a low financial risk and a low default risk. They also have a low stock price and shareholders' concentration (Hu and Mao, 2009). These findings justify a validity to use convertibles during a recession but cannot confirm hypothesis presented above. Moreover, issuers of convertibles appear not to be significantly different from the other companies considering their fixed assets, cash flow variability and a profit. Titman and Wessels show that firms with *certain level of* fixed assets are less likely to substitute assets (Titman and Wessels, 1988). In their opinion fixed assets are kind of a liabilities security and limit the ability of new debt issues. For this reason, a company with a high share of fixed assets should avoid issuing convertible bonds.

Despite the rich literary output related to the motives of a use of a hybrid debt, a relatively little attention is paid to the problems of the convertible bonds structure, especially in the context of the issuer's financial performance. Lewis et al. notice that companies with a high growth opportunities (measured by market-to-book ratio) decide to issue convertibles with a shorter conversion period due to minimize a probability of conversion, which makes the bonds more debt-like security (Lewis et al., 1998). A shorter maturity of convertibles is also proved among the firms financing investments in the R&D sector, while nonconvertible bonds are more often issued by companies investing in fixed assets (Julio et al. 2007). However, convertible bonds have initial maturities five years longer in contrast to nonconvertible bonds.

From above-mentioned reasons, the aim of this article is to expand the existing literature and mention a topic which has been widely ignored so far, namely, we want to concentrate on the aspect of the hybrid debt structure in the convertibles financing. In our study, we analyze a correlation between certain parameters of convertible bonds

issues related to the issuers' financial performance. We want to estimate essential level of issued convertible bonds' parameters in the context of the issuers' characteristics. This problem seems to be particularly important, because comprehensiveness and diversity of hybrid debt may determine investors' behavior and influence the issuer's capital structure. It may be especially significant in the context of the previously presented concepts.

The hybrid nature of convertible bonds makes it more difficult for managers to come to proper financing decisions. A conversion option built-in the convertibles, may lower the interest rate of the bonds in comparison to ordinary debt, which makes them profitable for issuers, but less attractive for bondholders. In order to attract investors, a company may set a higher conversion ratio, which translates into higher number of shares which may be taken up by bondholders upon conversion. A higher return from converted shares compensates investors a lower interest income.

Another way to achieve the expected capital structure by convertibles' issuers is to fix an appropriate conversion period. It has a direct impact on a probability of conversion. By short conversion period at high conversion premium, a conversion is unlikely. When a company wants to avoid redeeming convertibles, it may settle a longer conversion period which is usually related to expected period of an investment project. A profitable investment can increase a market value of an issuer and result in conversion. Hence, a company will not have to redeem bonds and can benefit from a lower coupon offered by a convertible debt. Therefore, a long conversion period, with a lower cost of capital, positively affects the issuer's financial standing, because conversion may reduce the real cost of capital, due to a decrease in the indebtedness level.

A conversion value is another parameter that may significantly determine the profitability of the convertible bonds issue. It is influenced by two variables: a conversion period and a conversion premium. They may strengthen, weaken or substitute each other. High conversion premium is unlikely, but its probability increases with the conversion period. A successful convertibles issue may be achieved by optimizing a relation between longer conversion period and a lower conversion premium. The first strategy seems to be profitable in financing long-term or risky investment projects. An issuer may have enough time to increase its market value or enough time to collect buyback funds. Lowering a conversion premium may be reasonable during recession or a short conversion period imposed by a company.

2 Methodology and Data

An optimal hybrid debt financing was analyzed using the regression trees. They are considered to be one of the most important methods of non-parametric discriminatory models. This method involves the sequential distribution of the m-dimensional subspace R_k variables (segments) until the moment when the dependent variable reaches the minimum level of variation (measured by an appropriate loss function). On this basis the expected level of the issued convertible bond parameter was evaluated if the variable (descriptor) reaches a certain level. In case of the regression trees, the distribution assessment of each subspace homogeneity, which shares the same variable was done by using the square function:

$$Q(R_k) = \frac{1}{N(k)} \sum_{x_i \in R_k} (y_i - \alpha_k)^2 \quad (1)$$

where k is determined by the formula $\alpha_k = \frac{1}{N(k)} \sum_{x_i \in R_k} y_i$, and *N(k)* is the number of observations belonging to the segment R_k.

Featured segments of units set, characterized by a set of variables called descriptors, should be homogeneous due to the chosen segmentation criterion. Since these criteria can lead to very complex patterns of distribution (very complex trees), an additional criterion, so-called "the final stop", (trimming trees) was used. It guarantees a satisfactory homogeneity of the segments (a classification error is committed, measured by the risk of misclassification). This method requires no assumptions about the

distribution of variables and is resistant to diverged observations. It is also easy to interpret.

Among the potential explanatory variables, a stepwise variable selection method was used for estimating the parameters of the model. It guarantees the optimal model using the F statistics relevance. If the value of statistics for the specified variable outside the model is high enough, it is used in the estimation, and if the same statistics for variable already used in the model was too low, the variable was removed from the model.

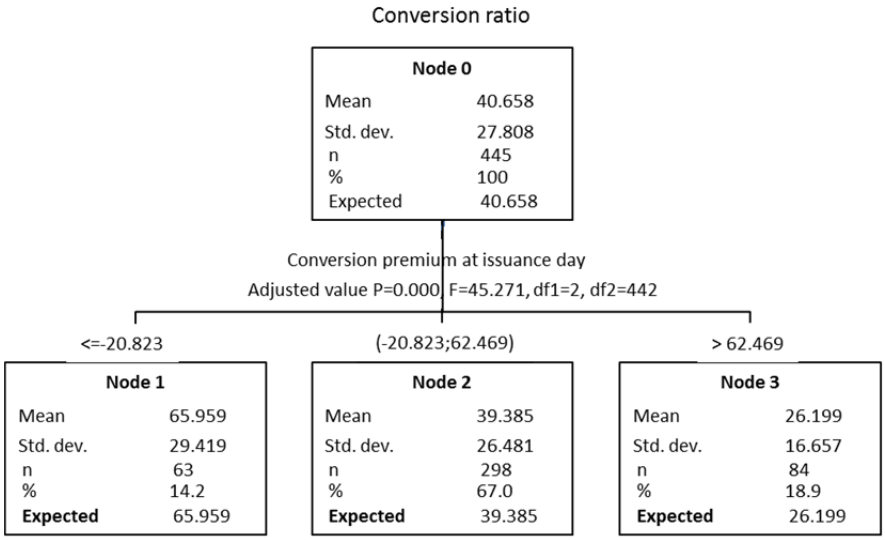
The main assumption of the research is that all successful convertible bonds issues represent consensus between the issuer and investors. It means that all convertible debt parameters were accepted by both sides and asymmetry problems were involved. In accordance with the discussion in section one, a full substitution among convertible bond parameters was assumed. The main goal of the analysis is to find some statistically significant relations between a conversion ratio, a conversion premium and a conversion period of issued convertible bonds. Then particular parameter is compared to several financial ratios computed from the issuers' financial statements. According to previous research and findings, our analysis is focused on the financial risk measured by financial leverage, liabilities and assets structures, liquidity and profitability.

The sample was prepared using Bloomberg database and it encompasses the convertibles issued in the American convertible bonds market, which is supposed to be the biggest in the world. The initial sample contained 134574 issues from all over the world. The issues conducted by the financial institutions were then excluded. Their motives to issue hybrid debt may differ from ordinary companies due to i.a. financial supervision requirements, especially capital adequacy ratios. The financial institutions have a different financial statement structure in comparison with other entities. The sample was also adjusted in terms of unusual, enormous observations. Only listed companies were taken into consideration. The final sample contains 562 convertibles issued by the American, nonfinancial companies between 2002-2013. It includes the firms of any size and sector. Financial data of the issuers were taken from the last annual financial report before the convertibles issue.

3 Results and Discussion

The first parameter analysed was a conversion ratio. It is similar to economic leverage because its changes may strongly determine a rate of return from the convertible bond investment. The higher the conversion ratio, the higher the investor's profits from the conversion, after a certain and sufficient growth in underlying shares price. The higher conversion ratio also increases a problem of equity dilution. Hence, an issuer should use this parameter to manage the attractiveness of the offered bonds.
The analysis of the factors determining the conversion ratio shows a significant influence of the conversion premium at the issuance day. If the difference between conversion price and actual share price is smaller than about 20.8%, the conversion ratio is fixed on average at around 66. If the conversion premium varies between 20.8% and 62.5% - the conversion ratio stands at an average of 39.4. When the premium is higher than 62.5%, the conversion ratio reaches an average of 26.2. Therefore it can be noted that a high conversion ratio occurs when a company is high-valued, so the conversion premium is negative. When the premium increases the conversion ratio decreases. It should be stressed that analyzed parameter is characterized by a very high volatility. Because of a very wide range of applied statistical significance, it is difficult to formulate some practical hints how the conversion ratio should be fixed. The interpretation of node 2 is particularly difficult due to a high level of standard deviation and diametrically different values of the conversion premium. This strong differentiation concerns 67% of the sample.

Figure 1 Regression tree for the conversion ratio



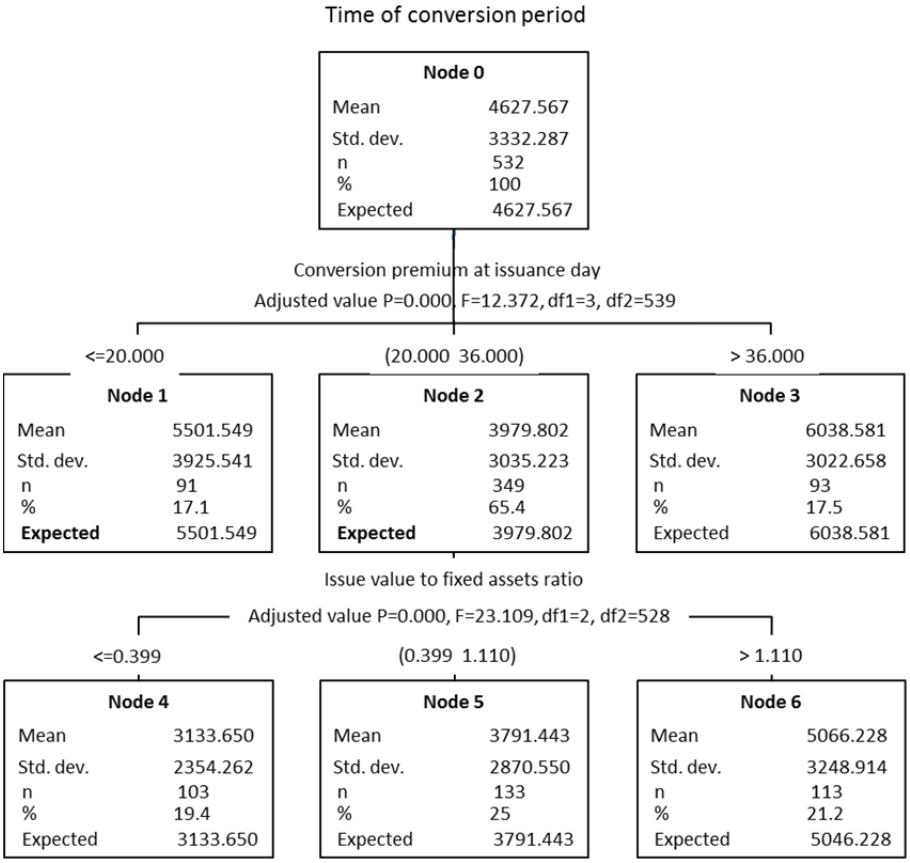
Source: Own calculation using Bloomberg database

The first criterion differentiating conversion period is the conversion premium at the issuance day (Figure 2). If this parameter is lower than 20%, the average conversion period reaches to approximately 5501 days (this applies to about 17% of the sample) and when it is higher than 36% - it reaches approximately 6300 days (this applies to 17.5% of the sample). If the conversion premium at the issuance day is extremely determined, the conversion period is almost twice higher in comparison to more balanced value. When an average level of the conversion premium is about 20-36%, the conversion period should reach about 4000 days. If the conversion premium at the issuance day varies between 20 and 36%, another important criterion appears – the issue value to fixed assets ratio. The higher is the ratio, the higher applied conversion period can be observed. If the level of this variable is relatively low (up to 0.40) the conversion period about 3133 days may be recommended. When the issue value related to fixed assets of the issuer is higher than 1.11 it is recommended to increase the conversion period to approximately 5000 days. If the ratio is between 0.4 and 1.11, the conversion period reaches approximately 3791 days.

The relationship between the parameters of the convertible bonds, their values and the level of fixed assets refers to the asset substitution hypothesis described in section 1. It is the only statistically significant relationship between the elements of the convertible bond structure and the issuer's financial features. The findings of this research indicate that a higher level of debt towards the value of fixed assets extends the conversion period of bonds.

It confirms the asset substitution hypothesis. Fixed assets are a company’s security which protects creditors of a firm. If their value in relation to a new debt is reduced, an issuer’s risk of insolvency increases. In order to make a convertibles issue successful, this risk must be compensated by additional benefits for investors. One approach may be to set a longer conversion period which increases a probability of conversion and expected rate of return from an investment.

Figure 2 Regression tree for the time of conversion period

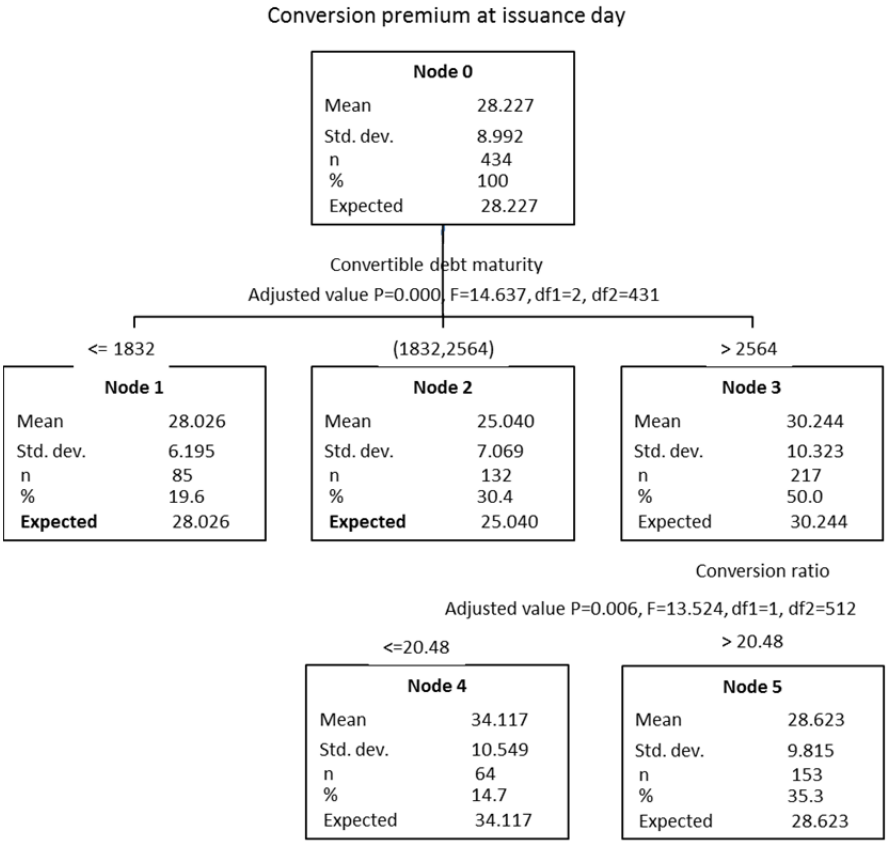


Source: Own calculation using Bloomberg database

The conversion premium at the issuance day is determined by the hybrid debt maturity (Figure 3). It is worth noting that this relationship is not explicit. When the debt maturity is shorter than 1832 days, the conversion premium reaches an average of about 28%. If it is longer than 2564 days - premium reaches an average of about 30%, while the lowest conversion premium is when the debt maturity is between 1832 and 2564 days. When the debt maturity is long, another important factor should be taken into consideration – the conversion ratio. If it doesn't exceed 20.5, the conversion premium is higher (average 34.1%) than with a longer maturity of debt (average 28.6%).

The relationship between the conversion premium and the hybrid debt maturity is related to the analysis showed in Figure 2. Time to maturity of the debt and the conversion period is very similar. They are also strongly and positively correlated. Therefore, they interact similarly to the conversion premium. The strength and direction of this influence, however, is different, which may be explained by the differences between the debt maturity and the conversion period. The relationship between the conversion premium and the conversion ratio also seems to be interesting. Similarly to Figure 1, the inverse relationship between these parameters is observed. Nevertheless, it should be noted, that it concerns only the bonds with the longest maturity. It confirms the ambiguity of the conversion ratio, because it seems to be the most important parameter for the bonds with a short maturity. Such bonds have the lowest time value of the conversion option. The conversion ratio changes could significantly determine the probability of conversion of these bonds.

Figure 3 Regression tree for the conversion premium at the issuance day



Source: Own calculation using Bloomberg database

Conclusions

Convertible bonds can support decisions optimizing the capital structure of the company. The issuer has many possibilities to manage the conditions under which financing will be realized. Successful issuance process depends from the investors offer acceptance. In the current literature, much attention was paid to the asymmetry problems between investors and the issuer that may be solved by the issue of convertible bonds. This article assumes that fact of the issuance constitutes acceptance of the terms of issue by both parties. The study of the U.S. convertible debt market suggests that issuers try to optimize the hybrid financing structure by the relationship between the parameters of convertible bonds. Statistical relationships between the conversion ratio, conversion premium and conversion period was observed. First, high conversion ratio occurred when a company was high-valued, so the conversion premium was negative. When the premium increased the conversion ratio decreased. Moreover, higher is the ratio, the higher applied conversion period can be observed. Finally, the conversion premium at the issuance day is determined by the hybrid debt maturity. Despite the statistical differences in the observed relationships their directions were consistent with theoretical expectations. The issuance means that investors accept conditions that thresholds were determined using regression trees. Their evaluations are too general to formulate detailed guidance for optimal hybrid financing. The research shows, however, the direction of change supporting this optimization.

The obtained results indicate that higher level of debt towards to the value of fixed assets extends the conversion period of bonds. This confirms the asset substitution hypothesis. It also shows that asymmetry problems come from financial risk. Fixed assets are company's security protecting creditors of the company. If their value in relation to the new debt is reduces, the issuer's risk of insolvency increases. To succeed convertible bonds issuance, this risk must be compensated by additional benefits for investors. One

of them may be longer conversion period which increases probability of conversion and expected rate of return from investment. According to other findings, it may be achieved by higher conversion premium. Finally the higher conversion ratio can be applied. It will rise equity/debt ratio and lower the financial risk.

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Investments Allocation Tax Factors in Pre-crisis Time

Lukas Moravec, Gabriela Kukalová

Czech University of Life Sciences Prague
Faculty of Economics and Management, Department of Business and Finance
Kamycka 129, 165 21 Prague 6 - Suchdol, Czech Republic
E-mail: moravec@pef.czu.cz, kukalova@pef.czu.cz

Abstract: *This study sets as its target to verify the influence of tax environment on the foreign direct investments allocation (hereinafter mentioned only as "FDI") and identify the specific tax factors having significant impact on the FDI geographical structure and quantify the factors power applying the correlate and regression functions on the 2006 OECD data. The study analyzes influence of direct taxes burden and consumer taxes burden on investments. Special stress is put on the double tax treaties as a factor influencing cross-border investments tax burden in the time of growing globalization process. The result of this study is the proof that the inward FDI stock geographical allocation among the states of OECD in 2006 is influenced by the social contribution burden, direct taxes burden (personal, corporate, income and profit taxes) and particularly number of concluded double tax treaties. The influence of consumption taxes is not statistically important based on the study conclusions. The research was conducted as a partial result of the CZU PEF IGA 20131056 project.*

Keywords: foreign direct investments, double tax treaties, consumption taxes burden, direct taxes burden, econometric modeling

JEL codes: H21, H22, E62, C51

1 Introduction

Since the introduction of the topic, studies concerned with the USA attractiveness (Bartik, 1985) as well as more recent interesting studies taking into consideration the bilateral effective tax rate (Yoo, 2003) have been carried out; moreover the comparison between tax havens and the USA tax burden has been examined (Yilmaz, 2006) and the question of the double tax treaties role has been introduced (Hajkova at al., 2006). We should mention the OECD publication summarizing the previous results (OECD, 2007). One of the analysis targeted to the double tax treaty importance indicate that double tax treaties lead to higher FDI stocks and that the effects are substantively important (Barthel, 2010). On the contrary there is a study stating that the double tax treaties do not support incoming FDI (Baker, 2012), this study analyzed the case of FDI flowing from developed countries into developing ones. Another paper (Glass and Saggi, 2014) shows that tax competition deforms the motives of investors which is in line with the study confirming the exceptional position and attractiveness of tax havens (Haberly and Wójcik, 2014). There are different factors which influence the attractiveness of state for foreign investors as the system political stability (Kim, 2010).

The aim of this paper is to verify the influence of tax environment on the foreign direct investments allocation (hereinafter only as "FDI"), to identify the specific tax factors having significant impact on the FDI geographical structure and to quantify the factors power applying the correlate and regression functions on the data of the OECD countries from 2006, before the financial crisis of 2007-2008. Special attention is devoted to the double tax treaties as a factor influencing cross-border investments tax burden in the time of growing globalization and tax burden of direct and consumption taxes.

2 Methodology and Data

This paper is a partial result of the project conducted under the CZU PEF IGA 20131056 project framework.

Firstly, there are specified the tax factors which potentially influence the FDI allocation and the indicators representing the FDI allocation.

Subsequently tax factors of mutual correlation matrix are checked to avoid multicollinearity and we specify the group of dependant variables to be implemented in the econometric models expressing the FDI allocation indicators. For the expression of dependency multifactorial regression analysis linear model with intercept will be used for its clear interpretation and linear relationships expectation. The parameters of the models are output of the backward elimination method primarily at the 95% significance level. The econometric models are based on cross-section data of OECD countries describing the situation in 2006, for the dependent variables data of M&A were available from 2006 and previous years. The group of thirty countries covered by the study consists of Australia, Austria, Belgium, Canada, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Korea, Luxembourg, Mexico, the Netherlands, New Zealand, Norway, Poland, Portugal, Slovakia, Spain, Sweden, Switzerland, Turkey, the United Kingdom and the United States.

Evaluated cross-section data were used from the statistical databases of UN (UNCTAD, 2007 and 2009), World Bank (The World Bank Group, 2010), OECD (OECD, 2009 and 2008) and KPMG (KPMG International, 2006). The statistical software SPSS has been used to identify the significant variables (tax factors) and quantify their power of influence on the FDI geographical structuring and the validity of the regression models.

Model Specification

As we expect a linear regression between the independent variables and each dependent variable the multifactorial linear regression model is used. For all dependent variables we consider a model containing all relevant independent variables in the beginning; this means that every model has been used in the following form:

$$Yj = \beta ij + \sum \beta ij \, Xij + \mu j \qquad (1)$$

Where:

i expresses the indication of X in the model as an independent variable explaining each dependent variable Y; and

j expresses the sequence of Y equation

μj – the stochastic variable covering the occurrences of dependent variable Y which is not expressed by the independent variables which are explained by the model is specified by the model index of adjusted R-square applied to the final model output.

Considered Tax Factors Identification: Potential Independent Variables to Be Checked for the Model Entry – Xi

X1 – intercept
X2 – DTT = Number of double tax treaties concluded prior to 2006 (UNCTAD, 2009)
X3 – BIT = Number of bilateral investment treaties concluded up to 2006 (UNCTAD, 2009)
X4 – CoRate = NOMINAL tax rate of corporate income tax (KPMG International, 2006)
X5 – Tax2GDP = Simple tax quote (OECD, 2008)
X6 – Soc2GDP = Social quote (OECD, 2008)
X7 – Inc2GDP = The ratio of income and profit taxes on GDP (OECD, 2008)
X8 – Inc2Tota = The ration of income and profit taxes on total tax burden (OECD, 2008)
X9 – Co2GDP = The ratio of corporate income tax on GDP (OECD, 2008)
X10 – Co2Tota = The ratio of corporate income tax on total tax burden (OECD, 2008)
X11* – Time = the Average number of payments realized by SME to pay taxes (OECD, 2008)
X12* – Hours = the Average number of hours needed for accounting and tax administration by SME
X13 – Per2GDP = The ratio of personal income taxes on GDP (OECD, 2008)
X14 – Per2Tota = The ration of personal income taxes on total tax burden (OECD, 2008)

X15 – Con2GDP = The ratio of Consumption taxes on GDP (OECD, 2009)
X16 – Con2Tota = The ratio of Consumption taxes on total tax burden (OECD, 2009)

* Factors Time and Hours (X11 and X12) are calculated for Small and Medium Enterprises (SME); nevertheless, they can be considered a sufficient evaluation of tax environment in every country.

Dependent Variables – Yi

Model A: Y1 = Stocks of FDI inward in USD at current prices and exchange rates in millions (UNCTAD, 2009)
Model B: Y2 = Flow of FDI inward in USD at current prices and exchange rates in millions (UNCTAD, 2009)
Model C: Y3 = Amount of mergers and acquisitions inward in USD at current prices (UNCTAD, 2007)
Model D: Y4 = Number of realized mergers and acquisitions inward (UNCTAD, 2007)

Hušek stipulates that multicolinearity is not acceptable if the absolute value of any simple bilateral correlation coefficient is higher than 0,8 (Hušek, 1999) and other authors (Seger, Hindls, 1995) mention the limit of approximately 0,75. As t these approximate limits are suitable for simple regression models the multicolinearity was tested again at the final output model as a part of the output results interpretation. Following the conditions for avoiding multicolinearity, all the variables having the correlation coefficient above 0,7 were eliminated.

It was necessary to modify the originally implemented independent variables by eliminating certain independent variables from future consideration for models entry.

Since it is not possible to involve all independent variables in one model alternative models for different situations have been created. These models variations can answer the question which tax combination has higher statistically significant influence on FDI:

- Alternative sub-model I) Including Simple Tax Quote (TAX2GDP),
- Alternative sub-model II) Including the Ratio of Personal income taxes on GDP (PER2GDP),
- Alternative sub-model III) Including the Ratio of Income and profits taxes on GDP (INC2GDP).

3 Results and Discussion

In the beginning, the alternative sub-model I expressing dependent variables (Yj) considered all the above-mentioned variables including simple tax quote, excluding the ratio of collected personal taxes collected on GDP and the ratio of collected income and profit taxes on GDP. Tax factors influencing the geographical allocation of FDI at significance level of 99% (=0,01) have been identified and shown in Table 1.

No statistically significant independent variables for the FDI allocation at the significance level of 99% and even at the significance level of 95% have been identified. I.e. the following variables do not significantly influence the FDI allocation:

- Number of concluded bilateral investment treaties,
- Nominal rate of corporate income tax,
- Ratio of collected corporate taxes collected on GDP,
- Number of payments per year according to the tax legislation,
- Number of hours spent by SMEs on accounting and tax administration,
- Ratio of collected consumption taxes collected on GDP.

The adjusted R-Squared statistics indicates that the used models explain approximately 66% of the variability in FDI stock inwards and about 57% of the variability in FDI flow inward. The same estimation of significant parameters of the models covering the inward M&A amount and number of deals explaining the variables about from 61% and 62% have been shown. A partial conclusion that there is a significant influence on inward FDI

and M&A allocation of the factors such as the number of double tax treaties, social quote and simple tax quote as a complex tax burden can be derived from the current results.

Table 1 Allocation factors of foreign direct investments STOCKS, FLOWS, M&A amount and M&A number of deals – the Sub-model I

		Statistically	***significant***	***independent***	***variables***
	Intercept	**DTT - number of double tax treaties concluded**	**Tax2GDP – Simple tax quote**	**Soc2GDP – Social quote**	**Adjusted R-square of model**
Dependant variables	***Regression parameters estimates at significance level 99%*** *(α=0.01)*				
Stocks of FDI (viz výše) in USD at current prices and exchange rates in millions	314985	8929.05311	-22058	-9936.17233	0.66
Flow of FDI i in USD at current prices and exchange rates in millions	42576	1101.17618	-2766.25440	-1491.97499	0.57
Amount of mergers and acquisitions in USD at current prices	33011	927.16443	-2222.99344	-1366.37817	0.61
Number of mergers and acquisitions inward realized	268.20853	5.39480	-14.37074	-8.36228	0.62

Source: Authors (software SPSS)

The sub-model II includes all independent variables excluding the Simple tax quote and the Ratio of collected income and profits taxes collected on GDP and including the Ratio of collected personal income taxes on GDP. As indicated in Table 2, the tax factors influencing the geographical allocation of FDI at significance level of 95% (α=0,05) have been determined.

Table 2 Allocation factors of foreign direct investments STOCKS, FLOWS, M&A amount and M&A number of deals - the Sub-model II

		Statistically	***significant***	***independent***	***variables***	
	Intercept	**DTT - Number of double tax treaties concluded**	**Per2GDP – Personal taxes quote**	**Co2GDP – Corporate taxes quote**	**Soc2GDP - Social quote**	**Adjusted R-square of model**
Dependant variables	***Regression parameters estimates at significance level 95%*** *(α=0.05)*					
Stocks of FDI inward in USD at current prices and exchange rates in millions	43302	9886.34386	-26636	-43567	-10271	0.67
Flow of FDI inward in USD at current prices and exchange rates in millions	-57038	967.35324				0.5
Amount of mergers and acquisition inward in USD at current prices	-50658	812.98073				0.53
Number of mergers and acquisition inward realized	-262.50103	4.67533				0.51

Source: Authors (software SPSS)

No statistically significant independent variable except the Number of double tax treaties for explanation of the inward FDI flow, M&A amount and number allocation if model include the Personal income tax quote and Corporate income tax quote as independent variables instead if Simple tax quote have been identified at the significance level of 95%. The adjusted R-Squared statistics indicates that the model explain about 67% of the variability in FDI stock inward, about 50% of the variability in FDI flow inward.

Significant parameters estimation of the models covering the inward M&A amount and number of deals explaining the variables from approximately 53% and 51% have been shown. These models contain only the DTT variable (Number of double tax treaties concluded).

The sub-model III includes the independent variables excluding the Simple tax quote and the Ratio of collected personal income taxes and including the Ratio of collected income and profits taxes on GDP. As indicated in table 3, tax factors influencing the geographical allocation of FDI at the significance level of 95% (α=0,05) have been identified.

Table 3 Allocation factors of foreign direct investments STOCKS, FLOWS, M&A amount and M&A number of deals - the Sub-model III

	Statistically	***significant***	***independent***	***variables***	
	Intercept	**DTT - Number of double tax treaties concluded**	**Inc2GDP – Income and profits taxes quote**	**Co2GDP – Corporate taxes quote**	**Soc2GDP - Social quote**	**Adjusted R-square of model**
Dependent variables	***Regression parameters estimates at significance level 95%*** *(α=0.05)*					
Stocks of FDI inward in USD at current prices and exchange rates in millions	116127	-11864	-31519		-11864	0.66
Flow of FDI inward in USD at current prices and exchange rates in millions	17214	1190.18061	-3926.97587		-1725.39728	0.58
Amount of mergers and acquisition inward in USD at current prices	14784	1005.53567	-3287.04394		-1596.44174	0.63
Number of mergers and acquisition inward realized	-108.91159	4.99270	-17.56338	9.34174	-8.69858	0.64

Source: Authors (software SPSS)

At the significance level of 95% none of the following independent variables for the inward FDI stock, inward FDI flow and amount of M&A allocation have been identified as statistically significant: I.e. the following variables do not significantly influence the FDI allocation:

- Number of bilateral investment treaties concluded,
- Nominal rate of corporate income tax,
- Number of payments per year according to the tax legislation,
- Number of hours spent by SMEs on accounting and tax administration,
- Ratio of collected consumption taxes on GDP,
- Ratio of collected corporate taxes to GDP.

Moreover, the Ratio of corporate taxes collected to GDP at the significance level of 99% has also been identified as a statistically significant independent variable for the M&A inward number allocation. The adjusted R-Squared statistics indicates that the models explain about 66% of the variability in FDI stock inward and about 58% of the variability in FDI flow inwards. There were shown the significant parameters estimation of the models covering the inward M&A amount and number of deals explaining the variables about 63% and 64%. Significant parameters of the models covering the inward M&A amount and number of deals explaining the variables from approximately 63% and 64% have been shown.

Let us sum up the model results and compare their rate of possible valid interpretation for tax policy creation needs in the Table 4.

Table 4 Adjusted R-square comparison and significance level

	***Adjusted R-square* of models**		
	Tax2GDP – Simple tax quote *(alternative I.)*	**Per2GDP – Personal tax quote *(alternative II.)***	**Inc2GDP – Income and profits taxes quote *(alternative III.)***
Stocks of FDI inward in USD at current prices and exchange rates in millions	0.66	0.67	0.66
Flow of FDI inward in USD at current prices and exchange rates in millions	0.57	0.5*	0.58
Amount of mergers and acquisition inward in USD at current prices	0.61	0.53*	0.63
Number of mergers and acquisition inward realized	0.62	0.51*	0.64*
Significance level of models	**99%**	95%	95%

* Marked models contain autocorrelation based on the estimated results of Durbin-Watson statistic criteria (tested value lower than 1.4) and will not be interpreted in conclusion.

Source: Authors (software SPSS)

The models identified as the most reliable ones are those containing the Simple tax quote since their results are statistically significant at 99%; this means the model covers 99% of potential incidences of inward FDI stock and flow and M&A amount and number. The R-Squared statistics indicate that the models explain 66 % of the variability in inward FDI stock, 57% of the variability in inward FDI flow, 61% of variability of M&A amount and 62% of variability of M&A numbers.

4 Conclusions

The result of this study is the proof that the inward FDI stock geographical allocation among the member states of OECD in 2006, before the first sign of the financial crisis in 2007-8, was influenced by the social contribution burden, direct taxes burden (personal, corporate, income and profit taxes) and particularly the number of concluded double tax treaties.

If we consider FDI stock as the indicator of the long term FDI allocation we can evaluate the inward FDI flow, inward M&A realized amount and number as well as the indicators of short term investment trends. In this respect there were important factors for investors the social contributions burden, income and profit taxes burden and again the number of double tax treaties particularly.

We can identify outputs that the factors as the nominal rate of corporate income tax and the ratio of collected consumption taxes to GDP were not statistically important factors.

As the double tax treaties have significant relationship with the foreign direct investments we can say the flexibility of capital movement free of tax was the substantial tax environment creating factor for investors.

The findings of the paper complement the approach of published studies focused particularly on importance of double tax treaties and the outputs of the paper are in line with results of the studies of Barthel (2010), Glass at al. (2014) and Hajkova at al. (2006).

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Cross-Sectional Examination of Classic Asset Pricing Models on the Russian Stock Market

Galina Mukhacheva, Oleg Deev

Masaryk University
Faculty of Economics and Administration, Department of Finance
Lipová 41a, 60200, Brno, Czech Republic
E-mail: galinamukhacheva@yandex.ru, oleg@mail.muni.cz

Abstract: *Emerging stock markets are generally considered the highly profitable opportunity for global investors. However, their relative instability, especially disclosed in high volatility and lower trading volumes, makes the forecast of returns on these markets extremely difficult. In this paper, we test the forecast accuracy of classic asset pricing models, namely capital asset pricing model (CAPM) and several specifications of multi-factor asset pricing models with time-varying risk factor measurements to predict returns of Russian stocks. CAPM with time-varying beta is found to be the most successful, but still highly unreliable model among classic asset pricing models to explain excess returns of Russian stocks.*

Keywords: CAPM, multi-factor asset pricing models, time-varying beta, emerging market

JEL codes: G12, G14, G17

1 Introduction

The fundamental question of financial economics is why different financial assets earn different rates of return. Classic answer from the capital asset pricing model lays in the linear relationship between market risks and assets expected returns. However, the considerable evidence of cross-sectional patterns in asset returns raises doubts about such relationships and highlights other explanation factors. Moreover, since the majority of empirical evidence on the risk-return paradigm is built on the examination of financial markets in developed countries, emerging markets pose an additional puzzle for researchers and investors on how to explain the relatively higher returns in these markets and estimate the cost of equity.

The aim of our investigation is to examine the capability of different asset pricing models to identify the rate of return on probably the most volatile emerging stock market – the Russian stock market. This paper reports our preliminary findings from testing classic capital asset pricing model and multi-factor asset pricing models with time-varying factor loadings on the Russian stock market data.

Classical static CAPM with time-fixed beta is taken as a benchmark for comparison with results presented by dynamic beta models. Models under study are basic CAPM with time-varying betas, Fama-French three-factor model, and three-factor model augmented by liquidity factor. Time-varying betas are applied as risk measurements in these models to eliminate one of the restricting assumptions of basic CAPM - an invariable risk measurement (beta coefficient). The idea is to determine, if excess returns of Russian stocks are dependent on the equity characteristics, such as company size (market capitalization of company's shares), book-to-market ratio (index of under- or overvaluation of a firm), and turnover (liquidity factor – share trading volume divided by shares outstanding).

To our knowledge, the topic has not been previously heavily investigated for the Russian stock market especially in cross sectional framework, presumably due to the short span of data available, small number of liquid instruments and general understanding that Russian stock market is largely dependent on the changes of exchange rates and commodity prices and some other macroeconomic factors. For an overview of the Russian stock market characteristics see Goriaev and Zabotkin (2006), which findings are still considerably relevant nowadays.

2 Data and Methodology

Moscow Exchange is the biggest facility for stock trading in Russia. Due to the shortcomings of data availability for the Russian stock market, we include only 50 liquid stocks with substantially longer trading history into our study. Table 1 provides a brief notion of what kind of stocks are examined in the study. Twelve most liquid stocks (Table 1) comprise about 78% of the MICEX index and more than half of Moscow Exchange trading activities. Noticeably energy sector captures almost half of the stock market, what underscores the fact of Russia being an emerging market.

Examined stocks data consist of weekly returns, market capitalization (company size), book-to-market ratio (B/M), and turnover (liquidity factor). Market return is calculated on the base of the MICEX capitalization-weighted index. Risk-free rate is based on the Russian government bond index (RGBI). All data expressed in local currency for the time interval of January 5, 2003 to April 20, 2014 were obtained from Bloomberg. Each time series include 583 observations. Since the trading of some stocks was launched after January 2003, number of observations for most of the stocks under investigation is shorter.

Table 1 Description of stocks with more than 2% weight in the MICEX index

Ticker	Company	Index weight	Market Capitalization	Ownership	Traded since	Industry
GAZP	Gazprom	15.00%	2 978	State	January 2006	Oil & Gas
SBER	Sberbank	13.28%	1 545	State	January 2003	Banking
LKOH	Lukoil	13.68%	1 587	Private	January 2003	Oil & Gas
MGNT	Magnit	6.31%	680	Private	July 2006	Retail
GMKN	Norilsk Nickel	4.33%	1 010	Private	December 2006	Materials
ROSN	Rosneft	4.74%	2 333	State	July 2006	Oil & Gas
NVTK	Novatek	5.18%	1 025	Private/State	January 2005	Oil & Gas
SNGS	Surgutneftegas	3.50%	885	Private	January 2003	Oil & Gas
MTSS	MTS	4.22%	531	Private	February 2004	Telecom
VTBR	VTB Bank	3.26%	502	State	June 2007	Banking
TATN	Tatneft	2.24%	440	State	January 2003	Oil & Gas
AFKS	AFK Sistema	2.17%	352	Private	September 2007	Telecom

Note: Index weight and market capitalization (in bln rubles) are denoted as of February 1st, 2014.
Source: Bloomberg and Moscow Exchange

Table 2 presents the time-series averages of the cross-sectional means, medians, and standard deviations for market excess return and company's characteristics observed during the studied period. Variably of firm characteristics certainly allows for the testing of the multifactor models.

Table 2 Descriptive statistics

	Mean	Median	Standard deviation
Market excess return, $r_m - r_f$	0.0025	0.0057	0.0469
Firm size (market capitalization), bln. RUB	1415,91	737,57	9849,09
Book-to-market ratio (B/M)	0.6422	0.455928	0.6383
Turnover, %	0.0065	0.00024	0.0276

The two main approaches for testing asset pricing models are time-series regressions and cross-sectional regressions. For the purposes of our study we employ cross-sectional testing framework. According to Goyal (2011), there are several advantages of the Fama-MacBeth (1973) approach for testing asset pricing models with cross-sectional regression. First, the distribution of the risk-premium estimates does not depend on number of stocks, which can vary over time. Second, the procedure is flexible to implementing time-varying betas. Third, it is possible that autocorrelation in returns frequency leads to autocorrelation in risk-premium estimates. It is accounted by Newey-West type corrections to variance formulas.

Fama and MacBeth (1973) use rolling betas in their analysis, however, Fama and French (1992) report evidence that use of rolling betas does not yield different inferences. Testing this ambiguity, we allow betas to vary over time, so we should obtain weekly changing betas and assign them to the second-pass of cross-sectional regression. Betas are considered being measures of relevant contribution that factor loadings make toward the overall model's efficiency in demonstrating cross-sectional return variance.

We run cross-sectional regression of individual stock returns on their factor loadings as cross-sectional methodology corrects standard errors caused by time-series procedure. Therefore, we implement two-step Fama-MacBeth approach. In the first step, each stock's return is regressed against one (in case of CAPM) or more factors (Fama-French three-factor model, Fama-French three-factor model augmented by adding liquidity factor) to obtain regression coefficients.

$$R_{i,t} = \alpha_i + \beta_{i,F_1} F_{1,t} + \beta_{i,F_2} F_{2,t} + \ldots + \beta_{i,F_m} F_{m,t} + \varepsilon_{i,t}, \quad (1)$$

where $R_{i,t}$ is return of a stock *i* at time *t* (*t=1…T*), $F_{j,t}$ is the factor *j* at time *t (F=1…m),* β_{i,F_m} are the factor loadings that describe how returns are explained by the factors.

The second step is to determine T cross-sectional regressions of the returns on the *m* estimates of the βs (denote them as $\hat{\beta}$), computed in the first step.

$$R_{i,T} = \gamma_{T,0} + \gamma_{n,1} \hat{\beta}_{i,F_1} + \gamma_{n,2} \hat{\beta}_{i,F_2} + \ldots + \gamma_{n,m} \hat{\beta}_{i,F_m} + \varepsilon_{i,T}, \quad (2)$$

where the returns *R* (*i=1…n*) are the same as those in equation (1), γ are regression coefficients that are assumed to be used in to compute the risk premium for each factor.

We use single stocks estimations instead of creating portfolios, so we could restrict for portfolio grouping resulting in small sample bias According to Ang et al. (2010), creating portfolios misrepresents information by diminishing the description of beta and leads to larger standard errors. According to Avramov and Chordia (2006) and Lo and MacKinlay (1990) focusing on single securities avoids the data snooping biases that are inherent in portfolio-based approaches and is robust to the sensitivity of asset pricing tests.

3 Results and Discussion

For the first step of our analysis, we test ordinary CAPM with static beta using two-pass cross-sectional regression. As the result of the first-pass time-series regression individual betas of each stock were obtained (Table 3).

Table 3 Chosen estimation results of CAPM with fixed betas (the first-pass of cross-sectional regression results)

Stock	const	beta	p-value (beta)
AFKS	0.0004	0.2182	0.0062
GAZP	-0.0014	-0.0169	0.7636
GMKN	0.0009	-0.1309	0.0841
LKOH	0.0017	0.1038	0.0175
MGNT	0.0058	0.3143	0.0000
MTSS	0.0007	0.1662	0.0003
NVTK	0.0044	0.0854	0.1079
ROSN	0.0001	-0.1241	0.0268
SBER	0.0034	0.2021	0.0001
SNGS	0.0011	0.0318	0.5134
TATN	0.0028	0.2423	0.0000
VTBR	-0.0039	0.0024	0.9711

Source: Ordinary least squares regression on individual stocks returns

Risk factor presented by excess market return is able to explain the majority of individual stocks' excess returns; however, in all cases the explanatory power of the model is extremely low. We could not find any explanations on why beta coefficient is significant for some stocks, but not significant for others. The analysis proceeds with the second

step of cross-sectional regression, where the betas from time-series regressions are taken as factors.

Table 4 Estimation results of CAPM with fixed beta
(the second-pass of cross-sectional regression results)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Beta_CAPM_static	0.0112	0.0062	1.8156	0.0695
Const.	0.0005	0.0010	0.5292	0.5967

The null hypothesis of fixed betas being an appropriate risk measurement of excess stock return is rejected with the R-squared ratio of 0.0005 signaling extremely low explanatory power of static CAPM, the static version of CAPM should not be used as a reliable model for predicting future returns of Russian stocks.

The testing procedure For CAPM with time-varying betas is based on the equivalent method as presented before. The first-pass time-series regression was a tool for achieving beta coefficients with their future implementation as the factor loading into the second-pass regression. The only difference from the first examination was that betas were measured in a time-varying framework of one week step on the one year horizon. Rolling betas' estimations are taken into attention as measures of model sustainability.

Table 5 Descriptive statistics of chosen time-varying betas
(the first-pass of cross-sectional regression results for CAPM with time-varying betas)

	Mean	Median	Standard deviation
AFKS	-0.0004	-0.0127	0.2926
GAZP	-0.0091	-0.0377	0.2143
GMKN	-0.2096	-0.1956	0.2112
LKOH	0.0815	-0.0204	0.3047
MGNT	0.1551	0.1799	0.2714
MTSS	0.0660	0.0904	0.3275
NVTK	0.0103	0.0092	0.2085
ROSN	-0.1215	-0.1241	0.1753
SBER	0.1187	0.0633	0.3257
SNGS	0.0970	-0.0409	0.3893
TATN	0.1463	0.1101	0.3778
VTBR	-0.0387	-0.0356	0.1882

Table 6 Estimation results of CAPM with time-varying betas
(the second-pass of cross-sectional regression results)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Beta_CAPM_varying	-0.0057	0.0027	-2.1345	0.0329
Const.	0.0018	0.0008	2.1115	0.0348

Table 6 provides us with the information about ability of time-varying beta to perform as efficient risk-measurement for stock's excess return. The null hypothesis of time-varying beta being an appropriate risk measurement of excess stock returns is accepted at 5% significance level, implying the efficiency of CAPM with time-varying beta and its capability to perform better than CAPM with static betas. However, the still quite low R-squared (0.0008) motivates us to continue with our examination of asset pricing models. Moreover, constant terms are not significantly different form zero.

The next explored model is Fama-French three factor model with time-varying factor estimators. The model tests if firm characteristics such as size (measured by market capitalization) and book-to-market ratio can provide additional risk measurement to the classical market excess return evaluation. During the first-pass regression, the estimators for each of three factor loadings were generated and their means, medians and standard deviations are presented in Table 7. These values were then implemented as factors in the second-pass regression (Table 8). Neither of time-varying factor

estimators has added any information on risk measurements of excess returns. The basic Fama-French three factor model does not indicate implied anomalies for the Russian stock market.

Table 7 Descriptive statistics of chosen stock characteristics betas from the time-varying Fama-French three factor model (the first-pass of cross-sectional regression results)

	Excess return estimator			Capitalization estimator			Book-to-Market estimator		
	Mean	**Median**	**St. Dev**	**Mean**	**Median**	**St. Dev.**	**Mean**	**Median**	**St. Dev.**
AFKS	-0.1204	-0.0458	0.7228	-0.0017	0.0001	0.0292	-1.4442	-0.0468	20.8701
GAZP	-0.0897	-0.1259	0.2073	0.0000	0.0000	0.0001	-0.1640	-0.0688	0.4098
GMKN	-0.2994	-0.2814	0.1879	-0.0000	-0.0000	0.0005	-9.7114	-7.3587	23.8581
LKOH	-0.0178	-0.1348	0.3409	0.0000	0.0000	0.0002	-3.5867	-3.2836	7.5225
MGNT	0.1234	0.1737	0.2783	-0.0035	-0.0001	0.1340	-2.1396	-0.4809	52.2829
MTSS	0.0321	0.0484	0.2922	-0.0008	0.0000	0.0122	-1.9520	-0.4054	22.6721
NVTK	-0.0646	-0.0618	0.2631	-0.0037	-0.0001	0.0411	-1.1947	-0.2986	6.8851
ROSN	-0.2026	-0.1939	0.1687	0.0001	0.0000	0.0045	0.4439	-0.0806	65.3252
SBER	-0.0743	-0.0361	0.3501	0.0000	-0.0000	0.0017	0.4421	-0.1218	13.4646
SNGS	0.02902	-0.1313	0.4057	0.0001	0.0001	0.0004	-0.0572	-0.0433	0.2818
TATN	-0.1023	-0.0752	0.1479	-0.0017	-0.0015	0.0006	-0.5257	-0.5313	0.2399
VTBR	-0.1282	-0.1281	0.1886	0.0001	0.0001	0.0005	-0.0584	-0.0112	0.4158

Table 8 Fama-French three factor model with time-varying factor estimators (the second-pass of cross-sectional regression results)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Beta1_excess_return	-0.0023	0.0025	-0.8991	0.3687
Beta2_capitalization	0.5662	27.4992	0.0206	0.9836
Beta3_book-to-market	0.0021	0.0400	0.0504	0.9598
Const.	0.0007	0.0009	0.7730	0.4396

The last model under investigation is Fama-French model augmented by liquidity factor calculated as a turnover ratio. The addition of the liquidity factor to the Fama-French model does not affect the results of our previous findings.

Table 9 Fama-French model augmented by liquidity factor (the first-pass of cross-sectional regression results)

	Excess return estimator			Capitalization estimator			Book-to-Market estimator			Turnover estimator		
	Mean	**Median**	**St.Dev.**	**Mean**	**Median**	**St.Dev.**	**Mean**	**Median**	**St.Dev.**	**Mean**	**Median**	**St.Dev.**
AFKS	-0.0652	-0.1252	0.3529	-0.0001	0.0002	0.0046	-0.3838	-0.0362	3.6469	25.0740	2.5542	76.6658
GAZP	-0.0827	-0.1160	0.2082	0.0000	0.0000	0.0001	-0.2423	-0.0977	0.8390	0.0100	0.0023	0.0729
GMKN	-0.2751	-0.3090	0.6222	-0.0011	0.0000	0.0174	-61.60	-7.6504	863.54	0.0023	0.0017	0.0968
LKOH	-0.2131	-0.2098	0.1584	0.0001	0.0001	0.0010	4.7076	-2.9891	125.15	0.6935	0.1982	3.2750
MGNT	0.1215	0.1682	0.2642	0.0041	0.0001	0.0744	0.6769	-0.4671	29.72	-0.0001	-0.0001	0.0037
MTSS	-0.1020	-0.0129	0.6476	0.0000	0.0001	0.0007	-0.3272	-0.2407	0.9288	-0.0001	0.0000	0.0005
NVTK	-0.2014	-0.1260	0.2847	0.0000	-0.0001	0.0004	-0.6661	-0.3936	1.0815	-0.0057	-0.0014	0.0309
ROSN	-0.2484	-0.2298	0.1997	0.0000	0.0000	0.0007	-0.5349	-0.0452	7.5310	-0.3215	-0.0962	2.0872
SBER	-0.0886	-0.0563	0.3142	0.0000	0.0000	0.0005	-0.0557	-0.2015	3.0716	-0.0577	-0.1759	0.7371
SNGS	-0.2188	-0.2244	0.2073	0.0003	0.0002	0.0022	0.0044	0.0204	5.6831	-0.1164	0.2240	2.6632
TATN	-0.1071	-0.0667	0.1456	-0.0017	-0.0016	0.0006	-0.5266	-0.5317	0.2234	0.0000	0.0000	0.0001
VTBR	-0.1427	-0.1293	0.2067	0.0001	0.0001	0.0005	-0.0637	-0.0289	0.4073	-112.76	-193.77	692.72

Table 10 Fama-French model augmented by liquidity factor (the first-pass of cross-sectional regression results)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Beta1_excess_return	0.0059	0.0033	1.7812	0.0749
Beta2_capitalization	-24.7665	46.2838	-0.5351	0.5926
Beta3_book-to-market	0.0042	0.0048	0.8743	0.3820
Beta4_turnover	-0.000008	-0.000005	-1.6293	0.1033
Const.	0.0003	0.0011	0.2546	0.7990

Clearly, classic asset pricing models tested using the cross-sectional approach of Fama and MacBeth (1973) on the Russian stock market data do not yield any significant and reliable results. Since the studied models are extremely popular among investors, their usage should be considered with great caution.

4 Concluding Remarks

Three versions of classic asset pricing models were examined to check their capability to predict future excess returns of individual stocks in the emerging market framework of the Russian stock market. Our findings support CAPM with time-varying beta being the most successful, but not reliable forecasting instrument to predict stock returns. The classical CAPM performed moderately sufficient results, while Fama-French Three factor model presented limitations in asset return explanations. The probable explanation of our findings would be the nature of emerging markets where firm characteristics do not affect the market price of the asset, while market factors such as cumulative market return can explain individual stock's return. The moderate success of CAPM with time-varying beta can be justified by its ability to capture high volatility of individual asset returns and general market return.

Clearly, further search of the reliable model to explain excess returns of Russian stocks is needed. Other models, especially with international and momentum factors should be examined.

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The Impact of Indicators of Capital Structure on Profit of Viticulture and Viniculture Enterprises

Zdeňka Náglová[1], Eliška Vlašicová[2], Martin Gürtler[3], Marta Gryčová[4]

[1, 2, 3, 4] Czech University of Life Sciences Prague
Faculty of Economics and Management, Department of Economics
Kamýcká 129, 165 00 Prague, Czech Republic
E-mail: naglova@pef.czu.cz, vlasicova@pef.czu.cz, gurtler@pef.czu.cz, grycova@pef.czu.cz

Abstract: *This paper examines the influence of particular aspects of capital structure on profit or loss of a company. The aim of this paper is to identify an impact of selected indicators on profit, resp. on EBIT and EAT of viticulture and viniculturae companies in the Czech Republic. A regression and correlation analysis is used to identify the influence of the selected indicators. The paper works with accounting data of wine and viticulture businesses during the time period of 2005 - 2011. Data were obtained from a database of companies and institutions Albertina. Altogether 75 companies are analysed. Two models are selected, one to determine the impact of each indicator on the EBIT and the other on the EAT. Specific results are available in the section Results and Discussion.*

Keywords: capital structure, results of operations, linear regression model, viticulture, viniculture

JEL codes: M21, G30, G32, Q14

1 Introduction

Vine growing and wine production in some parts of the Czech Republic, especially in southern Moravia, is not only an important part of the traditional and cultural practices, but also contributes significantly to the local and regional economies.

The research of the economic impact in the wine sector in the Czech Republic is covered by a research of e.g Tomšík, Sedlo, Chládková, Kučerová, Žufan, Prokeš, or Šperková. Chládková et al. (2009) identified the main factors which influenced the wine demand and analysed its development. Tomšík and Sedlo (2013) also analysed the demand for wine and engaged in the management of wine production with regard to its implementation into the wine markets of the Czech Republic. Many researchers focused on wine production and wine consumption in the Czech Republic in recent years, e.g. Chládková et al. (2004), Chládková (2005), Kučerová (2005), Tomšík and Chládková (2005), Tomšík (2006), Tomšík et al. (2006), Pyšný et al. (2007). Šperková and Hejmalová (2011) analysed suppliers in the wine sector and their bargaining power. There were the following major groups of suppliers - feedstock suppliers (wine grapes), suppliers of chemical additives and other substances necessary for the production of wine, suppliers of manufacturing technology, suppliers of packaging materials, energy suppliers and other vendors. Each group of suppliers has different bargaining power.

Authors such as Tomšík, Prokeš and Šperková within the wine sector engaged in management and marketing analysis. Prokeš (2013) followed the development of tourism in the wine sector and a substantial part of his work is dedicated to wine growers' association in the Czech Republic in terms of management and marketing opportunities. His research is covered in his dissertation thesis and in several scientific articles. A similar theme is also addressed by Tomšík, with who Prokeš wrote several joint scientific publications (Tomšík and Prokeš, 2011a, 2011b). Šperková with their colleagues occupies with competitiveness of winemakers, STEPE analysis of the wine sector, or strategic options of a new entrant companies into the wine sector (Šperková and Duda, 2009; Šperková and Hejmalová, 2012; Šperková and Skýpalová, 2012).

Up to now, however, economic situation, respectively financial management, of wine and viticulture enterprises in the Czech Republic has not been adequately explored. One of the fundamental problems of financial management in addition to determining the total

amount of capital is also the choice of the right mix of financing resources for its activities. This composition has undoubtedly an influence on the financial results of the company. This article aims to identify the impact of selected indicators of capital structure on financial results, respectively EBIT and EAT, of viniculture and viticulture enterprises in the Czech Republic during the monitored period.

Aspects of the capital structure and profit within the farm are explored by Aulová, her dissertation thesis is devoted to this research. Aulová et al. (2013) investigated determinants of the results of economic activity in a sample of 2 314 farms. In another article, Aulová and Hlavsa (2013) examined the determinants of the capital structure of agricultural farms in the Czech Republic. A similar theme is dealt with Prášilová (2012) or Dryjová and Zeman (2007). Hlavsa and Aulová (2013) also performed the analysis of an effect of a legal form and size group on the capital structure of agricultural businesses of legal entities. Among other authors who deal with financial analysis enterprises it can be included Lososová and Zdeněk (2014), who used the method of linear regression and correlation analysis to determine the factors affecting the profitability of farms in the Czech Republic.

2 Methodology and Data

This paper works with accounting data of wine and viticulture enterprises during the time period of 2005 - 2011. Data of enterprises of the Czech Republic were selected and extracted from the database of companies and institutions Albertina and from Commercial register and the collection of documents. Enterprises were chosen according to methodology CZ-NACE - Wine growing and Wine making. The final data set includes 75 companies. Most of enterprises belong to the Small and Medium Enterprises category. Incomplete data and duplication of chosen companies were excluded.

The primary aim of estimating the impact of capital structure on the profit of viniculture and viticulture enterprises is using a linear regression model (LRM) in two scenarios - the first one making an estimate with respect to EBIT (Earnings Before Interest and Taxes) and the second one with respect to EAT (Earnings After Taxes). Due to a limited length of disposable time series (only 7 observations), it is not possible for low degrees of freedom to use in LRM all regressors, which are rational from economic point of view. Furthermore most of these explanatory variables show high form of linear dependence (problem of multicollinearity), see Figure 1 and Figure 2. Therefore we finally use simple linear regression models (models with constant and one strictly exogenous variable) extended by the AR (1) process, i.e. models have following form (actually it is dynamic version of simple LRM):

$$y_t = \beta_0 + \beta_1 y_{t-1} + \gamma_0 x_t + \varepsilon_t, \qquad \varepsilon_t \sim IID(0, \sigma^2) \tag{1}$$

In fact we are estimating 12 models, in six ones EBIT is separately regressed on ROE, total debt, debt rate and three levels of liquidity (further noted as L1, L2 and L3). Second half of models is based on the same regressors, but the dependent variable is EAT. As we have mentioned and as is evident from equation (1), particular dependent variable is regressed on its fist-order lag, assuming continuous development and thus a dependence on the previous period. AR(1) process was mainly used to deals with the autocorrelation of residuals. Naturally a coefficient of determination is computed for every regression (informing about the tightness of the regression and the value of R2 can be interpreted as a percentage indicating by how many per cent the changes in the explained variable are dependent on the changes in explanatory variables), as well as correlation coefficient (expressing the dependence between variables, without causality restriction). Every estimated model has been tested, especially for residual's autocorrelation using LM (Breusch-Godfrey) test. For more details in construction and verification of used models see Green (2012).

We are considering each possible determinant of capital structure affecting EBIT or EAT. General assumption for profit realisation is high rate of return on equity (ROE). Another variables are indicators of different levels of the liquidity (current, immediate and

prompt, L1, L2, L3), i.e. the enterprise's ability to meet its liabilities. If a company has high liquidity, it is able to pay its liabilities with high likelihood, but at the same time if the current assets make substantial value, then enterprise has significant opportunity costs. As additional determinants are selected indicators of indebtedness (total debt and debt rate). High proportion of financing enterprise activities by debt, might contribute to higher rentability, resp. profit, if debt is used efficiently.

Software Gretl and SPSS have been used for the analysis in this paper.

3 Results and Discussion

The results of correlation and regression analysis using EBIT are shown in the table 1. The p-value is stated in angular brackets and standard errors in round brackets.

Table 1 Results of regression and correlation analysis using EBIT for the assessment

	Intercept coefficient β_0	**AR(1) coefficient β_1**	**Regression parameter of interest γ_0**	**Coef. of determ. R^2**	**Correl. coef.**	**Test of autocorrel. (p-value from LM test)**
ROE	-1318	0.9351	41126.6	0.7098	0.1681	0.1010
	(2755.29)	(0.3521)	(24513.8)			
	[0.6651]	[0.0766]	[0.192]			
Total Debt	-5013.9	0.7961	14011.7	0.6482	0.2235	0.1180
	(5736.7)	(0.3588)	(10455.4)			
	[0.4465]	[0.1132]	[0.2727]			
Debt Rate	-2689.9	0.8285	4410.41	0.6136	0.1799	0.1200
	(4667.88)	(0.3875)	(3771.9)			
	[0.6048]	[0.1221]	[0.3267]			
L3	8827.78	1.1657	-4019.5	0.6642	0.3531	0.0861
	(5027.34)	(0.4863)	(2824.63)			
	[0.1774]	[0.0961]	[0.2499]			
L2	5923.56	1.5168	-7996.9	0.7094	0.4423	0.1070
	(2841.66)	(0.5962)	(4773.11)			
	[0.1284]	[0.0844]	[0.1925]			
L1	4686.34	1.4402	-22951	0.7297	0.4157	0.0647
	(2199)	(0.5252)	(12747.2)			
	[0.1229]	[0.0712]	[0.1696]			

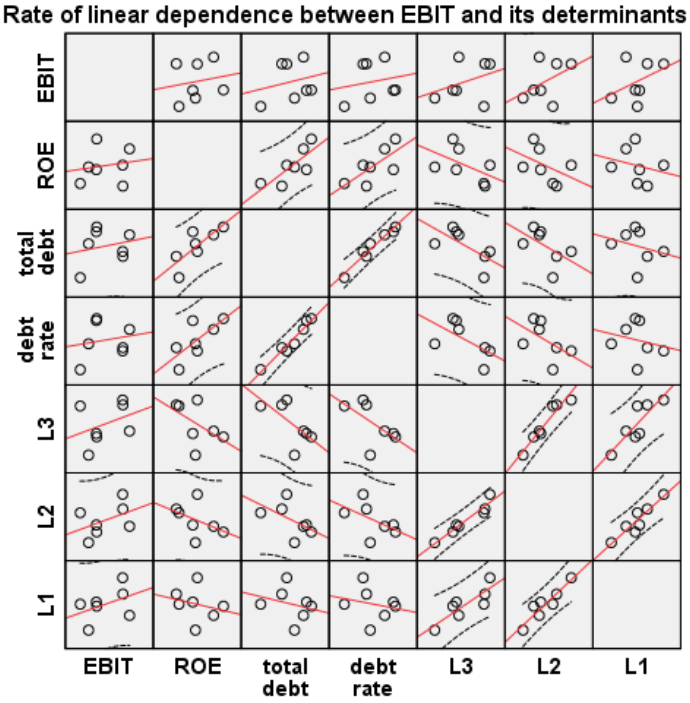
Source: own elaboration

According to the index of determination, it can be said that the greatest variability in earnings is explained on average from 73% by the estimated model that includes the Cash Position Ratio (L1). This liquidity ratio indicates by how much CZK of the short-term financial assets 1 CZK of short-term payables are covered. If there will be an increase in the coverage of another 1 CZK, then there would be a decrease in profit of 22 295 CZK. The increasing character of this value has a negative effect on EBIT due to inefficient use of funds. Similar (negative) values can be seen for the other levels of liquidity. With the growing liquidity of the second level (Quick Asset Ratio, L2) by 1 CZK there is a drop in EBIT of 7 996.9 CZK. If the short-term receivables is taken into account as a source of potential coverage of short-term payables, which are included in the calculation of quick asset ratio, and if they increases, then the impact on EBIT will be much lower than in the case of Cash Position Ratio (L1). In the case of Current Ratio (L3), which allows for coverage of liabilities by total current assets, it can be concluded that any increase in the coverage by total current assets by 1 CZK causes a decrease in profit of 4 019.5 CZK, i.e. the lowest decline of all these liquidity ratios. Conversely, a positive effect on EBIT is caused by ROE (return on equity), total debt (total debt to total assets ratio) and debt rate (Total Debt to Equity ratio). The change in profit variability can be explained from 71% by the variability of ROE. If the return on equity (ROE) increases by 1 CZK, then EBIT will increase by 41 126.6 CZK. However, ROE does not grow in the terms of units of

crowns so often, thus it is closer to mention this interpretation in heller. Therefore, if ROE increases by 1 heller, EBIT increases by 411.3 CZK. A considerable percentage (64 %) of the change in profit can be explained by the change in total debt or in the debt rate (61 %). Both indicators have a positive effect on EBIT. In the case of total debt, if there is an increase in the utilization of debt, then for each additional CZK of the total debt, EBIT will increase by 14 011.7 CZK. Also, if we take into account the debt rate, which is the ratio between debt and equity, and if there is a growth of this ratio (by a predominance of debt) by 1 CZK, then EBIT will increase by 4 410 CZK. At the same time the rule that states that higher debt contributes to higher profitability or, conversely, a negative effect on profitability, was verified. The result is that if there is an increase in debt of 1 CZK, ROE will increase by 0.33 CZK. The positive relationship between the debt rate and ROE is confirmed and it can be said that enterprises utilize effectively financial resources from their debt that increases ROE. The correlation coefficients ranged from 0.16 to 0.44, so the low dependence can be confirmed. The movement of the trend of the two time series (L2 and EBIT) is the most determined by 44.2 % of common factors. In contrast, ROE and EBIT are determined only from less than 17% of common factors. According to the p-values of LM test for first order autocorrelation it is apparent, that the residuals are not serially correlated at a significance level of 5%.

The linear relationship between EBIT and selected indicators are stated in Figure 1 below.

Figure 1 Rates of linear dependence between EBIT and its determinants



Source: own elaboration

A model of a simple linear regression augmented by AR(1) process was also used to determine the dependence between the selected variables and EAT. The results of this correlation and regression analysis are shown in Table 2. P-values are again given in angular brackets and standard errors in round brackets.

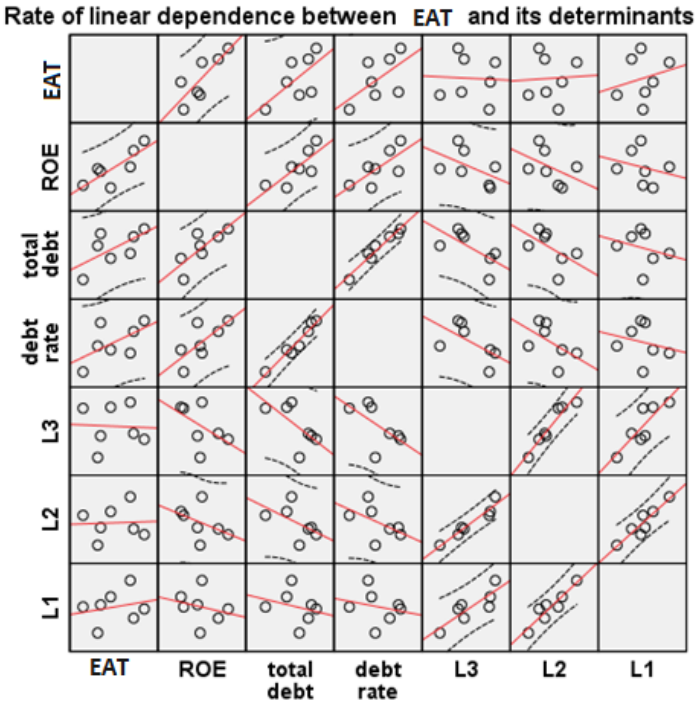
Table 2 Results of regression and correlation analysis using EAT for the assessment

	Intercept coefficient β_0	AR(1) coefficient β_1	Regression parameter of interest γ_0	Coef. of determ. R^2	Correl. coef.	Test of autocorrel. (p-value from LM test)
ROE	93.4824	0.1858	58272.5	0.7379	0.8074	0.4510
	(1980.85)	(0.3295)	(21429.9)			
	[0.9653]	[0.6123]	[0.0726]			
Total Debt	-3660.22	-0.2688	17789.7	0.5681	0.6386	0.8350
	(4776.3)	(0.3593)	(9783.33)			
	[0.4993]	[0.5087]	[0.1666]			
Debt Rate	87.851	-0.2706	4980.56	0.4265	0.5818	0.8190
	(3796.86)	(0.4141)	(3766.02)			
	[0.983]	[0.5601]	[0.2778]			
L3	8079.49	-0.1912	-1604.4	0.1793	-0.0455	0.0878
	(6296.83)	(0.5236)	(2841.58)			
	[0.2896]	[0.7392]	[0.6118]			
L2	5092.25	-0.2533	-507.297	0.0959	0.0481	0.0528
	(4136.48)	(0.6007)	(4493.33)			
	[0.306]	[0.7016]	[0.9172]			
L1	3440.81	-0.4501	6174.26	0.1452	0.2318	0.2200
	(3427.55)	(0.6305)	(14299.4)			
	[0.3894]	[0.5268]	[0.695]			

Source: own elaboration

If the results of analysis of EAT are compared with the previous results of EBIT analysis, similar results in some cases can be found. The variability of profit can be explained on average by 74% by the estimated model containing the return on equity. It can be stated that if the ROE will increase by 1 CZK, then EAT increases by 58 272 CZK. In the case of debt ratios (total debt and the debt rate) the changes of EAT in the average can be attributed of only 57%, respectively of 43% to the changes in these indicators. The changes in percentage points of profit for the period can be explained by a not significantly changes in the models consisting liquidity ratios. The linear relationship between EAT and selected indicators can be seen in Figure 2 below.

Figure 2 Rates of linear dependence between EAT and its determinants



Source: own elaboration

4 Conclusions

Both two simple linear regression models were developed for two scenarios. The first one involved the explained variable EBIT and as residues were chosen the return on equity (ROE), total debt, debt rate and liquidity ratios (Cash Position Ratio (L1), Quick Asset Ratio (L2) and Current Ratio (L3)). The second model has the same explanatory variables, but the EAT was explained. After comparing the obtained results, the same variability of changes of profits explained by the selected variables can be found. Specifically, this is the case of return on equity (ROE), total debt and debt rate. Conversely, very low coefficients of determination were identified in liquidity ratios, in the range 9-17 % for models containing EAT. Compared with EBIT variability, the coefficients are significantly higher (73-66 %). The percentage change in profit is therefore very little affected by the changes in indicators of liquidity. Thus it can be said that the EAT is more dependent on the return on equity (ROE) than EBIT, because an increase in this indicator by 1 CZK brings to EAT an increase of about 17 000 CZK more than compared to EBIT. Similarly, it is like that when considering the total debt (which will bring about 3 700 CZK more). Conversely, milder effects can be found within the model with EAT and with liquidity ratios, which brings with each additional use of means to cover short-term payables much lower decrease compared to the model underlying EBIT. In the case of Current Ratio (L3) its increase by 1 CZK has an impact on the EAT by 2 500 CZK less, in the case of Quick Asset Ratio by 7 400 CZK lower and in the case of Cash Position Ratio (L1) by 27 000 CZK less than in the model with EBIT. The last mentioned liquidity indicator (L1) compared to the model with EBIT does not decrease the profit, on the contrary, an increase in this liquidity indicators also contributes to the growth of EAT. However, the change in profit can be explained by the selected variables with a very low probability. In conclusion, it should be noted that the selection of the same variables for both models yielded different results. The variables are positively reflected in explanation of changes in EBIT. In the case of the model with EAT this measure of profit can be explained only by a change in the ROE and debt indicators. However, according to the statistical insignificance of majority of the estimated parameters, it is possible to apply the results of analyses only for the selected sample of companies.

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Non-life Insurance Market in the Czech Republic and Slovakia

Svatopluk Nečas[1], Viktória Čejková[2]

[1] Masaryk University
Faculty of Economics and Administration, Department of Finance
Lipová 41a, 602 00 Brno
E-mail: necas@econ.muni.cz

[2] Masaryk University
Faculty of Economics and Administration, Department of Finance
Lipová 41a, 602 00 Brno
E-mail: cejkova@econ.muni.cz

School of Economics and Management in Public Administration in Bratislava
Department of Economics and Finance
Furdekova 16, 851 04 Bratislava
E-mail: cejkova@vsemvs.sk

Abstract: *The paper shows the characteristics of the Czech and Slovak non-life insurance market and its comparison. The aim of the article is to compare the non-life insurance in the Czech Republic and Slovakia and to find out which market is more developed. At first, the structure of both markets is specified. After this first step the indicators of insurance market evaluation are introduced, e.g. premium written, insurance penetration, concentration of the insurance market, average premium per capita or loss ratio. On the basis of each selected indicator the development and comparison of the Czech and Slovak non-life insurance market is realized.*

Keywords: insurance, non-life insurance, insurance market, evaluation indicators of insurance market, structure of insurance market

JEL code: G22

1 Introduction

Non-life insurance always seemed to be more uncertain (if goes about insurers' economic results) according to catastrophic risks. The Czech Republic as well as Slovakia has many experiences with floods and windstorms. At the beginning of 1990s both insurance markets came through a period of a „flood" of foreign insurance companies which caused with their international know-how a „storm" on both markets. Last year we also reminded 20 years since the split of Czechoslovakia. It is likely the right time to make a small retro flashback and find out, how both markets developed during last decades.

2 Methodology and Data

The aim of the article (as mentioned above) is to compare the non-life insurance in the Czech Republic and Slovakia and to find out which market is more developed. In order to achieve the aim, the methods of analysis and comparison will be used. The statistics presented by Czech Insurance Association, Slovak Insurance Association and Insurance Europe (formerly CEA) will be used as a data source.

The potential and the level of each insurance market can be proved by some indicators. For instance: share of premiums written to gross domestic product (insurance penetration) or premiums written per capita (insurance density) or other indicators. Level indicators of insurance market assess market completely. These are the indicators used in developed economies and also in this paper:

- Premium written (an absolute value and a share of a selected segment)
- Average premium per capita (insurance density),
- Concentration of insurance market
- Loss ratio (or other similar ratios – Claims ratio and Combined loss ratio)
- Insurance penetration

3 Results and Discussion (Comparison of Non-life Insurance Markets)

The non-life insurance is a part of insurance market and this market belongs to a financial system. Financial system is the heart of each market economy. Insurance industry is influenced by globalization during last decades. The international concept of insurance (and especially reinsurance) operations brings a certainty and helps to balance the economic results. Without this concept the above mentioned catastrophes would be a danger for insurance companies and would limit their insurance capacity.

Non-life insurance helps us to solve financial or material losses after occurring accidental and unexpected events and to stabilize the standard of living or business. „Non-life insurance is an insurance, where the insurer clearly does not know if the insured event occurs or not, and whether he will provide insurance benefit, when and how much." (Kafková and Pukala, 2012) The loss may occur several times during the term of insurance, but it also has not to happen at all.

3.1 Structure of the Non-life Insurance Market in Researched Countries

Both Czech Republic and Slovakia have very similar legal background if goes about non-life insurance. The acts on insurance industry (No. 277/2009 Coll. in the Czech Republic and No. 8/2008 Coll. in Slovakia) provide in each country the list of non-life insurance products. Both acts specify 18 branches of insurance and 8 groups of branches in non-life insurance. Anyway, not all branches of insurance have the same importance on the market. Table 1 shows the structure of the Czech insurance market in first ten years after the market demonopolization that came through at the beginning of the 1990s.

Table 1 Structure of the Czech non-life insurance market in years 1992, 1997 and 2001 (%)

	1992	**1997**	**2001**
Motor	19.9	45.6	51.0
Accident & Health	11.6	6.9	6.8
Property	38.4	18.9	21.0
Liability	6.6	11.5	10.2
Legal expenses	-	0.11	0.23
Marine, Aviation and Transport	-	1.0	0.8
Others	23.5	16.1	10.0

Source: authors according to data from (CEA, 2003)

It is necessary to point out the specific segmentation of non-life insurance used in statistics of CEA/Insurance Europe. Motor third-party liability insurance and motor hull insurance constitute the segment of motor insurance. As seen from the Table 1, during the 1990s a massive share increase of motor insurance occurred. The reason is in rate increase of MTPL which was necessary due to social changes after the velvet revolution that brought foreign (expensive) cars on Czech roads. Additionally, the MTPL system was in the red for quite a long time and such a situation could not have been kept forever. Table 2 shows the development of the Czech non-life insurance market's structure in recent years.

Table 2 Structure of the Czech non-life insurance market in years 2006 – 2012 (%)

	2006	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
Motor third-party liability insurance (MTPL)	30.4	29.9	29.0	29.0	27.1	25.2	25.1
Property insurance	23.4	22.2	22.7	23.7	23.9	24.8	24.9
Motor damage insurance except rolling stock	21.0	20.8	20.4	19.9	18.6	17.9	18.7
General liability insurance	12.8	13.1	13.7	13.9	14.4	14.9	15.7
Other	12.4	14.0	14.2	13.5	16.0	17.2	15.7

Source: Czech Insurance Association (2013)

Both parts of the motor insurance have one common factor – an importance decrease in comparison to other parts of non-life insurance. This decrease has causation in the financial crisis, which influenced the sales and prices of new cars (this price is a basic item in premium calculation process in motor hull insurance), and in a competitive fight between insurers on the Czech insurance market, which cut the rates in MTPL significantly. The detailed analysis of this situation will be not involved in this paper due to its restricted extent.

Table 3 Structure of the Slovak non-life insurance market in years 1992, 1997 and 2001 (%)

	1992	**1997**	**2001**
Motor	35.8	44.3	57.7
Accident & Health	7.6	6.4	2.5
Property	36.1	29.6	25.5
Liability	0.9	11.8	7.7
Legal expenses	-	-	0.26
Marine, Aviation and Transport	-	1.2	1.3
Others	19.7	6.8	5.1

Source: authors according to data from (CEA, 2003)

Table 4 Structure of the Slovak non-life insurance market in years 2006 – 2012 (%)

	2006	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
Motor third-party liability insurance (MTPL)	34.48	33.57	32.03	29.76	30.31	30.25	29.81
Property insurance	22.07	22.05	21.93	23.78	23.32	24.47	24.73
Insurance of damage or loss to land vehicles	29.10	30.46	30.72	30.70	29.52	28.06	27.13
General liability insurance	5.39	5.54	5.80	5.43	6.12	5.93	6.39
Other	8.96	8.38	9.52	10.33	10.73	11.29	11.94

Source: authors according to data from (Slovak Insurance Association, 2007 - 2013)

Table 3 and Table 4 show the situation on the Slovak non-life insurance market in the same period. Although it is not possible to make a precise comparison (because of a little bit different determination of motor hull insurance) we can speak about quite similar reasons for the market development. The development reflects both the strong competition between motor insurers and the decrease in new car sales as a result of the economic slowdown in 2008 and 2009.

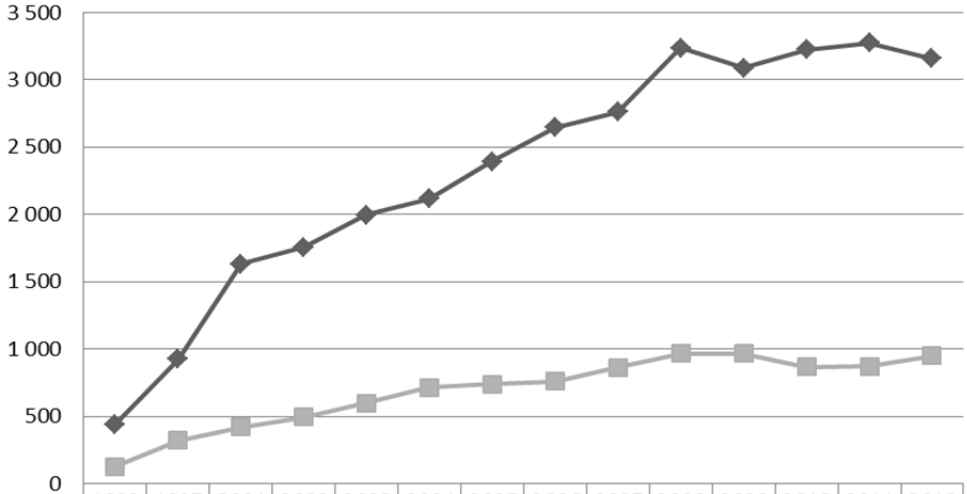
The great challenge for both markets was the transformation of the motor-third party liability insurance from a mandatory insurance (insurance required by law without policy-writing) to a compulsory contractual insurance. In the Czech Republic this process came through in 2000, Slovakia joined us 3 years later. The clients in both countries now have an opportunity to draw from advantages of a fully competitive market with a high product standard. The Slovak insurance market went through one more important moment, namely the merger of Slovenská poisťovňa, a.s. with Allianz poisťovňa, a.s. in 2002. Since 2003 we can also speak of a new subject Allianz Slovenská poisťovňa, a.s. (Slovak Insurance Association, 2003) Slovakia also solved the problem of a mandatory form of the worker's compensation insurance, namely by delegation on the Social Insurance Agency since 2004. In the Czech Republic, this insurance is still waiting for its transformation.

3.2 Premium Written

Premium written reflects the amount of premium corresponding to insurance contracts in force for the entire insurance market in the year. It can be evaluated separately for life and non-life insurance. In a microeconomic viewpoint it quantifies the price of insurance protection paid by a policyholder.

Premium written is an indicator for a certain period and a certain country. It shows a view of the performance of insurance industry and allows to determine ranking and share of commercial insurance companies, as well as countries. (Čejková, Martinovičová, Nečas, 2011) Data on the development of premium written in the Czech Republic and Slovakia are treated in Figure 1. Share of non-life insurance on the Czech and Slovak insurance market is the content of Figure 2.

Figure 1 Development of the Czech and Slovak non-life insurance market in years 1992 – 2012 (premium written, EUR million)



	1992	1997	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Czech Republic	441	924	1 631	1 755	1 994	2 113	2 391	2 642	2 758	3 233	3 086	3 224	3 273	3 156
Slovakia	125	319	420	495	598	713	738	759	861	965	965	868	870	949

Source: authors; based on data from (CEA, 2003; Insurance Europe, 2014)

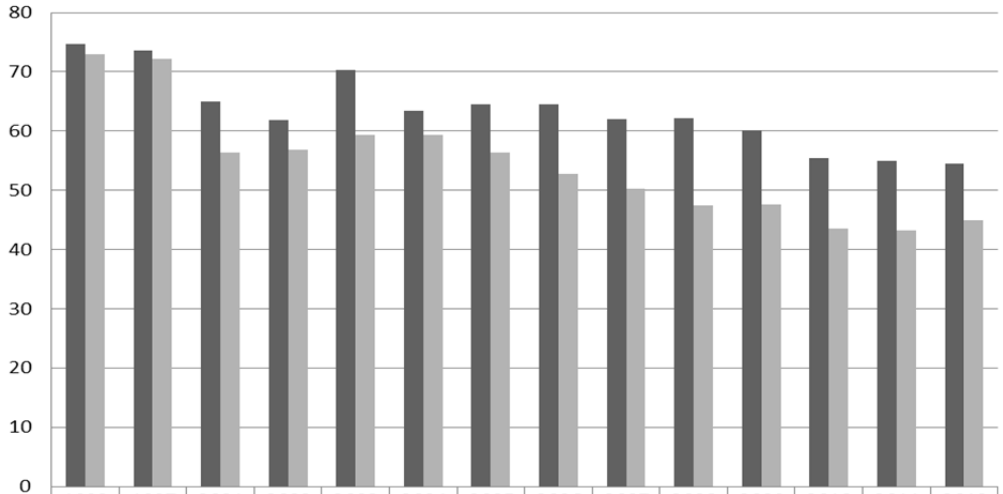
As seen from Figure 1, since the beginning of 1990s both insurance markets have been growing up in a satisfactory manner. With the incidence of financial crisis in 2008 the situation has changed. Regarding the high share of motor insurance in both non-life insurance markets the decrease of several percent occurred every year.

Herein it is necessary to mention that the data of national insurance associations vary from the CEA/Insurance Europe dataset, but only in some years. Probably the biggest difference is in data for Slovakia in years 2004 – 2011. When using the data from the Slovak Insurance Association there would be a small decrease in 2012, not a significant increase. The Czech Insurance Association also provides a little bit different data – when using the data from this source there would be a permanent decrease in non-life premiums written since 2009.

If goes about the share of non-life insurance on the market we can find a difference between both countries. Although the starting position was almost the same, approx. since the millennium Slovakia achieves better results and is much closer to European share of 60 percent to 40 percent in favour of life insurance.

Herein it is important to mention one methodology change that occured in Slovakia in 2006. „As a result of the introduction of International Accounting Standards (IAS) into the insurance companies' accounting systems and also due to the implementation of International Financial Reporting Standards (IFRS), the formerly used premiums written indicator became useless for the purposes of comparison. To show the continuous development of the insurance market with abstraction from the listed methodical changes, the Slovak National Bank introduced the term „technical premiums ", which means an approximate volume of insurance premiums written reported till the end of 2005." (Slovak Insurance Association, 2007) The term „Technical Premiums" will be used also in next years for the purpose of evaluation of the Slovak insurance market development.

Figure 2 Share of non-life insurance on the Czech and Slovak insurance market in years 1992 – 2012 (%)



	1992	1997	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Czech Republic	74,7	73,6	65	61,8	70,3	63,4	64,5	64,5	62	62,2	60,2	55,4	54,9	54,5
Slovakia	72,9	72,2	56,4	56,8	59,3	59,4	56,4	52,7	50,2	47,5	47,6	43,5	43,2	44,9

Source: authors according to data from (CEA, 2003; Insurance Europe, 2014)

3.3 Average Premium per Capita (Insurance Density)

The indicator of premium per capita is used for a better comparison of development of insurance markets. Total premium does not describe the force and quality of the market. Only ratio indicators can bring such information. Table 5 shows the development of this indicator in the Czech Republic and Slovakia. If we analyze the data we can mention that the level of this indicator is different in both countries, the Czech insurance market achieves up to double values than the Slovak insurance market.

Table 5 Average non-life premiums per capita in the Czech Republic and Slovakia in years 1992 – 2012 (EUR)

	1992	**1997**	**2001**	**2002**	**2003**	**2004**	**2005**
Czech Republic	42	90	150	180	195	207	234
Slovakia	24	59	77	90	111	132	137
	2006	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
Czech Republic	258	268	311	295	307	312	300
Slovakia	141	160	179	178	160	161	176

Source: authors according to data from (CEA, 2003; Insurance Europe, 2014)

3.4 Concentration of the Non-life Insurance Market

Concentration of the insurance market is an indicator that uses another indicator, namely premium written (from the market point of view). It shows how much of the market the market leader, first two, first five, first ten or first fifteen insurance companies occupy. If there is only one insurer on the market, the concentration is 100 %. Such a situation lasted on both markets till the beginning of the 1990s. Not until the process of demonopolization allowed the creation of new entities and the indicator gradually decreased. Still in 1997 first five insurance companies had 86.7 % of the Czech non-life insurance market and even 90.4 % of the Slovak non-life insurance market (CEA, 2003).

Neither after 20 years of a competitive market creation both countries' results are not comparable with advanced European insurance markets - the concentration level is still high.

Table 6 Market share of the largest non-life insurance groups (market concentration) in the Czech Republic and Slovakia in years 2000 – 2012 (%)

Czech Republic	**2000**	**2002**	**2004**	**2006**	**2008**	**2010**	**2012**
Market leader	36.7	36.9	36.7	35.3	31.7	29.4	27.7
First 2 companies	58.6	60.4	64.0	63.6	59.9	54.1	50.8
First 5 companies	80.4	80.4	84.4	83.5	80.6	78.6	75.8
First 10 companies	92.2	92.2	95.0	93.9	92.8	93.5	93.4
First 15 companies	95.5	95.4	97.2	95.9	94.8	96.7	96.7
Slovakia	**2000**	**2002**	**2004**	**2006**	**2008**	**2010**	**2012**
Market leader	55.5	39.8	49.2	39.3	36.9	37.6	35.7
First 2 companies	67.1	57.2	72.2	64.7	64.6	64.0	62.1
First 5 companies	85.6	86.3	88.4	83.8	89.1	88.7	86.5
First 10 companies	95.1	94.8	96.8	96.2	97.6	98.5	97.6
First 15 companies	98.8	98.8	99.5	99.4	99.2	99.9	99.8

Source: (CEA, 2010; Czech Insurance Association, 2001, 2003, 2009, 2013; Slovak Insurance Association, 2007, 2009, 2013)

The market leaders of both countries lost gradually their high market share during last 20 years. The current share is in both countries deeply below one half of the market. In the Czech Republic it approaches 25 %, in Slovakia one third of the non-life insurance market. As seen from the Table 6, the merger of Allianz and Slovenská poisťovňa could not have changed this trend for a long period. When making the comparison we can say the Czech insurance market is a little bit less concentrated.

For the sake of completeness: in 2012, the number of domestic insurers operating on the Czech market was 33. The number of foreign branches remained unchanged at 18. (Czech Insurance Association, 2013). In Slovakia, the number of domestic insurers operating on the Czech market was 18. (Slovak Insurance Association, 2013) The number of foreign branches was 20 at the end of April 2014. (National Bank of Slovakia, 2014)

3.5 Loss Ratio

Loss ratio is an indicator that expresses the ratio between the amount of paid claims and the amount of written premium in a respective insurance company for a certain period of time, for example. It can be also expressed from the view of a whole market. The loss ratio is expressed as a percentage. It is monitored also in life and non-life insurance separately. Apart from loss ratio we can speak also of claims ratio which is defined as: (paid claims + change in the provision for claims)/gross earned premiums. (Ducháčková, 2003) Especially in MTPL, the combined loss ratio is used as well. It is defined in this case as: [Total MTPL costs (total incurred losses in the occurrence year as to 31. 12. of the occurrence year, i.e. claims paid + RBNS + IBNR, including MTPL expenses) / MTPL premiums earned]. For instance, in the Czech Republic this indicator exceeded 100 % in 2011 and 2012. (Czech Insurance Association, 2013)

Table 7 Loss ratio in non-life insurance on the Czech and Slovak insurance market in years 1992 – 2012 (%)

	1992	**1997**	**2001**	**2002**	**2003**	**2004**	**2005**
Czech Republic	N.A.	70.9	51.4	82.2	69.8	52.0	47.6
Slovakia	N.A.	N.A.	53.0	46.6	40.0	37.6	35.6
	2006	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
Czech Republic	50.4	47.1	47.4	50.8	55.4	38.2	39.0
Slovakia	41.9	45.4	51.9	50.1	60.3	59.5	47.6

Source: authors; based on data from (Czech Insurance Association, 2000, 2004; Slovak Insurance Association, 2003, 2004; CEA, 2003; Insurance Europe, 2014)

For the comparison we used the simplest ratio, namely loss ratio. The reason for such a decision is as followed: unfortunately it is not possible to collect equal data of both markets for a purpose of time series. Anyway, as seen in Table 7, both markets cope with this indicator without serious problems. Catastrophes that occur occasionally in both countries do not influence the economics of insurance companies significantly. The reason for it is certainly a right extent of reinsurance protection.

3.6 Insurance Penetration

Insurance penetration is defined as a share of total written premiums to gross domestic product at current prices expressed in the analyzed year. The indicator value is given in a percentage. It shows the overall performance of the insurance sector in the various national economies. (Čejková, Martinovičová, Nečas, 2011) As seen below in the Table 8, in all observed years the value of this indicator was lower in Slovakia. On the other side it is necessary to point out that in Slovakia the non-life insurance has a smaller importance than life insurance.

Table 8 Insurance penetration in non-life insurance on the Czech and Slovak insurance market in years 1992 – 2012 (%)

	1992	**1997**	**2001**	**2002**	**2003**	**2004**	**2005**
Czech Republic	1.9	2.1	2.4	2.4	2.4	2.3	2.3
Slovakia	1.4	1.8	1.8	1.9	2.0	2.1	1.9
	2006	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
Czech Republic	2.2	2.1	2.1	2.2	2.2	2.1	2.1
Slovakia	1.7	1.6	1.5	1.5	1.3	1.3	1.3

Source: authors according to data from (CEA, 2003; Insurance Europe, 2014)

4 Conclusions

In this paper we described and presented data of the level of the non-life insurance market in the Czech Republic and Slovakia on a base of several indicators (premium written - in an absolute value and as a share of a selected segment), average premium per capita (insurance density), concentration of insurance market, loss ratio and insurance penetration. After this comparison we can't determine a clear winner.

If we compare both non-life insurance markets we can't find too many differences. The total non-life premium written is logically higher in the Czech Republic than in Slovakia. The same can be told about the insurance density. But the higher share of life insurance (lower share of non-life insurance) shows that Slovak insurance market can be regarded as quite advanced. Loss ratio, although there are differences between both markets, shows that neither the Czech Republic, nor Slovakia have troubles with the insurance economics. Both markets are therefore quite similar and the period of twenty years since the split of Czechoslovakia didn't markedly change it.

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Fiscal Imbalances: How Should Public Finance React?

Juraj Nemec[1], Markéta Šumpíková[2], Stanislav Klazar[3], Beáta Mikušová Meričková[4], Matúš Grega[5]

[1]Masaryk University
Faculty of Economics and Administration
Lipová 507/41a, Pisárky, Brno, Czech Republic
E-mail: juraj.nemec@econ.muni.cz

[2] Unicorn College Praha
V Kapslovně 2767/2, 130 00, Praha 3
E-mail: marketa.sumpikova@unicorncollege.cz

[3]University of Economics, Prague
Faculty of Finance and Accounting, Dep. of Financial Accounting and Auditing
Nám. W. Churchilla 4, 130 67 Praha 3, Czech Republic
E-mail: klazar@vse.cz

[4] Matej Bel University
Faculty of Economics, Department of Public Economics and Regional Development
Tajovského 10, 975 90, Banská Bystrica, Slovak Republic
E-mail: beata.merickova@umb.sk

[5] Matej Bel University
Faculty of Economics, Department of Finance and Accounting
Tajovského 10, 975 90, Banská Bystrica, Slovak Republic
E-mail: matus.grega@umb.sk

Abstract: *After 2008, one of the main issue in EU countries became growing deficit of public finances. This paper argues, that the most feasible way how to improve growing fiscal imbalances in Czech Republic and Slovakia is to focused on efficiency improvements, especially in contracting of public services and public procurement. Our ten year long research in contracting of public services shows, that low level of competition, lack of motivation and poor contract management skills are the main issues. In public procurement, active and passive corruption can be the source of inefficiency. According to our estimates, up to 5% of GDP is wasted because of allocative and technical inefficiencies in our public sector. Improvement solutions are briefly described in conclusions of this paper, but the core problem can be lack of political will and of implementation capacity.*

*Keywords**:** crisis, public finance, efficiency, effectiveness, public procurement*

JEL codes: E62, G01, G18, H57

1 Introduction

The main goal of our paper is suggesting that between many existing solutions to the fiscal crisis (this issue is briefly evaluated in the first part of the paper) the Czech and the Slovak state shall focus on improving efficiency and effectiveness of public expenditures. To support our statement we document the scale of inefficiencies in our public sectors in two areas, where large sums of public money are wasted – externalisation (contracting local public services and outsourcing internal services in public organisations) and public procurement.

Concerning externalisation, we present the data from our more than ten years long research of this topic (for more details and methodology see for example Mikušová-Meričková, Nemec, Sičáková-Beblavá, Beblavý, 2010). We try to analyse the results from externalisation and their purposes.

Concerning the public procurement, our assumption is that it is really inefficient in our conditions (see for example studies by Transparency International or the team from the Charles University). In our paper we test core possible factors influencing results of

procurement procedures in our conditions – general level of competiveness in the economy, level of corruption and "over-legalisation". The first and second issues are frequently discussed in existing literature and we will only briefly mention them in the paper. The last aspect is really rarely investigated issue. However, especially in our and similar conditions it is really important as we document by our research.

2 Crisis, Fiscal Crisis and Possible Reactions

The response to the economic crisis has been partly a global one, through measures such as increased resources for the IMF and policy co-ordination between central banks on monetary policy and to an extent between national governments on fiscal policy. Central banks, including the European Central Bank, have engaged in continual interest rate cuts to historically low levels, but have coupled this with a measure called quantitative easing, which is close to simply increasing the money supply. The central bank buys up assets such as government and corporate bonds - using money it has simply created itself out of thin air. The institutions selling those assets, often banks, will then have "new" money in their accounts, which then increases the money supply. In effect, this adds to the fiscal stimulus. Economies are being boosted with a fiscal stimulus by borrowing and also by 'quantitative easing'. However, this has not been a traditional Keynesian fiscal stimulus as much of the money is being used to help failing firms and in particular the finance sector. But, this deficit spending and process of quantitative easing cannot carry on indefinitely. It will have to be paid for and that means constraining spending and increasing taxes in the years to come. This will have an impact, in some countries a very large impact, on all areas of government spending in all countries. This problem was largely hidden at the moment, as the emphasis was on avoiding a prolonged economic recession, but many authors (for example Dvořák, 2010 in our conditions) immediately warned that it will have an increasing effect.

Massive government interventions to cope with the economic crisis, decreasing governmental revenues during the economic crisis and long term non-sustainability of public finance systems (pending pension reforms, increasing health care expenditures, etc.) opened the trap, where first small (Greece) but later also large (Spain) economies have fallen (Table 1 characterizes the situation in EU). The future in this complicated situation is non-predictable, but at least it is now visible that not only symptoms, but core problems need to be treated in the world economy (Šikula, 2010).

Table 1 Budged balances in Euro zone countries

	2007	2008	2009	2010
Greece	-5.1	-7.7	-13.6	-9.3
Ireland	0.1	-7.3	-14.3	-11.7
Portugal	-2.6	-2.8	-9.4	-8.5
Spain	1.9	-4.1	-11.2	-9.8
Italy	-1.5	-2.7	-5.3	-5
Germany	0.2	0	-3.3	-5
France	-2.7	-3.3	-7.5	-8
Belgium	-0.2	-1.2	-6	-5
Netherlands	0.2	0.7	-5.3	-6.3
Luxemburg	3.6	2.9	-0.7	-3.5
Denmark	0.2	0	-3.3	-5
Finland	5.2	4.2	-2.2	-3.8
Austria	-0.4	-0.4	-3.4	-4.7
Slovakia	-1.9	-2.3	-6.8	-6
Slovenia	0	-1.7	-5.5	-6.1
Malta	-2.2	-4.5	-3.8	-4.3
Cyprus	3.4	0.9	-6.1	-7.1

Source: Public finance in EMU, European commission 2010

Two standard types of measures (and their combinations) are hypothetically available for any government to cope with fiscal crisis problems characterized above (see for example Stiglitz, 1988):

- increasing taxes and
- decreasing expenditures.

Both of them have been and are used by almost all governments involved. However, from the point of view of a standard economic theory it is not very advisable to increase the level of taxation during the recession or early recovery period (Uramová, 2012). Moreover tax increases might be even more unpopular than well argumented and realized expenditure cuts. Thus, our meaning is that the main focus should be on expenditure side, where again, according to the theory, two options exist:

- lump sum (cross-sectional) expenditure cuts and
- efficiency improvements.

The hypothetical choice between these two options is very simple – focus on efficiency, because of the large scale pervasive effects of any lump sum cuts (limiting consumption, scale of services provide, etc.). If such assumption is accepted, than we need to define main areas of inefficiencies, their character and purposes, as the base for designing correction measures. The following parts of this paper document two areas where very important sums could be saved by improving the performance of our governments.

3 Contracting Public Services

Local governments (or their citizen) spend large sums of money to cover the costs of local public services (for detailed data see for example Matějová, 2014, Soukopová, 2011). In our previous research we collected a large series of data evaluating contracting and outsourcing in the Czech Republic and Slovakia. These data indicate that externalisation is really frequent (for example it represents the dominant method in waste management area). The data also indicate that externalisation does not automatically deliver positive results. Table 2 compares costs of in house and external production for local public services - cost efficiency of contracting is measured as the ratio of costs of outsourced services to costs of internal delivery (internal delivery = 100% - for details see for example Mikušová-Meričková, Nemec, Šumpíková, 2010).

Table 2 Efficiency of contracting out local public services

	Czech Republic		**Slovakia**					
Service	2004	2010	2001	2005	2006	2008	2009	2010
Waste management	137	115	94	94	125	184	100	138
Cemeteries	95	x	64	13	67	146	87	84
Public green	86	x	82	192	150	151	120	97
Maintenance of local communications	142	x	70	109	119	114	100	84
Maintenance of local lighting	118	x	100	138	128	156	104	103

Source: Mikušová-Meričková, Nemec, Šumpíková, 2010, Pavel, 2006, Soukopová, 2011

Data collected during our research show how money are wasted and also indicate the main barriers to successful outsourcing under transitional conditions. We briefly introduce three core issues—competition, motivation and contract management skills.

Contracting out is expected to produce major efficiency gains because of competition in the service delivery market. Our data indicate that this potential is not fully realised because of two problems limiting competition. First, there may be too few potential private suppliers (Lowery, 1998). Second, even if competitive selection is mandated, it

often does not happen. Table 3 illustrates the second problem, and in doing shows the limitations to the rule of law in this area.

Table 3 Methods of Selecting External Suppliers: Slovakia, sample 2010 (%)

Procurement method used	Number of inhabitants						Average
	less than 999	1000 – 4999	5000 – 9999	10000 – 19999	20000 – 49999	more than 50000	
Open procedure	16.50	7.66	44.83	60.00	68.42	60.87	43.04
Restricted procedure	3.25	3.12	13.79	0.00	10.53	0.00	5.12
Negotiated procedure	3.50	8.76	6.90	5.00	2.63	0.00	4.47
Price bid	56.00	48.30	10.34	10.00	15.79	0.00	23.41
Direct purchase	20.75	32.16	20.69	20.00	2.63	4.35	16.76
Municipality not willing to provide information	0.00	0.00	3.45	5.00	0.00	34.78	7.20

Source: Mikušová-Meričková, Nemec, Sičáková-Beblavá, Beblavý, 2010

Direct purchase, which avoids a tendering process, is used relatively frequently. This situation is alarming. Many municipalities do not respect the public procurement law. Slovak law clearly states that the procuring entity must respect principles of economy, effectiveness and efficiency in the transparent use of public funds, and must ensure competition, based on the equality of tenderers. A related problem is that some municipalities, mainly in the largest size category, were unwilling to state their procurement methods, despite being obliged to do so by the law on free access to information. We assume they illegally use direct awards.

A second related set of questions about barriers to implementing contracting-out is related to principal-agent problems (Arrow 1984). We would question whether at present the private sector is currently always ready to compete and cooperate with government. We also doubt that the public sector is consistently seeking transparency, accountability, and efficiency. Certainly, the situation is improving, but the business environment in most CEE countries is still far from perfect (See for example data on www.businessmonitor.com, 2013). Our and others` views are that short-term profit strategies prevail, and fair long-term business strategies are still rare.

Short-term rent-seeking strategies still seem to prevail on the side of the principals also. Perhaps unsurprisingly, there is a lack of official statistics confirming such a view, but Pavel and Sičáková-Beblavá (2008) and Beblavý and Sičáková-Beblavá (2006) provide some data.

The third issue, lack of contract management skills is clearly documented by our research – Table 4 provides data from 2010 sample.

Our data also indicate that the low quality of contract management may be one of purposes of the limited success of externalisation – see table 4, where 100 is maximum quality (for more see Mikušová-Meričková and Nemec, 2013).

Table 4 Quality of contract management for contracting local public services

Service	Competitiveness	Ex-ante evaluation	Monitoring	Sanctions	Payment conditions
Waste	42.84	67.12	70.32	42.08	65.65
Public lighting	47.11	72.73	65.26	45.20	63.72
Local communications	50.12	64.40	64.13	43.50	74.15
Public green	58.89	66.39	54.72	46.81	75.90
Cemeteries	29.43	68.27	64.29	45.18	45.79
Average	45.68	67.78	63.74	44.55	65.04

Source: own research, 2010

4 Public Procurement

Many experts feel (Pavel, 2013) that 10-20% savings in public procurement in our conditions are target that can be very simply achieved by improving the system. This may mean that about 3% of GDP is available for more effective use! What are the purposes for such large inefficiency? We discuss two core problems – "active corruption" well described by existing literature (Rose Ackerman, 1999), but also "passive corruption", the concept that is relatively new and rarely investigated (Pavel, 2013).

The existence of "active corruption" (corruption in later text) in public procurement is more or less natural feature of all modern societies. The question is not "yes or no", but the size and scale of corruption in public procurement. The purposes of corruption in public procurement have natural but also subjective character.

The main objective purpose of the existence of corruption in public procurement is the character and scale of the process. The "public procurement" expenditures in modern economies are estimated within the interval 10 – 20 % of GDP (Pavel, 2013). Public entities spend on public procurement large sums to purchase goods, services or to construct public works. The possibility to supply to the state is very good chance for private suppliers to sell their products or capacities in relatively "safe market" (in all developed countries the business with the state is the most safe part of the commercial operations – the state may be late, but will pay). Supplies are not only with limited risk but also normally have repeatable and predictable character what is really important for economic operators.

The size and character of public procurement market makes this market very popular and interesting to all economic operators, to large extend also in developing countries (where the state might be less stable compared to developed world). Private firms want to supply to the government and might be ready to compete for public orders also in unfair way.

Public officials are normally not very well paid in developing economies and may need extra incomes to "safe" their living standard. With this, private interest may overweigh public needs and public services principle, especially in less developed public procurement systems that are not transparent enough. Or just effective incentives to motivate public servants to serve to public interest might not be in force. In such situations allocative (what to buy) and technical (for how much to buy) efficiency of public expenditures cannot be achieved.

The last objective purpose of corruption in public procurement (all these purposes cannot be fully eliminated) is connected with the fact that procurement official and representative of supplier do not have incentives to report corruption. They both infringe the law (directly or indirectly) and both benefit. In situation of sophisticated public procurement corruption (corruption occurs but the law is not broken) only dissatisfied suppliers may have some interest to touch the problem. If economic subjects are afraid

to do this (loosing chance to win next tenders as unofficial "black list" members) there is almost no chance to discover that something went wrong.

"Passive corruption" (wasting public money for nobody´s interest, without direct corruption) in our and similar conditions may be as much (or more?) important as the issue of corruption. Administrative systems in Central and Eastern Europe – CEE (and in many other areas of the worked) prefer to focus more on process (probity) compared to results (outcomes and results) – see for example Wright and Nemec, 2002. In such situation what is the preferred behaviour of non-corrupted public official responsible for procurement? 3E or just "bureaucratic safety"? For clear majority it is the certainty that rules have been followed with as low risk as possible, independently of results?

Pavel (2013) clearly documents that the typical approach of CEE governments is to react to implementation problems by legislative and regulative changes and not process changes. With this the complexicity of procurement directives increases year by year, the risk of mistake increases and the space for managerial flexibility diminish.

The typical response to such over-legalisation is preference for "bureaucratic - safe" decisions. The process and not the results are the focus, resulting into large money wasting. It is not so simple to document our hypothesis that "over-legalisation/byrocratisation" of procurement exists and influences its results, but there are some options.

Our assumption is that too much bureaucracy in procurement motivates non-corrupted public officials (because of "safety" principle) to use economy (lowest price) as the selection criterion compared to efficiency (best bid). According to the existing literature (summarised for example by Pavel, 2013) economy shall be used only in cases where the procurer can really well specify ordered goods, services or works. There are no generally valid estimates, but this should mean that a lowest price is the main selection criterion for goods, but less important selection criterion for services and works.

Our data compiled from the international statistics for selected countries (most important CEE countries, UK as example of Anglo- Saxon managerialism, France as example of different public administration system and Austria and Germany as neighbours with Weberian tradition) are displayed by Figures 1-2 (EU PP statistics data processed). One might argue that the too high proportion of economy based procurement decision in CEE regions is the result of other factors and not "safety" principle.

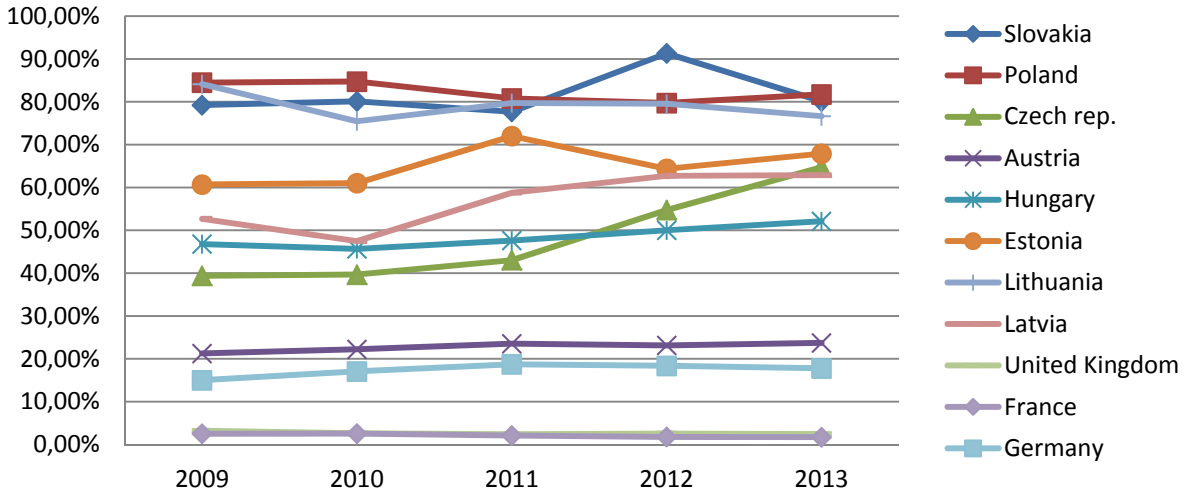
5 Conclusions

Current global crisis will be not so simple to "overcome", especially if voices of "pessimists" about systematic crisis are close to reality. In any case, most governments in the world, and all governments in our region have to revitalize their public finance.

Our paper is based on the argument that the best way to balance revenues and expenditures are efficiency improvements (according to our "private and experience based" estimates at least 5% of GDP is wasted because of allocative and technical inefficiencies in our public sector). It analyses two important examples of significant inefficiencies in our public sectors and proposes the core purposes of problems – contracting local public services and public procurement.

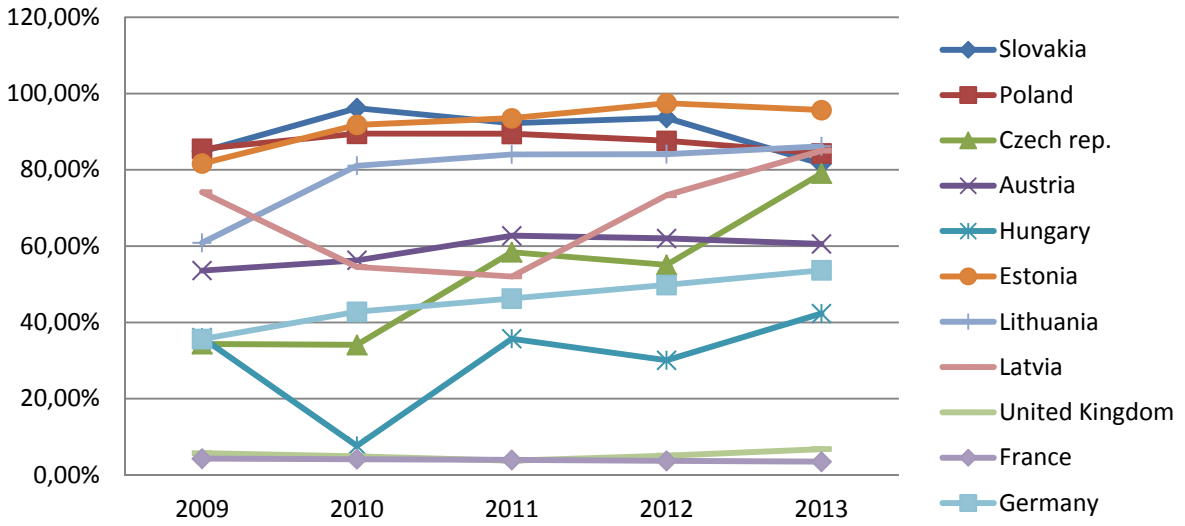
The conclusions are straightforward – contracting in our conditions delivers much less compared to developed countries, mainly because of limited contract management skills of our public officials. Public procurement is not only corrupted, because of active behaviour of actors, but it is also inefficient because of "passive corruption" cause by the fact that the focus of procurement in our conditions is on compliance and not results.

Figure 1 Lowest price in public procurement of services



Source: own research based on data from Tenders Electronic Daily, 2014

Figure 2 Lowest price in public procurement of works



Source: own research based on data from Tenders Electronic Daily, 2014

Possible solutions are very well described by the standard literature: ex-ante evaluating public expenditure; the implementation of accrual accounting in the public sector, improved control, effective training of public servants in the area of modern public management methods. Anyway, we are afraid that the core problem will be lack of will and of implementation capacity.

Acknowledgments

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Influence of International Trade on Economic Growth

Marcel Novák[1], Pavol Skalák[2]

[1] University of Economics in Bratislava
Faculty of National Economy, Department of Economic Theory
Dolnozemská cesta 1, 852 35 Bratislava, Slovakia
E-mail: marcel.novak@euba.sk

[2] University of Economics in Bratislava
Faculty of National Economy, Department of Applied Informatics
Dolnozemská cesta 1, 852 35 Bratislava, Slovakia
E-mail: pavol.skalak@euba.sk

Abstract: *International trade significantly affects our standard of living. It allows us to access goods and services that we don't produce in our country or we can't produce because we don't have resources to do so. Thereby imported good widened our consumer choices. The benefit of international trade is also in increased productivity, which has its origin in the specialization of production and competitive pressure from foreign producers and markets. Economic performance is not only determined by national production factors, but also by international factors and so interdependence of countries becomes more and more intense. In times of globalization, its importance raises and countries that underestimate its possibilities may stay behind the others. This paper therefore focuses on relationship of international trade and development of country with help of regression analyzes and comparative methods. As an example of opened economy was used Slovakia and countries of V4. In general, we cannot definitely consider the international trade as one of the source of economic growth. However, there are many ways how can it contribute to the development of the country.*

Keywords: international trade, economic growth, openness, Slovakia

JEL codes: F41, F43, F63

1 Introduction

The aim of this paper is to find an answer to the question whether trade can contribute to the economic development of countries. Theoretically, a long-term economic growth and productivity should be positively affected by openness of the country. Most authors explain this with easier transfer of technology and innovation in opened economies. From an empirical point of view, this relationship is not so cleared and there is long term discussion about the relationship between trade policy and economic performance. This paper tries to use regression analyses to find whether there is some sort of relationship between trade (represents openness) and economic growth (represents economic development).

We can find an example of this relationship in the past. In the 19th century the United Kingdom belonged to the biggest industrial producer. Large increase in output and population in the country poor in resources has led to the demand for food and raw materials exported from the newly populated countries such as the United States, Canada, Australia, New Zealand, Argentina, Uruguay, and South Africa. In the period 1815 - 1913 the population of Britain increased threefold, it's real GDP increased 10-fold and its importing increased twentyfold. This growth was subsequently extended to the countries with which Britain traded. Just export was the main factor that brought the economy to rapid growth and development (Nurkse, 1970). In this case, international trade operated as a source of growth for these countries in 19 century. For such development, however, there were necessary and favorable circumstances such as enough natural resources in exporting countries or transfer of labor and hence the capital from overcrowded Europe.

In recent time developing countries cannot rely so much on trade as a factor of development because of less favorable conditions of supply and demand. Compared to

the situation in the 19 century, reduced demand for raw materials has several reasons: (1) price elasticity of demand for raw materials exported from developing countries is less than 1, (2) the development of synthetic substitutes decreased the interest in natural raw materials (e.g. nylon-cotton), (3) technological advance reduced the amount of raw materials used in production, (4) developed countries use trade restrictions to limit imports. From the supply side, the situation is more or less similar, when the current developing countries are not as well equipped with natural resources (the exception is oil-exporting countries), or they are overcrowded and any increase in their production is absorbed by the domestic economy. Also, a capital inflow to these countries is not as massive as in the 19th century and the major concern is brain drain when educated workforce moves to countries with a higher standard of living (Rodríguez, and Rodrik, 1999; Frankel and Romer, 1999).

2 Trade and Development of Country

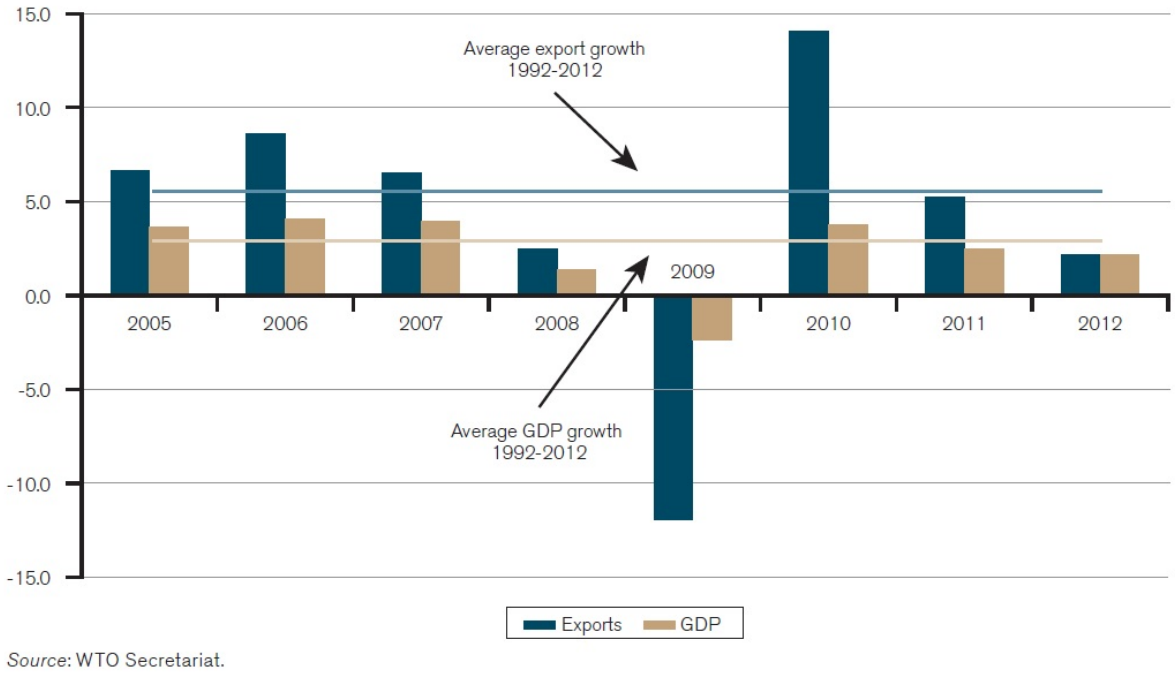
In general, we cannot definitely consider the international trade as one of the source of economic growth. However, there are many ways how can it contribute to the development of the country. (1) Trade can lead to full utilization of domestic resources (the country can get out of inefficient point below the production possibilities frontier, when it does not use its resources for the lack of internal demand, up to the point on the production possibilities frontier thanks to trade. For a country a trade will mean a possibility to use potential surplus, e.g. agricultural stock or raw materials). (2) By extending the market, trade allows division of labor and economies of scale (it was reflected mainly in the production of small economies such as Taiwan, Hong Kong and Singapore). (3) International trade helps in transferring new ideas, technologies, managerial and other skills. (4)Trade helps with the international flow of capital from developed to developing countries. (5)In some countries, the import of new products can cause increased domestic demand, which in turn results in a sufficient domestic production of those goods. (6)International trade is an excellent tool for antitrust policy because it promotes greater efficiency of domestic producers, who have to cope with foreign competition. (Haberler, 1964)

The ability of foreign trade to increase rate of economic growth is related to the specialization of the economy, which is determined by the following factors: (1) differences in the absolute cost of labor as explained in the theory of absolute advantage, (2) differences in comparative cost of labor as explained in the theory of comparative advantage, (3) differences in factors of production (their effect is formulated in the Heckscher-Ohlin theory), (4) technology differences related to technological gap when the economy has a comparative advantage over importing economy until producer in the importing economy begins production of the goods, (5) differences in sophistication of the product, which are related to the life cycle of the product (stage of introduction, growth, maturity and decline) so the greatest comparative advantage has the economy with excellent products and technological level and this advantage (at the same time also the export opportunity) decreases together with the life cycle of product, (6) differences in the level of human capital that result from comparative advantages when joining the international division of labor, (7) geographic factors that influence participation of economy in international trade in terms of geographical concentration (model center - periphery), creation of industrial areas (in relation to deposits of natural resources and raw materials) or differences and similarities in education, culture, policy, religion, climatic conditions. (Schultzová – Rabatinová, 2012; Pastoráková - Janíková - Brokešová – Ondruška, 2013)

Of course, we can always find cases in which international trade could hinder the economic development of the country; however, in most cases we expect the contribution of trade to the development process. The problem is if the most of the benefits from trade go to developed countries and not to developing, which need its positive effects on economic growth much more. Despite such cases, we can hardly talk about its negative impact. (Maksim – Péliová, 2011)

Figure 1 shows that development of world merchandise trade is same as development of world GDP so growth in export is followed by growth in GDP. Large decline of exports and GDP in 2009 is connected to the global crisis.

Figure 1 Growth in volume of world merchandise trade and GDP, 2005 – 2012 (annual percentage change)



Source: World trade report 2013

Based on traditional trade theories, countries should specialize in producing of goods in which they have a comparative advantage. Consequently, the global output would increase and all countries involved in international trade would profit. Shortcoming of this assumption is that according to theory of comparative advantage, developing countries should focus on production and export of primary commodities to developed countries in exchange for final products in compliance with current distribution of factors of production and technology between these countries. For developing countries this may be advantageous in short term, however in long term this would mean to stay behind developed economies. Such an approach would make it impossible to obtain the dynamic benefits of industrial production and trade that include for example educated workforce, more innovation, higher and more stable export prices, or higher income of population.

Endogenous growth theories (e.g. Romer, 1986) suggest that the reduction of trade barriers will increase the rate of economic growth and development in the long term by (1) a more rapid absorption of technology developed in more developed countries, (2) increasing the benefits of research and development, (3) greater economies of scale in production, (4) reducing the price gap and more effective use of domestic resources, (5) encouraging greater specialization and efficiency in the production of intermediate products. Many of these findings on the impact of free trade on economic growth have been mentioned before the theories of endogenous growth, but these theories examined the detailed way how lower trade barriers stimulate economic growth in the country.

Theoretical explanation of the positive relationship between international trade and economic growth does not automatically mean the empirical confirmation of this relationship. Various studies (e.g. Edwards, 1993) show that it is very difficult to test this relationship in the real world. The main cause of the problem is the lack of detailed data. This means that although empirical studies demonstrate the positive relationship of

openness and growth, but they cannot find and test the specific mechanisms by which this occurs.

Liberalism and Protectionism in International Trade

After World War II prevail the belief that for the economic development of independent countries is better to protect their infant industries than to apply open trade policy. This attitude was based on worst-case assumptions about the export opportunities for developing countries. These countries exported mainly primary commodities, while industrialized countries exported processed goods. The problem of primary commodities is their lower income elasticity of demand. If growth of GDP in developing countries was same as in developed countries, developing countries would have been under pressure of increasing external deficit and their export revenues couldn't keep the pace with their expenses on import. Based on the assumption that, in the long run, such deficit would be unsustainable, economic growth would be slower in less developed countries. To the long-term economic growth in developing countries could lead for example increased export of primary commodities, or increased export of processed goods. First problem would be in reduced export earnings, while the other was not realistic due to low productivity and competitiveness of industrialized countries.Based on these arguments, the way to achieve sustainable growth was the redistribution of production factors from the primary sector to the manufacturing sector (Nurkse, 1961). It began so called policy of import substitution, when developing countries should adopt protectionist strategy to retain the domestic market for local processing industry by limiting imports (introduction of import duties, quotas and other barriers) and stimulate import of capital goods needed for industrialization. Economists have criticized the policy of import substitution and infant industry, because it focuses only on one industry, while at the same time ignores the effects on macroeconomic variables such as exchange rates, aggregate export and import or monetary and fiscal policy. It was mostly the crisis and unsustainable deficit of import, unmanageable budget deficit, high inflation, and so on, which had a significant impact on the change of policy in most countries.

Although some studies describe a situation where protectionism can lead to faster economic growth, any of these studies does not consider protectionism as the long-term development strategy. Protectionism is considered as a short-term strategy that is needed to prepare the economy competitiveness in the international market in the long term (Soukiazis - Muchová - Lisý, 2013).

Change to liberal policy first appeared in the Far East (Taiwan, Singapore and South Korea). Their radical approach to trade liberalization was not followed by the most of developing countries until the debt crisis in 1982. During this period, countries were forced to borrow on international markets to deal with the problem of balance of payments and deficit. They realized that the only way to achieve sustainable growth was to leave the policy of import substitution. Even traditionally close economies such as Argentina, Chile, Mexico, Turkey, Ghana and Uganda have started to apply a liberal strategy (Baldwin, 2003). An important factor to change from a close to an open foreign policy has been a remarkable growth of several East Asian countries, causing a change in thinking of economists, the World Bank or the IMF.

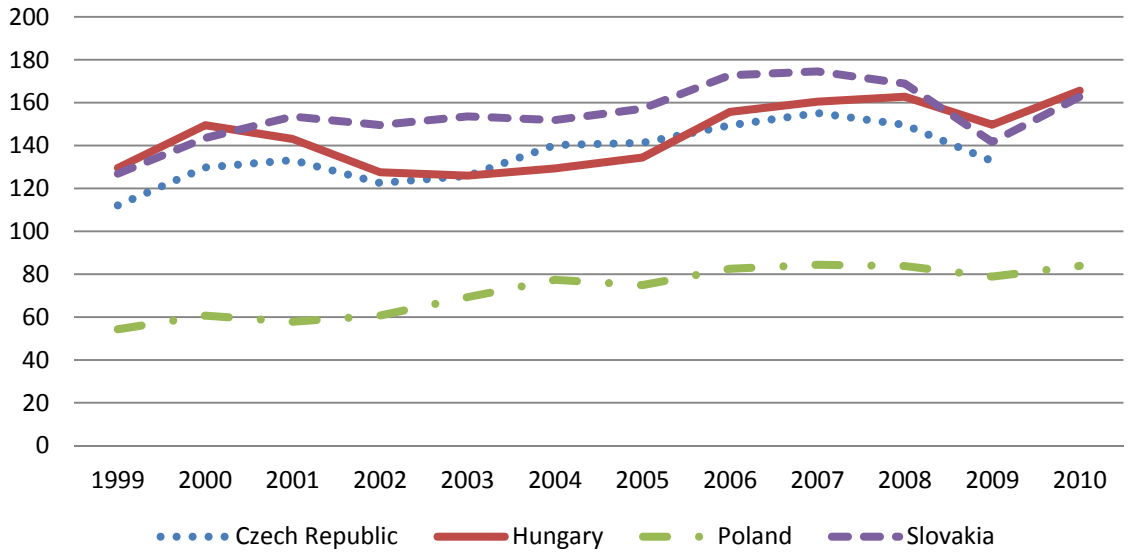
Although Adam Smith and David Ricardo defend free trade, their argument based on static comparative advantages is problematic and does not lead to higher long-term economic growth. Also, the traditional arguments in favor of eliminating protectionism are not confirmed by empirical evidence. However, it is necessary to look at other benefits of participation in international trade. The first argument is economy of scale, when country engaged in international trade gains access to larger markets than its own. This argument is implicitly based on the assumption that economies of scale exist mostly in export sectors, or at least, they are greater than in import sectors. However, if export consists of labor-intensive (non-sophisticated) products, trade liberalization will not lead to profit from economies of scale. The second contribution is related to the X - efficiency, which was formulated by Leibenstein (1966). In the case of protectionism, the incentives for entrepreneurs to be effective are weak. Open economy forces them to produce at the

lowest cost and so domestic production has also become X - efficient. The impact of trade policy on the pace of technological progress is also one of the potential arguments in favor of trade liberalization. In the endogenous growth model of an open economy is technological progress related to the transfer of knowledge between partners. If we assume perfect knowledge transfer, free trade will lead to higher economic growth as a result of increasing stocks of knowledge and the rate of technological progress. However, if there is no spill-over of knowledge between business partners, move to an open economy will not accelerate technological progress. Moreover, developing countries will not be able to compete with technologically more advanced countries.

3 Correlation of Trade and Economic Growth in Slovakia

Slovakia as a small economy is one of the most open economies in the world. According to figure 2, openness of Slovakia (measured as the ratio of foreign trade to GDP) gradually increases during the entire period with the highest values reached in 2007 – almost 180%. Since that time, however, we can see significant decline in openness, which is related to the global crisis on world markets and the subsequent decline in foreign trade. Within countries of Visegrad Group, Hungary and Czech Republic also have high values of openness.

Figure 2 Openness of the Visegrad Group, 1999 - 2010



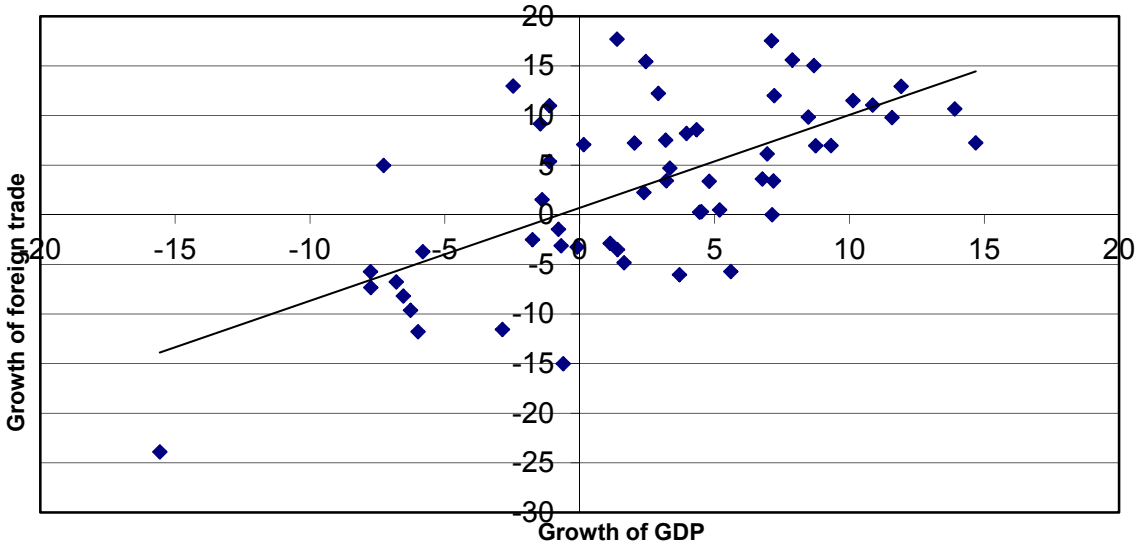
Source: OECD Statistics, authors

Whether a high degree of openness of Slovakia has a positive or negative impact on economic growth, we take into account the relationship between growth of foreign trade (measured as summary of export and import) and growth of GDP in Slovakia in the period from 1997 to 2011.

Figure 3 shows relationship between growth of foreign trade and growth of GDP in Slovakia. Positive correlation of these two variables shows the location of most of the data in the first and fourth quadrant of the chart. The correlation coefficient in this case is 0.653, reflecting moderately strong dependence.

Macroeconomic developments in Slovakia, as a small and open economy, is largely determined by the development of external economic relations and Slovakia are among the most open country of all EU countries. Given the size of market in Slovakia, lack of their own natural resources, dependence on import and its development, this position is legitimate.

Figure 3 Growth of foreign trade and GDP



Source: OECD Statistics, authors

We tried to find also general relationship between international trade and economic development. A major problem in analyzing the relationship of openness and growth is the lack and poor quality of available data. We used panel data for 30 OECD countries for 19 years (1995 - 2013) with International Trade (as total of export and import of goods and services in millions of US Dollars per year, seasonally adjusted) and Gross Domestic Product (in millions of US Dollars per year) as variables in regression analysis. Only for these countries and this time period we were able to find complete dataset. Model is as followed:

Figure 4 Regression analysis

Model: Pooled OLS, using 570 observations
Included 30 cross-sectional units
Time-series length = 19
Dependent variable: GDP

	Coefficient	Std. Error	t-ratio	p-value	
const	-355537	55550,5	-6.4003	<0.00001	***
Trade	2.77393	0.0623614	44.4815	<0.00001	***

Mean dependent var	1040144	S.D. dependent var	2315326
Sum squared resid	6,80E+14	S.E. of regression	1094429
R-squared	0.776958	Adjusted R-squared	0.776565
F(1, 568)	1978.604	P-value(F)	3.30E-187
Log-likelihood	-8734.067	Akaike criterion	17472.13
Schwarz criterion	17480.82	Hannan-Quinn	17475.52

Source: Gretl, OECD, authors

According to these results we can conclude that the assumption of a positive relationship between international trade and GDP can be confirmed. Variable international trade has positive effect on GDP and explains 77% of the variability of GDP; other 23% are caused

by factors not included in the model and the random effects. Statistical significance of individual coefficients is confirmed. This relationship is defined by following equation:

$$GDP = -355537 + 2{,}77 * \mathrm{TRADE}$$

According to our model, increase of international trade by 1 unit increase GDP by almost 2,8 units.

This positive result corresponds with empirical studies that tested relationship between openness and economic growth. The most cited paper Dollar (1992) showed that there is positive correlation between average growth of GDP and openness. Karras (2003) proved that effect of openness on economic growth is positive, permanent and statistically significant. According to his study increase of trade by 10% permanently increases real GDP growth rate by 0,25 to 0,3%. Edwards (1998) confirmed hypothesis about positive relationship between openness and economic growth. The problem may be relatively small quantitative effect of openness on economic growth. Frankel – Romer (1999) showed that there is a significant impact of trade openness on income growth. According to their study when the share of trade increases by 1%, revenues will grow by 0,5% to 2%.

4 Conclusions

International trade and interdependence of countries have become a part of everyday economic life. In times of globalization, its importance raises and countries that underestimate its possibilities may stay behind the others. Technological progress, innovation and the limitation of barriers to trade significantly contributes to the continuous development of international integration and strengthen the role of world trade. Economies that are oriented to support international trade can increase their competitiveness, productivity, economic growth and improve the standard of living. Generally speaking, bigger country with more inhabitants isn't so dependent on economic relationship. When the country is smaller and more open, it should focus on increasing and maintaining competitiveness.

In general we can say that countries that are more open to the world have a higher ability to absorb technological advances generated by the most developed countries of the world. Empirical researches, although they are largely problematic (model, econometric and data problems), suggest that countries with policies supporting market generally have higher economic growth.

The strategy of free trade may not always be a good choice for all countries. This orientation of economy can be effective only when the government adopted stabilization and structural policies appropriate for a particular country and its conditions or its stage of development. It is important that developing countries should focus on the possible impacts of trade liberalization before they adapt these strategies. If international trade leads economy to specialization in sectors that exhibit low potential for further growth, the overall growth of the economy can be reduced. On the other hand protectionist policy that brings specialization in sectors with potential for improving productivity may increase the general well-being.

Results in this paper confirmed positive relationship between openness (represent by trade) and economic growth (represent by growth of GDP). These results are also supported by many empirical literatures. Naturally, results we found are not definite and should be further analyzed to find different views and other components of analyzed relationship.

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Hedging against a Price Rice Using Vertical Ratio Call Back Spread Strategy Formed by Barrier Options

Bibiána Nováková, Pavol Baran

Technical University of Košice
Faculty of Economics, Department of Finance
Němcovej 32, 040 01 Košice
E-mail: bibiana.novakova@tuke.sk, pavolbaran@pbcapital.sk

Abstract: *This paper presents hedging analysis against an underlying price rise by using Vertical Ratio Call Back Spread strategy formed with barrier options. The main theoretical contribution is to specify profit functions for this strategy which can be applied in practice for a variety of underlying assets. In this paper the strategy is applied to real option data for SPDR Gold Shares, which are traded on the stock exchange.*

Keywords: barrier options, vertical ratio call back spread strategy, SPDR gold shares

JEL codes: G11, G15, G120

1 Introduction

Increased volatility in financial markets in the second half of the 20th century has resulted in the development of financial derivatives. Option strategies using vanilla options can be found in many papers (e.g., Cohen, 2005; Fontanills, 2005; Frederick, 2007; Smith, 2008; Thomsett; 2008).

Of particular importance for the further research of options´strategies and their applications is the approach of Šoltés, V. (2002), who described the profit functions in their analytical form. This approach allows to find the algorithm for the optimal use of various option trading strategies, if they can be created in multiple ways (Šoltés, V. 2001). The use of option strategies created by vanilla options is described in many papers (e.g., Šoltés, M., 2006; Amaitiek at al., 2010).

Profit functions in their analytical form allow to reveal the nature of the creation of various structured products, particularly investment certificates, presented in the following works of Šoltés, M., (2010) and Šoltés, V. (2011).

More complicated is the creation of hedging strategies using barrier options. If an option strategy can be created in one (sole) way by vanilla options, then it can be created in minimum 16 ways, using the barrier options. On the other hand, the option strategies created this way are more suitable for hedging, as well as for the creation of more interesting structured products. In this regard, we can cite following works of Šoltés, V. and Rusnáková (2012, 2013), Rusnáková and Šoltés, V. (2012), Gordiaková and Younis (2013), Rusnáková and Younis (2012).

The paper by Šoltés, V., (2002) presents Vertical Ratio Call Back Spread strategy (VRCBS), which can only be created in one way, using the vanilla options.

The main objective of the paper is to create this strategy by barrier options, and to select those of the sixteen possibilities which are suitable for hedging against the price rise of an underlying asset.

Another objective of the paper is to apply hedging by VRCBS strategy against the price rise, created by barrier options in SPDR Gold Shares, which are traded at the New York Stock Exchange (NYSE).

2 Barrier Options

Barrier options are different from vanilla options. They have a barrier level in the form of marginal underlying spot price. Exceeding the barrier during the option life means option activation (knock-in), or deactivation (knock-out). Barrier level can be

above or below the underlying spot price. Based on this, four basic types of barrier options are recognized:

- up and knock-in (UI) call/put option – is activated, if an underlying price during the life of an option increases above upper barrier U,
- down and knock-in (DI) call/put option - is activated, if an underlying price during the life of an option decreases below lower barrier D,
- up and knock-out (UO) call/put option - is deactivated, if an underlying price during the life of an option increases above upper barrier U,
- down and knock-out (DO) call/put option - is deactivated, if an underlying price during the life of an option decreases below lower barrier D.

While there are four basic option positions for vanilla options (buying or selling call/put option), there exist sixteen basic option positions for barrier options (combinations of buying or selling call /put, up/ down and knock-in/ knock-out options).

If option strategy is formed by two options, then there is only one possibility available of creation for vanilla options in comparison to sixteen possibilities for barrier options. There are other possibilities for creation if some of the options is vanilla, or if the barrier levels are different for each option.

3 Hedging against a Price Rise by VRCBS Strategy Using Barrier Options

Let us suppose that in the future we want to buy n units of underlying asset, but we are afraid of price rise in the market. Therefore we have decided to hedge against the price rise of underlying asset using VRCBS strategy formed with barrier options. They have the same underlying asset and the same time to maturity. In our analysis, we have selected the best suitable variants of formation of the VRCBS strategy for hedging against the price rise.

I. Let us construct VRCBS strategy by selling n_1 vanilla call options with a lower strike price X_1 and premium c_{1S} per option and, at the same time, by buying n_2 UI call options with a higher strike price X_2, premium c_{2BUI} per option and a barrier level U $(U > X_2)$.We select the number of options in a way that enables $n + n_1 = n_2$. If the condition $n_1 c_{1S} + n_2 c_{2BUI} \geq 0$ is fulfilled, we can construct the strategy with zero initial cost. The profit function from selling n_1 vanilla call options is:

$$P_1(S_T) = \begin{cases} n_1 c_{1S} & \text{if} \quad S_T < X_1, \\ -n_1(S_T - X_1 - c_{1S}) & \text{if} \quad S_T \geq X_1, \end{cases} \tag{1}$$

where S_T is the spot price of barrier option at expiration time.

The profit function from buying n_2 up and knock-in call options is:

$$P_2(S_T) = \begin{cases} -n_2 c_{2BUI} & \text{if} \quad S_T < X_2, \\ n_2(S_T - X_2 - c_{2BUI}) & \text{if} \quad \max\limits_{0 \leq t \leq T}(S_t) \geq U \wedge S_T \geq X_2, \\ -n c_{2BUI} & \text{if} \quad \max\limits_{0 \leq t \leq T}(S_t) < U \wedge S_T \geq X_2, \end{cases} \tag{2}$$

and the function of cost from unsecured position is:

$$P_3(S_T) = -nS_T . \tag{3}$$

We can form the profit function for secured position using the VRCBS strategy as a sum of the functions (1), (2) and (3) from the individual operations.

$$ZP_I(S_T)=\begin{cases}-nS_T+n_1c_{1S}-n_2c_{2BUI} & \text{if } S_T<X_1,\\ -(n+n_1)S_T+n_1X_1+n_1c_{1S}-n_2c_{2BUI} & \text{if } X_1\le S_T<X_2,\\ -(n+n_1)S_T+n_1X_1+n_1c_{1S}-n_2c_{2BUI} & \text{if } \max\limits_{0\le t\le T}(S_t)<U\wedge S_T\ge X_2,\\ n_1X_1-n_2X_2+n_1c_{1S}-n_2c_{2BUI} & \text{if } \max\limits_{0\le t\le T}(S_t)\ge U\wedge S_T\ge X_2.\end{cases} \quad (4)$$

This way of hedging will be applied when we expect the price rise of the underlying asset above the barrier level U. If our assumptions are fulfilled and the spot price is from the interval $S_T > X_2$ at the expiration time, then we have ensured the constant cost of buying $n = n_2 - n_1$ units of underlying asset, equal to $n_1X_1 - n_2X_2 + n_1c_{1S} - n_2c_{2BUI}$.

II. Let us create this option strategy by selling n_1 down and knock-in call options with a lower strike price X_1, premium c_{1SDI} per option and a barrier level $D\ (D < X_1)$ and, at the same time, by buying up and knock-in call options with a higher strike price X_2, premium c_{2BUI} per option and a barrier level $U\ (U > X_2)$, while $n + n_1 = n_2$. The profit function from selling n_1 down and knock-in call options is:

$$P_1(S_T)=\begin{cases}n_1c_{1SDI} & \text{if } S_T<X_1,\\ -n_1(S_T-X_1-c_{1SDI}) & \text{if } \min\limits_{0\le t\le T}(S_t)\le D\wedge S_T\ge X_1,\\ n_1c_{1SDI} & \text{if } \min\limits_{0\le t\le T}(S_t)>D\wedge S_T\ge X_1,\end{cases} \quad (5)$$

where S_T is the spot price of barrier option at the expiration time.

The profit function from secured position (6), can be obtain as a sum of the functions (2), (3) and (5).

$$ZP_{II}(S_T)=\begin{cases}-nS_T+n_1c_{1SDI}-n_2c_{2BUI} & \text{if } S_T<X_1,\\ -(n+n_1)S_T+n_1X_1+n_1c_{1SDI}-n_2c_{2BUI} & \text{if } \min\limits_{0\le t\le T}(S_t)\le D\wedge X_1\le S_T<X_2,\\ -nS_T+n_1c_{1SDI}-n_2c_{2BUI} & \text{if } \min\limits_{0\le t\le T}(S_t)>D\wedge X_1\le S_T<X_2,\\ -(n+n_1)S_T+n_1X_1+n_1c_{1SDI}-n_2c_{2BUI} & \text{if } \min\limits_{0\le t\le T}(S_t)\le D\wedge \max\limits_{0\le t\le T}(S_t)<U\wedge S_T\ge X_2,\\ -nS_T+n_1c_{1SDI}-n_2c_{2BUI} & \text{if } \min\limits_{0\le t\le T}(S_t)>D\wedge \max\limits_{0\le t\le T}(S_t)<U\wedge S_T\ge X_2,\\ n_1X_1+n_1c_{1SDI}-n_2X_2-n_2c_{2BUI} & \text{if } \min\limits_{0\le t\le T}(S_t)\le D\wedge \max\limits_{0\le t\le T}(S_t)\ge U\wedge S_T\ge X_2,\\ n_1S_T+n_1c_{1SDI}-n_2X_2-n_2c_{2BUI} & \text{if } \min\limits_{0\le t\le T}(S_t)>D\wedge \max\limits_{0\le t\le T}(S_t)\ge U\wedge S_T\ge X_2.\end{cases} \quad (6)$$

We will prefer this variant of hedging, when we assume that spot price of underlying asset will be always above the lower barrier level D and at least above the upper barrier level U during the time to maturity. In this case, secured price of buying $n = n_2 - n_1$ units of underlying asset at the time of expiration even decreases with the increasing price of the underlying asset above the upper barrier U. The disadvantage of this strategy is that it cannot be created with zero initial cost, which increases the price, if the price of the underlying asset does not reach the upper barrier U, but especially if it decreases below the lower barrier D.

III. Let us use the VRCBS strategy by selling n_1 down and knock-out call options with a lower strike price X_1, premium c_{1SDO} per option and a barrier level $D\ (D < X_1)$ and, at the same time, by buying up and knock-in call options with a higher strike price X_2, premium c_{2BUI} per option and a barrier level $U\ (U > X_2)$, while $n + n_1 = n_2$. The profit function from selling n_1 down and knock-out call options is:

$$P_1(S_T) = \begin{cases} n_1 c_{1SDO} & \text{if } S_T < X_1, \\ -n_1(S_T - X_1 - c_{1SDO}) & \text{if } \min\limits_{0\le t\le T}(S_t) > D \wedge S_T \ge X_1, \\ n_1 c_{1SDO} & \text{if } \min\limits_{0\le t\le T}(S_t) \le D \wedge S_T \ge X_1, \end{cases} \tag{7}$$

where S_T is the spot price of barrier option at the expiration time.

The profit function from secured position (8), can be obtain as a sum of the functions (2), (3) and (7).

$$ZP_{III}(S_T) = \begin{cases} -nS_T + n_1 c_{1SDO} - n_2 c_{2BUI} & \text{if } S_T < X_1, \\ -(n+n_1)S_T + n_1 X_1 + n_1 c_{1SDO} - n_2 c_{2BUI} & \text{if } \min\limits_{0\le t\le T}(S_t) > D \wedge X_1 \le S_T < X_2, \\ -nS_T + n_1 c_{1SDO} - n_2 c_{2BUI} & \text{if } \min\limits_{0\le t\le T}(S_t) \le D \wedge X_1 \le S_T < X_2, \\ -(n+n_1)S_T + n_1 X_1 + n_1 c_{1SDO} - n_2 c_{2BUI} & \text{if } \min\limits_{0\le t\le T}(S_t) > D \wedge \max\limits_{0\le t\le T}(S_t) < U \wedge S_T \ge X_2, \\ -nS_T + n_1 c_{1SDO} - n_2 c_{2BUI} & \text{if } \min\limits_{0\le t\le T}(S_t) \le D \wedge \max\limits_{0\le t\le T}(S_t) < U \wedge S_T \ge X_2, \\ n_1 S_T + n_1 c_{SDO} - n_2 X_2 - n_2 c_{2BUI} & \text{if } \min\limits_{0\le t\le T}(S_t) \le D \wedge \max\limits_{0\le t\le T}(S_t) \ge U \wedge S_T \ge X_2, \\ n_1 X_1 + n_1 c_{SDI} - n_2 X_2 - n_2 c_{2BUI} & \text{if } \min\limits_{0\le t\le T}(S_t) > D \wedge \max\limits_{0\le t\le T}(S_t) \ge U \wedge S_T \ge X_2. \end{cases} \tag{8}$$

This variant is the best if we expect a significant price drop during the time to maturity (below the lower barrier D) and then a significant price rise (above the upper barrier U).

IV. In the last case let us form the hedging strategy by selling n_1 up and knock-out call options with a lower strike price X_1, premium c_{1SUO} per option and a barrier level U $(U > X_1)$ and, at the same time, by buying up and knock-in call options with a higher strike price X_2, premium c_{2BUI} per option and a barrier level U $(U > X_2)$, while $n + n_1 = n_2$. The profit function from selling n_1 up and knock-out call options is:

$$P_1(S_T) = \begin{cases} n_1 c_{1SUO} & \text{if } S_T < X_1, \\ -n_1(S_T - X_1 - c_{1SUO}) & \text{if } \max\limits_{0\le t\le T}(S_t) < U \wedge S_T \ge X_1, \\ n_1 c_{1SUO} & \text{if } \max\limits_{0\le t\le T}(S_t) \ge U \wedge S_T \ge X_1, \end{cases} \tag{9}$$

where S_T is the spot price of barrier option at the expiration time.

The profit function from secured position (10), can be obtain as a sum of the functions (2), (3) and (9).

$$ZP_{IV}(S_T) = \begin{cases} -nS_T + n_1 c_{1SUO} - n_2 c_{2BUI} & \text{if } S_T < X_1, \\ -(n+n_1)S_T + n_1 X_1 + n_1 c_{1SUO} - n_2 c_{2BUI} & \text{if } \max\limits_{0\le t\le T}(S_t) < U \wedge X_1 \le S_T < X_2, \\ -nS_T + n_1 c_{1SUO} - n_2 c_{2BUI} & \text{if } \max\limits_{0\le t\le T}(S_t) \ge U \wedge X_1 \le S_T < X_2, \\ -(n+n_1)S_T + n_1 X_1 + n_1 c_{1SUO} - n_2 c_{2BUI} & \text{if } \max\limits_{0\le t\le T}(S_t) < U \wedge S_T \ge X_2, \\ n_1 S_T + n_1 c_{SUO} - n_2 X_2 - n_2 c_{2BUI} & \text{if } \max\limits_{0\le t\le T}(S_t) \ge U \wedge S_T \ge X_2. \end{cases} \tag{10}$$

The main advantage of this hedging variant is the importance of price movements only at the expiration time (not during the time to maturity). We have hedged the price to buy $n = n_2 - n_1$ units of shares, which decreases linearly with the increasing price of the underlying asset. The disadvantage of this strategy is that it cannot be created with zero initial cost.

4 Application of Hedging Results to SPRD Gold Shares

Let us assume that in the future (January 2016) we are planning to buy 100 units of SPDR Gold Shares (GLD) and we are afraid of price rise in the market. We are going to apply the above mentioned VRCBS hedging strategy using barrier and vanilla options with the expiration time in January 2016. On 17th December 2013, the shares were traded at the New York Stock Exchange at approximately 118.98 USD per share.

In the case of vanilla options we use real data (source: www.finance.yahoo.com). Due to the lack of real-traded barrier option data the barrier option premiums are calculated. We use the Black-Sholes Model (method for option pricing). We will consider analytical closed formulas under the Black-Scholes-Merton framework provided by Haug (1998). Black-Scholes model for stock without dividends with the following parameters: type of option (DI/DO/UI/UO CALL/PUT), actual underlying spot price, strike price, barrier level, time to maturity, rebate=0, implied volatility of underlying asset, is used to calculate barrier option prices (Black, F., Scholes, M., 1973). Also Rich, Don R. (1994) in his paper has presented the mathematical foundation necessary to value barrier options in an intuitive and unified framework.

The risk free rate is the U.S. Treasury rate, which was at 0.34% p.a. for the given time to expiration (source: www.treasury.gov). To simplify the calculations of particular barrier options premiums, we use the statistical programme R (package *fOptions* and *fExoticOptions*). We will propose some hedging variants, which meet the above stated requirements.

1. We sell $n_1 = 136$ vanilla call options with the strike price $X_1 = 60$ and the premium $c_{1S} = 59.05$ per option and, at the same time, we will buy $n_2 = 236$ UI call options with he higher strike price $X_2 = 90$, the premium $c_{2BUI} = 33.95$ per option and the barrier level $U = 130$ $(U > X_2)$. The profit function from secured position in this portfolio is:

$$ZP_1(S_T) = \begin{cases} -100S_T + 16.5 & \text{if } S_T < 60, \\ -236S_T + 8176.5 & \text{if } 60 \le S_T < 90, \\ -236S_T + 8176.5 & \text{if } \max\limits_{0\le t\le T}(S_t) < 130 \wedge S_T \ge 90, \\ -13063.5 & \text{if } \max\limits_{0\le t\le T}(S_t) \ge 130 \wedge S_T \ge 90. \end{cases} \tag{11}$$

2. In this case, we sell $n_1 = 50$ DI call options with the strike price $X_1 = 60$, the premium $c_{1SDI} = 2.43$ per option and the barrier level $D = 55$, and at the same time, we will buy $n_2 = 150$ UI call options with the higher strike price $X_2 = 90$, the premium $c_{2BUI} = 34.43$ per option and the barrier level $U = 120$. Profit function from secured position in this portfolio is expressed by formula (12):

$$ZP_2(S_T) = \begin{cases} -100S_T - 5042.4 & \text{if } S_T < 60, \\ -150S_T - 2042.4 & \text{if } \min\limits_{0\le t\le T}(S_t) \le 55 \wedge 60 \le S_T < 90, \\ -100S_T - 5042.4 & \text{if } \min\limits_{0\le t\le T}(S_t) > 55 \wedge 60 \le S_T < 90, \\ -150S_T - 2042.4 & \text{if } \min\limits_{0\le t\le T}(S_t) \le 55 \wedge \max\limits_{0\le t\le T}(S_t) < 120 \wedge S_T \ge 90, \\ -100S_T - 5042.4 & \text{if } \min\limits_{0\le t\le T}(S_t) > 55 \wedge \max\limits_{0\le t\le T}(S_t) < 120 \wedge S_T \ge 90, \\ -15542.4 & \text{if } \min\limits_{0\le t\le T}(S_t) \le 55 \wedge \max\limits_{0\le t\le T}(S_t) \ge 120 \wedge S_T \ge 90, \\ 50S_T - 18542.4 & \text{if } \min\limits_{0\le t\le T}(S_t) > 55 \wedge \max\limits_{0\le t\le T}(S_t) \ge 120 \wedge S_T \ge 90. \end{cases} \tag{12}$$

3. Let us form the strategy by selling $n_1 = 150$ DO call options with the strike price $X_1 = 60$, the premium $c_{1SDO} = 56.62$ per option and the barrier level $D = 55$ and, at the same time, we will buy $n_2 = 250$ UI call options with the higher strike price $X_2 = 90$,

the premium $c_{2BUI} = 33.96$ per option and the barrier level $U = 130$. The profit function from secured position in this portfolio is:

$$ZP_3(S_T) = \begin{cases} -100S_T + 3.3 & \text{if } S_T < 60, \\ -250S_T + 9003.3 & \text{if } \min_{0\le t\le T}(S_t) > 55 \wedge 60 \le S_T < 90, \\ -100S_T + 3.3 & \text{if } \min_{0\le t\le T}(S_t) \le 55 \wedge 60 \le S_T < 90, \\ -250S_T + 9003.3 & \text{if } \min_{0\le t\le T}(S_t) > 55 \wedge \max_{0\le t\le T}(S_t) < 130 \wedge S_T \ge 90, \\ -100S_T + 3.3 & \text{if } \min_{0\le t\le T}(S_t) \le 55 \wedge \max_{0\le t\le T}(S_t) < 130 \wedge S_T \ge 90, \\ -13496.7 & \text{if } \min_{0\le t\le T}(S_t) > 55 \wedge \max_{0\le t\le T}(S_t) \ge 130 \wedge S_T \ge 90, \\ 150S_T - 22496.7 & \text{if } \min_{0\le t\le T}(S_t) \le 55 \wedge \max_{0\le t\le T}(S_t) \ge 130 \wedge S_T \ge 90. \end{cases} \quad (13)$$

4. Finally, we form the strategy by selling $n_1 = 50$ UO call options with the strike price $X_1 = 60$, the premium $c_{1SDO} = 0.08$ per option and the barrier level $U = 120$ and, at the same time, we will buy $n_2 = 150$ UI call options with the higher strike price $X_2 = 90$, the premium $c_{2BUI} = 34.43$ per option and the barrier level $U = 120$. The profit function from secured position in this portfolio is:

$$ZP_4(S_T) = \begin{cases} -100S_T - 5159.9 & \text{if } S_T < 60, \\ -150S_T - 2159.9 & \text{if } \max_{0\le t\le T}(S_t) < 120 \wedge 60 \le S_T < 90, \\ -100S_T - 5159.9 & \text{if } \max_{0\le t\le T}(S_t) \ge 120 \wedge 60 \le S_T < 90, \\ -150S_T - 2159.9 & \text{if } \max_{0\le t\le T}(S_t) < 120 \wedge S_T \ge 90, \\ 50S_T - 18659.9 & \text{if } \max_{0\le t\le T}(S_t) \ge 120 \wedge S_T \ge 90. \end{cases} \quad (14)$$

5 Discussion

If our assumptions concerning price rise of the underlying asset are fulfilled and its spot price in January 2016 is above 130 USD per unit, then:

1. By means of the first hedging variant, we can hedge the price equal to 130.635 USD per share in each case.
2. By means of the second hedging variant, we can hedge the price equal to $\frac{-50S_T + 18542.4}{100}$, which even decreases with price rise of the shares, but only if the share price never drops below the barrier level 55 USD. If it ever drops, then we can hedge the price equal to 155.424 USD.
3. By the means of the third hedging variant, we can hedge the price equal to 134.967 USD, if the share price does not decrease below the barrier level 55 USD. If it ever decreases, then we can hedge a price equal to $\frac{-150S_T + 22496.7}{100}$, that is extremely good and again decreases with increase in the share price.
4. With the help of the fourth hedging variant we can hedge the price equal to $\frac{-50S_T + 18659.9}{100}$, which decreases with increase in share price.

The disadvantage of the second and the fourth hedging variant is that it cannot be created with zero initial cost. If the share price does not rise, the costs of hedging strategy are higher in comparison with unsecured position.

From our point of view, if considering our required risk exposition and expectations concerning the future underlying price movement, we recommend the third hedging variant. If we consider the strategy with initial costs, we recommend the fourth hedging variant.

6 Conclusions

The main objective of the paper was the creation of VRCBS strategy by barrier options and the selection of the most appropriate variants of strategy formation for hedging against the price rise of an underlying asset. Selected hedging variants were applied to the SPDR Gold Shares, which are traded at the New York Stock Exchange (NYSE).

Each of the above mentioned variants of VRCBS has both advantages and disadvantages. Selection of the appropriate hedging variant must be made by the investor depending on his expectations concerning the future underlying price movement and required risk exposition. For the future research, there are many possibilities of formation of strategies created by barrier options which are suitable for hedging against expected price movement and current conditions in the market. Another utilization of barrier options is a creation of modern structured products, for example discount certificates.

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Overconfidence as a Cognitive Bias and its Implications for Insurance Industry

Tomáš Ondruška

University of Economics in Bratislava
Faculty of National Economy, Department of Insurance
Dolnozemská cesta 1, 852 35 Bratislava, Slovak Republic
E-mail: tomas.ondruska@euba.sk

Abstract: *The behavior of individuals is influenced by many biases that cause their deviation from the rationality. One of them, discussed extensively in the financial industry is cognitive bias - overconfidence. It is a firmly established feature of an individual behavior in the psychological point of view. On the other hand in the economics it is extensively explained by inefficient market outcomes connected to a biased sense of self-confidence. In short, the bias is shown for numerous real-world situations and cause changes in consumers' behavior. However, what are implications of overconfidence for the insurance sector? Are there significant differences in the presence of the overconfidence between men and women? Our results based on the survey of 870 respondents show that we cannot confirm the presence of the overconfidence in the overall sample. However, we found the reason of this situation - significant difference between men and women and their perceived and actual financial literacy. While in group of men we confirmed presence of the overconfidence, in the group of women, we found out the opposite effect - underrate. Paper also provides implications of these phenomena in the insurance market.*

Keywords: bias, consumer, financial literacy, insurance, overconfidence

JEL codes: D03, G22

1 Introduction

The behavior and decision-making of individuals in insurance matters is often influenced by biases. One of them is the overconfidence. The term refers to a systematic error of judgment made by individuals when they assess the correctness of their responses to questions relating to intellectual or perceptual problems (Pallier et al., 2002, p. 258). It is a cognitive deviation from rationality, which rises in individuals' minds unfounded belief in their own knowledge, intuition and judgment (Baláž, 2009). In the behavior of the individuals is the subjective confidence in their judgments reliably greater than its objective accuracy.

Overconfidence is associated with two phenomena - the illusion of knowledge and illusion of control. The illusion of knowledge is closely connected to the fact that more information reduces accuracy and increases confidence of individuals (Hall et al., 2007). Individuals mistakenly deluding that the more information they have, the more they will also know about some issue. Although there is not currently a problem for individuals to obtain some information, it should be noted that in the case of complex decisions (such as the decision-making of insurance policy) the presence of the illusion of knowledge may have negative consequences. Individuals may have enough information about a certain insurance product, but even the number of identified information cannot substitute their own experience and other skills that can improve their judgment. Similarly, it is not certain whether the person is able to correctly understand and process obtained information. On the other hand there is the illusion of control that describes the tendency for individuals to behave as if they might have some control when in fact they have none (Langer, 1975). This phenomenon is undoubtedly associated with insurance since the insurance industry inherently handles with uncertain events and so the awareness of its presence is important. Individuals influenced by the illusion of control may underestimate their insurance protection against some events. Also their conviction about knowing more than others is enhanced. Individuals as the result of this illusion dive into some risky

activities that may unfold against them. Overconfidence can cause that individuals do not buy insurance protection or if they buy it is with insufficient coverage that do not reflect their real needs.

Therefore the main aim of this paper is to verify the presence of overconfidence on the sample of survey respondents with respect to gender perspective and to suggest recommendations how to eliminate its negative impact on the insurance industry. We expect the presence of the overconfidence in our research sample (Cordell et al., 2011; Matsumoto et al., 2013) and also we assume that the extent of the overconfidence will be higher in case of men (Barber & Odean, 2001).

The paper is divided into four chapters. The remaining chapters include the description of used methodology and data; result of our analysis with discussion of practical applications of our findings; and conclusion.

2 Methodology and Data

Data were obtained via survey questionnaire about consumers of insurance products and their attitudes towards insurance. Survey was conducted in electronic and paper form. We used this method to investigate the presence of overconfidence in the insurance market. The research sample consisted of citizens of the Slovak Republic in the age structure from 18 to 61. Data collection was carried out in two periods, first from 1st June 2013 to 31st July 2013 and the second from 15th November 2013 to 15th December 2013. Overall, the survey involved 1 044 respondents, from which we obtained 870 random respondents who represent the distribution of the Slovak population by gender and age according to the Statistical Office of the Slovak Republic. Sample consists of 438 men (50,34%) and 432 women (49,66%) and age groups were represented as follows: 15,10% respondents from 18 to 24 years; 38,00% from 25 to 39 years and 46,90% respondents from 40 to 61 years.

Since the survey was designed broadly, for the identification of the overconfidence in behavior of respondents we used their declared financial literacy. We were interested in respondents' knowledge of the world of finance. They could assess themselves whether they are very well, good or bad financially versed. We provided in survey also description of each of these three levels of financial literacy for the better understanding. Answers to this question are the basis for respondents' self-evaluation of the financial literacy.

One part of survey consisted of a questions that we used as a proxy to review the knowledge of insurance issues. Specifically, for that purpose we used two questions (statements), and respondents should decide whether they are true or false. We used answers to following questions: "If I pay an insurance premium regularly, in the case of occurrence of the insured damage, insurance company will always pay me the full amount of loss" and "I do not consider the increase in the amount of damage incurred during the insured accident with "small" amount as wrong" as the proxy for a real financial literacy. The correct answer to both questions is "no", because in the first case, the insured person have to take into account also deductible, or decreased value of the property covered by insurance policy. In the second case, the unjustified increase of damage is dishonest act, in many countries classified as an insurance fraud.

The number of correct answers to these questions represent for us a dummy variable for the actual degree of financial literacy, and on the basis of those answers, an individual could earn a maximum of 2 (very good) and the minimum 0 points (bad). Again, we get three-point range, which is the starting point for us to determine the actual level of financial literacy, similarly to their self-classification. Based on these two observations, we determined the difference in the level of their own financial literacy (perceived) and literacy based on our test (actual). We were able to quantify the difference due to the numerical coding of these categories (coding in IBM SPSS: 0 for very good; 1 for good; and 2 for bad) as the difference between own, perceived level and the actual, calculated level. This difference can only take whole number values in the range from -2 to 2, which

means that for value -2 respondent overestimated his financial literacy by 2 levels and demonstrated his overconfidence, and vice versa in case of the value of 2.

We tested the presence of overconfidence in our research sample by Student's T-test. T-test compares sample means by calculating Student's t and displays the two-tailed probability of the difference between the means (Field, 2009). Student's T-test can be used to test the null hypotheses, which claims that the mean of a sample is equal to the assigned constant (Rimarčík, 2000). The T-test help us answer the question whether, on a random sample the mean of a sample is equal to the chosen constant, respectively, whether it is larger or smaller than the selected number. Indeed, if the P-value is less than the chosen significance level (usually 5 %, respectively 0.05), the null hypothesis is rejected and we accept the alternative one. This means that the difference between a specified constant and the calculated average of the sample is too large to be just the result of random selection and therefore it is statistically significant.

The survey data were analyzed by the IBM SPSS Statistics program. However, we focused not only on the whole sample but we also examined gender differences in the presence of the overconfidence between men and women. The results of our analysis are discussed in the following chapter.

3 Results and Discussion

Overconfidence is without any doubt the phenomenon that affects not only consumers but also the insurers and other market subjects. That is the reason why the research in this area is necessary. Awareness of the overconfidence may be beneficial for both sides of insurance market - demand as well as supply. We use T-test to test assumptions that respondents in the research sample are overconfident. Statistics of the one-sample test are below in Table 1.

Table 1 One-Sample Statistics - Change in financial literacy (level)

	N	Mean	Std. Deviation	Std. Error Mean
Both	870	-0.04	0.890	0.030
Women	432	0.09	0.889	0.043
Men	438	-0.16	0.874	0.042

Source: own calculations

The descriptive table displays the sample size, mean, standard deviation, and standard error for each of the three samples (women, men, both). The sample means disperse around the 0 (0 means that there is not big difference between actual and perceived financial literacy) by what appears to be a small amount of variation. But we can see that there is different sign of the mean between men and women. The test statistic Table 2 shows the results of the one-sample T-test.

Table 2 One-Sample Test - Change in financial literacy (level)

	Test Value = 0					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of Difference	
					Lower	Upper
Both	-1.258	869	0.209	-0.038	-0.10	0.02
Women	2.056	431	0.040	0.088	0.00	0.17
Men	-3.883	437	0.000	-0.162	-0.24	0.08

Source: own calculations

The t column displays the observed t statistic for each sample, which is calculated as the ratio of the mean difference divided by the standard error of the sample mean. The column labeled Sig. (2-tailed) displays a probability from the t distribution with

appropriate degrees of freedom (df). The value listed is the probability of obtaining an absolute value greater than or equal to the observed t statistic, if the difference between the sample mean and the test value is purely random. The Mean Difference is obtained by subtracting the test value (0 in our case) from each sample mean. The 95% Confidence Interval of the Difference provides an estimate of the boundaries between which the true mean difference lies in 95% of all possible random samples of respondents. Following the results of the one-sample test we cannot confirm the presence of the overconfidence in the overall sample. More importantly, we found the reason of this situation. There is significant difference between men and women and their perceived and actual financial literacy. While in one group we confirmed presence of the overconfidence, in the second one we found out the opposite effect.

Since the confidence interval of men lies entirely below 0.0 (their actual knowledge of insurance related issues is worse than they declared), men overestimated their financial knowledge and in their behavior is present overconfidence. Similarly, because confidence intervals of women lie entirely above 0.0; we can conclude that their difference in perceived and actual financial literacy is significantly higher than 0 on the average. This means that there is not argument to conclude that the overconfidence is present in behavior of women. However, the positive sign mean that women underrated their financial literacy, what is worth noticing. Cause of the underestimation of their own experience and knowledge of the financial issues may lie in their smaller participation in investing as well as engagement in financial markets. The financial world is often (wrongly) considered as a male affair. Also in matters of finance men tend to feel greater competence (Prince, 1993). As a result of simultaneous overconfidence of men and underestimation of women experience, we failed to prove the effect of overconfidence in the overall sample of respondents.

What are the implications of our findings for insurance industry? We can view these implications in two perspectives, from the insurers' point of view on the one side and consumers on the other. We can discuss consumer related issues first. It is well-known fact that the level of financial literacy in Slovak republic is very low (Pastoráková, 2012). However, taking this fact into account, individuals (men in our sample) tend to overestimate their knowledge and experience, what is characterized by the excessive degree of their confidence in knowledge of financial matters. Insurance market is represented by the large group of "non-professional" consumers, characterized by a lack of correct information. Moreover due their low levels of financial literacy and presence of the overconfidence in their behavior, they are easily influenced and also vulnerable. They often underrate the process of insurance policy purchase and do not use service of financial advisers. Alternatively, when potential clients use help of financial advisers, they often do not ask questions about issues that they do not know or they are not sure about them. There are few motives for this kind of behavior. Consumers pretend their knowledge and do not want to ask question to deflate their ego, respectively they are indifferent to their financial issues or they do not want to show their weak points. This may lead to loss of trust in insurance services in future because consumers' expectations of the insurance were biased. After all whole insurance industry suffers by this loss of trust and it is very hard to restore trust in industry. On the other hand we also need to take into account different gender perspective in the show of overconfidence. Several papers confirmed that the men's overconfidence is higher in men related issues (Deaux & Emswiller, 1974; Beyer & Bowden, 1997; Brokešová, 2013). Important decisions about purchase of the insurance policy should men and women discuss together. The effect of the overconfidence of men and the effect of underrating financial literacy of women may be reduced by their mutual dissemination of knowledge and their considered decision. Women are more patient in the information seeking, use consultation, and in the end they compare findings. Authors Barber and Odean (2001) bring the advice that men and women should make their decision in financial issues together to eliminate negative decisions.

The overconfidence is not only matter of consumers. Insurers should also realize their responsibility in bad decisions of consumers due their overconfidence. The crucial roles in

this problem hold financial advisors. However, the placed demands on the quality of financial advisors are often insufficient (Pastoráková, 2006). Financial advisors should concentrate their effort not only into volume of the sale but they should also provide sufficient and comprehensible information to potential clients. We consider as appropriate to ask random questions by financial advisors (agents/brokers) related to subject of the selling process to ensure that consumer understands insurance terms and conditions. This could help potential clients to understand complicated insurance products and to avoid hesitation to ask questions. Mainly because the occurrence of the overconfidence is higher in the more complex tasks (Fischhoff, et al., 1977), as insurance undoubtedly is. Insurers should also raise public awareness of some kind of insurance products because of the illusion of control, which is one of the aspects of the overconfidence. This is necessary mostly in case of small probability events and in the private pension products due to unsustainable state schemes. Beyond all the insurance companies should also participate on the education of the public and their potential consumers to increase financial literacy.

4 Conclusions

The overconfidence bias is a solidly established feature in behavior of individuals and their decision making. This phenomenon affects not only consumers, but also the insurers and other market subjects. Main aim of the paper was to verify the presence of overconfidence on the sample of survey respondents with respect to gender perspective and to suggest recommendations how to eliminate its negative impact on the insurance industry. Using actual and perceived financial literacy as well as the Student's T-test we tested the appearance of the overconfidence bias in the sample of 870 respondents. Our results show that we cannot confirm the presence of the overconfidence in the overall sample. However, we found the reason of this situation - significant difference between men and women and their perceived and actual financial literacy. While in group of men we confirmed presence of the overconfidence, in the group of women, we found out the opposite effect - underrate.

We can view implications for insurance industry of our findings in two perspectives, from the insurers' point of view on the one side and consumers on the other. Due low levels of financial literacy and presence of the overconfidence in consumers' behavior, they are easily influenced and also vulnerable. They often underrate the process of insurance policy purchase and do not use service of financial advisers. Important decisions about purchasing the insurance policy should men and women discuss together because of different confidence in their financial literacy. The effect of the overconfidence of men and the effect of underrating financial literacy of women may be reduced by their mutual dissemination of knowledge and their considered decision. On the other hand, insurers should also realize their responsibility in bad decisions of consumers due their overconfidence, when the essential roles in this problem hold financial advisors. Insurance companies should also participate in the education of the public and their potential consumers to increase financial literacy. These are the key elements to build the trust in relationships in the insurance market.

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Pharming in the E-banking Field and Protection Techniques against this Type of Fraud

Gabriela Oškrdalová

Masaryk University
Faculty of Economics and Administration, Department of Finance
Lipová 41a, Brno, Czech Republic
E-mail: oskrdalo@econ.muni.cz

Abstract: *The subject of the paper "Pharming in the e-banking field and protection techniques against this type of fraud" is a description of pharming in the e-banking field, identification of warning signs of pharming, creating of models of this type of fraud, interpretation of results of own quantitative research (focused on knowledge of pharming) and an identification of the basic recommendations for users of e-banking services (especially for users of internet banking services) to reduce security risks connected with using of e-banking services.*

Keywords: e-banking, security, risk, fraud, pharming

JEL codes: G020, G210, G290

1 Introduction

Pharming is one of contemporary basic types of frauds in the e-banking sector we can meet with in the Czech Republic and all over the world. For the precision we can meet with the pharming not only in the e-banking field, but in the e-shopping field as well. Pharming is a newer and more dangerous attack way than phishing when generally a defrauder addresses an e-banking services user (for example a payment card user, an internet banking or phone banking user) under somebody else's identity and requests notification of sensitive information - personal data, passwords, logins, PIN codes, account numbers, payment card numbers, date of payment card expiry etc. (More information about phishing attacks in the e-banking field are published for example in Oškrdalová, 2013a) Pharming can be defined generally as a criminal mechanism when a Domain Name System (DNS) or a host file of a computer are attacked by a defrauder to gain sensitive information as personal data, passwords, logins, PIN codes, account numbers etc. In connection with this definition of pharming and understanding of the importance of pharming risks danger, we should mention the analysis of data of DNS working in the Czech Republic in 2011 which the security team CSIRT.CZ did. According to this analysis approximately 1 500 DNS servers had only very low level of security which cause was the absence of a basic security – random ports for outgoing queries. In this case the server could be successfully attacked in a few seconds. More information about this analysis is in CSIRT.CZ.

2 Methodology and Data

The aim of this paper is to describe pharming in the e-banking field, identify warning signs of pharming, create models of this type of fraud, introduce results of own quantitative research (focused on knowledge of pharming) and define the basic recommendations for users of e-banking services (especially for users of internet banking services) to reduce security risks connected with using of e-banking services. The mentioned aim is reached by using of general science methods, primarily description, synthesis, induction, deduction, modelling and analysis. Data of own quantitative research (focused on knowledge of pharming) are evaluated by methods of descriptive statistics. Normative and positivist methodologies have been employed to reach the aim.

3 Results and Discussion

As it was recognized, generally pharming can be defined as a criminal mechanism when a Domain Name System (DNS) or a host file of a computer are attacked by a defrauder

to gain sensitive information as personal data, passwords, logins, PIN codes, account numbers etc. So there are two basic ways of pharming (according to Klufa, Scholz and Kozlová (2012). In the first case a defrauder uses/attacks a Domain Name System, a system of domain names which are hierarchically organized and whose main task is the mutual transfer of domain names and IP addresses. If this system is attacked and user (of e-banking services) writes WWW address in the address line of an internet browser, he/she visits other WWW pages than he/she wants because the attacked Domain Name System translates the written WWW address to other, wrong IP address. The ground of the success of this pharming fraud type is a treatment of DNS record of a subject which a defrauder wants to abuse to gain users' sensitive information. For example if a pharming defrauder modifies the record of the bank of the user of internet banking services, the user visits other, fraudulent WWW pages which have been created by the pharming defrauder and which look as original WWW pages of the user's bank. And if this user enters sensitive information, he/she provides it to the pharming defrauder than can abuse gained sensitive information, for example to transfer money from the deceived user's account. It is typical for pharming frauds that victimized users of e-banking services believe it is all right and they do not suspect that they have become a victim of a pharming fraud.

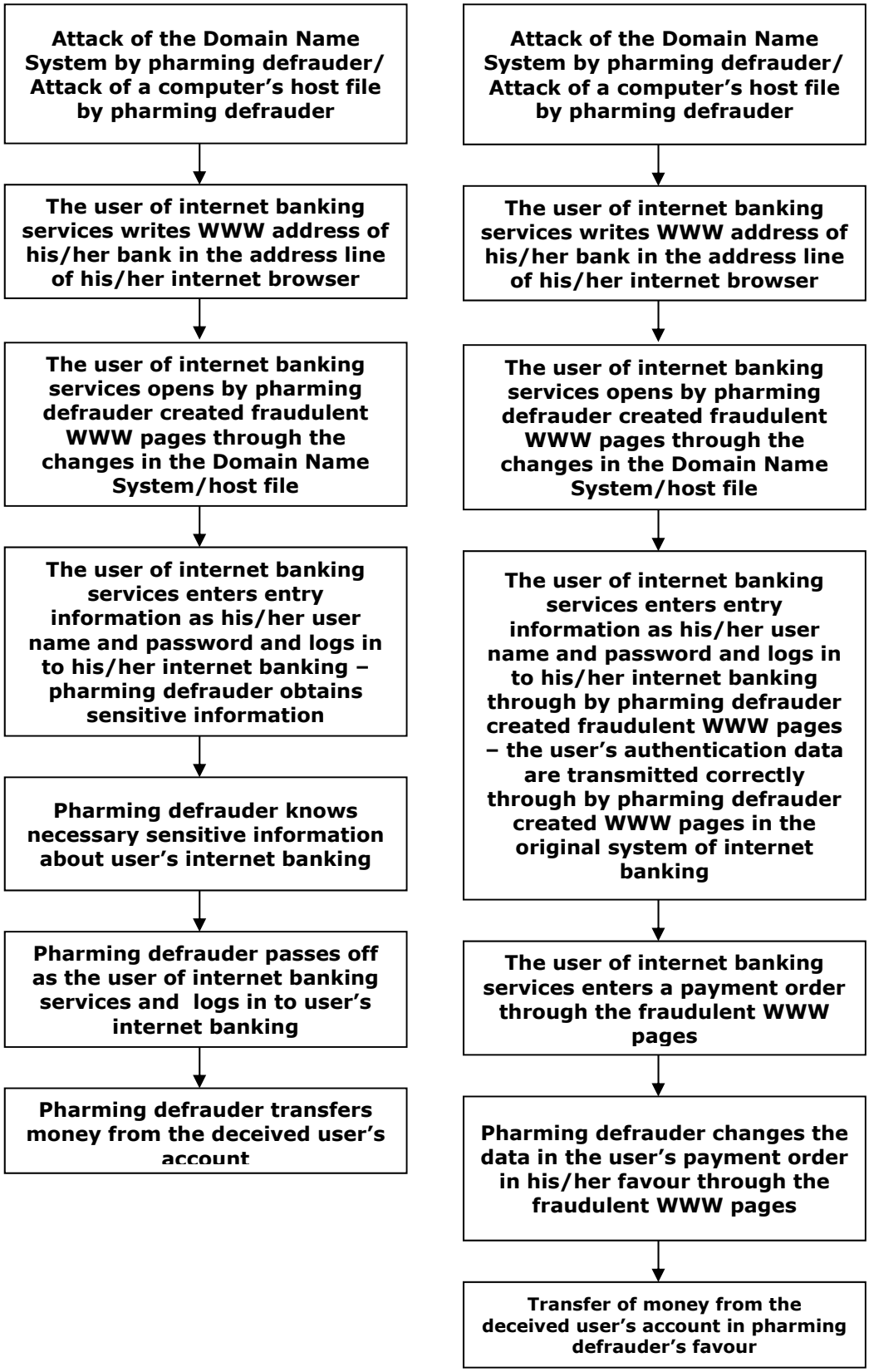
This type of pharming fraud is effective, but it is relatively difficult for a defrauder who wants to gain user's sensitive information. The other type of pharming fraud is easier and currently more used possibility. In this case individual computers are attacked by defrauders to write the address of fraudulent WWW pages (which have been created by them) with the appropriate domain in the host file. This file contains IP addresses and appropriate domains. The computer can be attacked by e-mail containing so-called Trojan horse, by downloading of an application from internet or entering WWW pages through in e-mail sent link. If the defrauder is successful, the user visits by the defrauder created WWW pages to gain users' sensitive information through the change in the host file.

Krhovják, Kumpošt and Matyáš (2012) mention an additional way to realize the pharmig fraud when by the pharming defrauder created fraudulent WWW pages serve only as an intermediary between the user of internet banking services and the real system of user's internet banking. In this case the pharming defrauder attacks the Domain Name System or the computer's host file and creates fraudulent WWW pages too. When the user of internet banking services writes WWW address of his/her bank in the address line of his/her internet browser, he/she opens by pharming defrauder created fraudulent WWW pages through the changes in the Domain Name System/host file. On these WWW pages the user of internet banking services enters entry information as his/her user name and password which are transmitted correctly through by the pharming defrauder created WWW pages in the original system of internet banking. The user of internet banking services is successfully logged in to his/her internet banking and is able to enter payment orders. The pharming defrauders exploit this situation. User's payment orders are changed by pharming defrauder in his/her favour through the fraudulent WWW pages.

3.1 Models of Pharming Frauds

As we have noted there are two basic ways for realizing of pharming frauds. The first of possible ways of this type of fraud in the internet banking field is represented in the following figure "Abuse of internet banking with pharming" on the left. In this case the defrauder gains sensitive information through the attacked Domain Name System or host file and created fraudulent WWW pages. On the right side of this figure the other pharming possibility is represented when by pharming defrauder created fraudulent WWW pages serve only as an intermediary between user of internet banking services and real system of user's internet banking.

Figure 1 Abuse of internet banking with pharming



Source: Author

3.2 Safety Literacy and Knowledge of Pharming in the Czech Republic

In the introduction in connection with the definition of pharming and understanding of the importance of pharming risks danger, the analysis of data of DNS working in the Czech Republic in 2011 was mentioned. This analysis identified weaknesses of DNS servers' security. As we could see, the role of user of e-banking services is important to reduce the pharming risk too. His/her knowledge, skills, behaviour etc. can contribute significantly to reduce the risk.

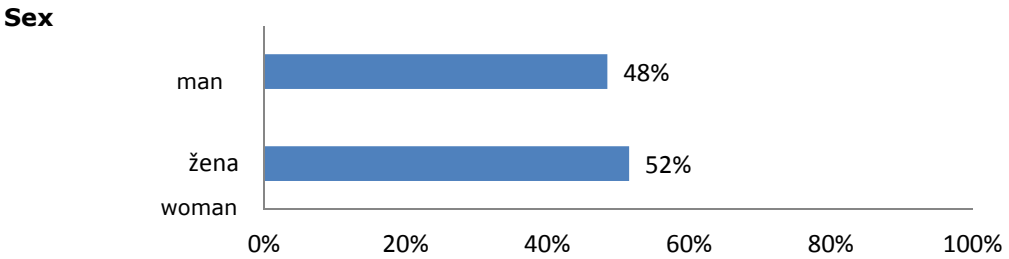
In this context we can mention results of the European study of safety literacy, which Microsoft published in 2012 (Microsoft). This survey showed, that 82 % continentals have basic information about computer safety, but only 4 % continentals are able to resist advanced threats as for example the loss of on-line identity is. Results of Czechs are not significantly different. 90 % Czechs have basic information about computer safety and 9 % Czech respondents are able to resist advanced threats. This means that the level of safety literacy of Czechs can be evaluated positively, if we focus on basic knowledge of computer safety. But in case of advanced threats the situation is worse and in my opinion it is alarming. The survey showed, that users in the age category of 45 – 59 years are the most endangered group, if we evaluate knowledge of safe using of computer. Czech (as European) users have the greatest weaknesses in protection of his/her personality and identity on the internet. Relating the pharming risk we can mention, that 77 % Czech respondents use software update (the European average is 57 %), 85 % Czech respondents use antiviral software (the European average is 85 %), 74 % Czech respondents use firewall on personal computer (the European average is 50 %), 26 % Czech respondents use different passwords for each web service (the European average is 31 %) and 3 % Czech respondents do not use any method of protection against on-line risks (the European average is 5 %). More information about this study is in MICROSOFT.

In the following section the results of own quantitative research are presented, focused on knowledge of pharming. The mentioned research was realized during writing my dissertation, data were collected electronically in 2012. The target group were people studying at Faculty of Economics and Administration of Masaryk University, number of respondents was 910. The structure of the sample is represented in Graph 1 (by sex, age and education). It is important to note on the definition of target group, that formulated conclusions can be generalized to the population of people studying at economic colleges in the Czech Republic, for them the research sample is representative. For more information on this research see Oškrdalová (2013b).

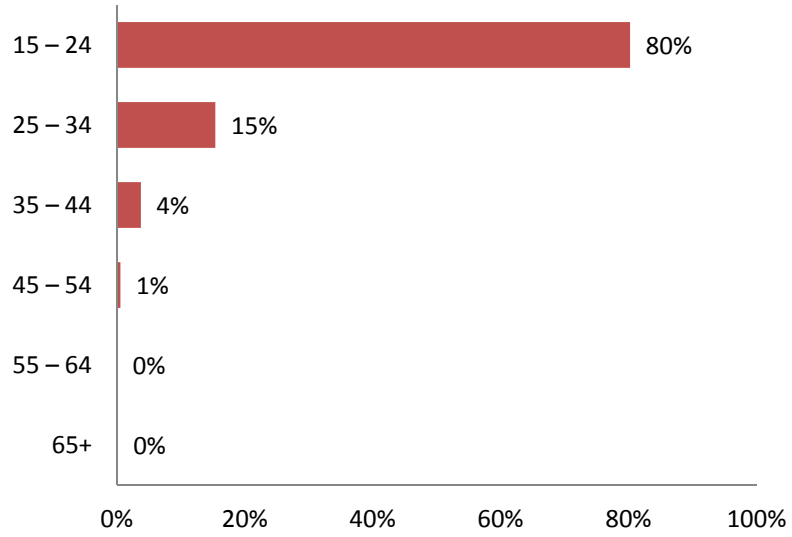
A part of the research was focused on frauds in the e-banking and e-shopping field. Respondents should mark type (or types) of fraud in the e-banking and e-shopping field, which principle they know. As we can see in Graph 2, only 11 % respondents know the principle of pharming. It is very small number of respondents. In this context, it should be note, that the role of user is important (or his/her behaviour, knowledge and skills are important), because the user can contribute to reduce the pharming risk. The basic recommendations for users to reduce the pharming risk are introduced in the part 3.3 Recommendations to reduce the pharming risk.

Graph 1 Structure of the sample

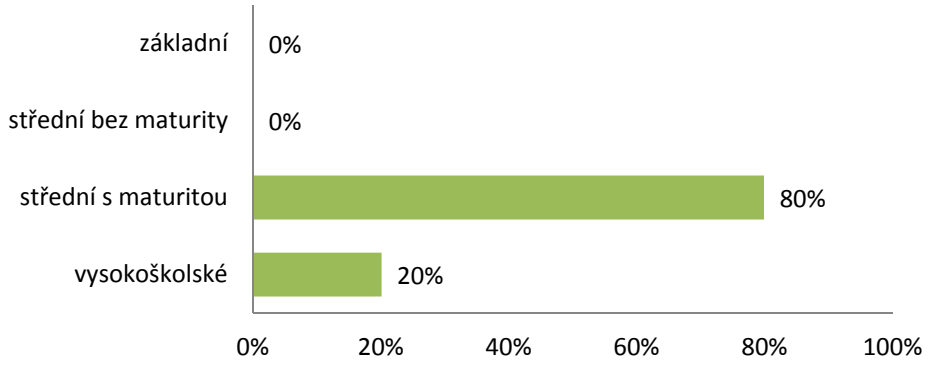
Basis: All respondents, n = 910



Age



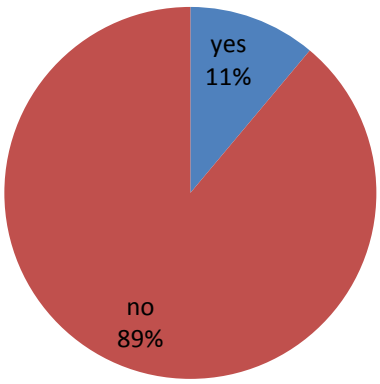
Education



Source: Author

Graph 2 Knowledge of pharming

Basis: All respondents, n = 910



Source: Author

3.3 Recommendations to Reduce the Pharming Risk

Recommendations to reduce pharming risk are variable. As first we should mention that to reduce pharming risk it contributes when user of e-banking services (especially of internet banking services) knows and observes basic security rules for safe using of personal computer and internet. He/she should use only trustworthy computers (not publicly accessible computers) with periodically updated software (as an operating programme, an antiviral and an antispyware programme etc.), use powerful firewalls, computers controlled by user, where he/she does not visit suspicious WWW pages, where he/she does not use suspicious programmes, where he/she does not download applications from unknown servers etc. It is dangerous to enter links which were sent to the user in an e-mail too. In connection with these security recommendations we can recommend to limit the use of accounts with administrator rights, create separate accounts for each user and use secure passwords. It should be obvious that DNS servers are appropriately secure (nowadays the protection of DNS servers can be on very high level).

To reduce pharming risk we should remind common e-banking services security recommendations as "use supplementary safety elements (as confirmation of a transaction by sending authorisation SMS messages and using client certificate)", which reduce possibility of an abuse of gained users' sensitive information. In this case, if the pharming defrauder obtains user's sensitive information as his/her user name and password of his/her internet banking, the pharming defrauder could "only" determine the amount of his/her account balance, realized transactions etc., but he/she could not transfer money from the user's bank account in his/her favour.

From other common e-banking services security recommendations we should not forget "use day, week or month limits for e-banking (in this case especially internet banking) transaction", "check carefully your bank account statements, when you get them", "if you find a discrepancy in your bank account statements (for example a cashless transfer you have not assigned, a cashless transfer on an unknown account number, the amount of a transaction is higher than it really was), you should contact your bank and complain about this transaction" too.

The user of internet banking services should carefully check visited WWW pages whether these WWW pages are really the original WWW pages of the subject (in this case especially of his/her e-bank) he/she wants to visit. To identify the attempt of a pharming fraud the low quality level of an attack can help. We can mention in a foreign language written WWW pages, with grammatical or stylistic mistakes, WWW pages with mistakes in format, used colours, contents spreading etc. But it is true that nowadays pharming attacks are often on very high quality level which increases the success probability of this attack.

To reduce pharming risk the control of the WWW pages authenticity by way of the certification verifying can be recommended. In this case the user of internet banking services is able to verify that the visited WWW pages have a certificate which has been issued for the subject whose WWW pages the user of internet banking services wants really to visit and for these WWW pages. Preferably the certificate should be issued by a reputable company. The user is able to verify the WWW pages authenticity by a click on a padlock symbol (this symbol can be situated in the right bottom corner on the lath or in the address line of the used internet browser).

In addition, it can be recommended to users of internet banking services (as well as common e-banking services) not making an intended transaction or to break realized transaction if the user discovers that the system does not behave standardly, as usual, it asks entering sensitive information which it does not need or which it has not wanted to enter sooner or which it should not want to enter. In these cases the user should contact the bank (or another subject, according the particular case) and describe the situation. If user's suspicion is confirmed or his/her doubts remain, he/she should agree on the blocked account and next steps. It is possible to contact the police too.

It can be summarized that users of internet banking services (as well as common e-banking services) have the important role to reduce pharming risk.

4 Conclusions

Pharming is one of contemporary basic types of frauds in the e-banking sector we can meet with in the Czech Republic and all over the world. Pharming is a newer and more dangerous attack way than phishing when generally a defrauder addresses an e-banking services user under somebody else's identity and requests notification of sensitive information. Pharming can be defined generally as a criminal mechanism when a Domain Name System (DNS) or a host file of a computer are attacked by a defrauder to gain sensitive information as personal data, passwords, logins, PIN codes, account numbers etc.

So there are two basic ways of pharming. In the first case a defrauder uses/attacks a Domain Name System, a system of domain names which are hierarchically organized and whose main task is the mutual transfer of domain names and IP addresses. This type of pharming fraud is effective, but it is relatively difficult for a defrauder who wants to gain user's sensitive information. The other type of pharming fraud is easier and currently more used possibility. In this case individual computers are attacked by defrauders to write the address of fraudulent WWW pages (which have been created by them) with the appropriate domain in the host file.

It is typical for pharming frauds that victimized users of internet banking services believe it is all right and they do not suspect that they have become a victim of a pharming fraud. Recommendations to reduce pharming risk are variable. We can highlight that users of internet banking services have the important role to reduce pharming risk. So it is very important to reduce pharming risk so that users of internet banking services know and observe basic security rules for safe using of personal computer and internet as common e-banking (especially internet banking) services security recommendations too. As we could see, according to results of mentioned researches, there are gaps in users' behaviour and knowledge in the e-banking (as well as e-shopping) field.

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Bayesian Estimation of Event Probability in Accident Insurance

Viera Pacáková [1], Eva Kotlebová [2]

[1] University of Pardubice
Faculty of Economics and Administration, Institute of Mathematics and Quantitative Methods
Studentská 84, 532 10 Pardubice, Czech Republic
E-mail: Viera.Pacakova@upce.cz

[2] University of Economics in Bratislava
Faculty of Economic Informatics, Department of Statistics
Dolnozemská cesta 1/b, 852 35 Bratislava, Slovakia
E-mail: Eva.Kotlebova@euba.sk

Abstract: *Knowledge of the probability of an insured event is the basis for the valuation of the products in life and non-life insurance companies. For estimation of event probability in insurance practice the most often use the historical data from a large portfolio of insurance policies. The classical approach to point estimation of the event probability is by proportion of occurrence of the event in large portfolio of policies. The objective of this paper is to present Bayesian estimation of selected binomial proportions in accident insurance. The classical approach to point estimation treats parameters as something fixed but unknown. The essential difference in the Bayesian approach to inference is that parameters are treated as random variables and therefore they have probability distributions. In Bayesian approach to estimation we should always start with a priori distribution for unknown parameter, precise or vague according to the information available. In this paper we have derived an algorithm for such a priori estimation of the binomial probability, which allows Bayesian estimates with less square error compared with classical estimates. In article the suggested algorithm has been applied on the data submitted by the Decree No. 20/2008 to the National Bank of Slovakia from insurance companies giving exposure to the accident risk.*

Keywords: event probability, Bayesian estimation, prior distribution, posterior distribution, binomial/beta model

JEL codes: C11, C13, G22

1 Introduction

Accident insurance is extended product of life and nonlife insurance companies. It covers a number of risks associated with injuries. Insurance products differ in their specifications and premiums. In their creation there is necessary knowledge about the probabilities of claims that are covered by accident insurance. These probabilities need to know for different homogeneous groups of clients.

This article aims to explain and apply methods of classical and Bayesian statistical inference to estimate the probability of accidental death, specifically for the men and women and for various age groups. It also included a comparison of results obtained by above mentioned two approaches and shows the advantages of Bayesian estimates. Article investigates the Bayesian estimators of the parameters of binomial distribution using quadratic loss function. The possibility to express the Bayesian estimators in the form of credibility formulas allows easy application of these models in insurance practice.

2 Methodology and Data

The classical approach to point estimation treats parameters as something fixed but unknown. The essential difference in the Bayesian approach to inference is that parameters are treated as random variables and therefore they have probability distributions.

Suppose $\mathbf{x} = (\mathrm{x}_1, \mathrm{x}_2, \ldots \mathrm{x}_\mathrm{n})$ is a random sample from a population specified by density function $f(\boldsymbol{x}|\theta)$ and it is required to estimate parameter θ. By Tse, Y. K. (2009) or

Waters, H. R. (1994) prior information about θ that we have before collection of any data is the prior distribution $f(\theta)$ which is probability density function or probability mass function. The information about θ provided by the sample data $\boldsymbol{x} = (x_1, x_2, \ldots x_n)$ is contained in the likelihood

$$f(\mathbf{x}/\theta) = \prod_{i=1}^{n} f(x_i/\theta) \tag{1}$$

Bayes theorem combines this information with the information contained in $f(\theta)$ in the form

$$f_{\Theta}(\theta/\mathbf{x}) = \frac{f(\mathbf{x}/\theta)\, f(\theta)}{\int_{\theta} f(\mathbf{x}/\theta)\, f(\theta)\, \mathrm{d}\theta} \tag{2}$$

which determines the posterior distribution. A useful way of expressing the posterior density is to use proportionality. We can write

$$f(\theta/\mathbf{x}) \propto f(\mathbf{x}/\theta)\, f(\theta) \tag{3}$$

or simply posterior $\propto$ likelihood * prior. The posterior distribution contains all available information about θ and therefore should be used for making decisions, estimates or inferences. The following procedure of Bayesian estimation of the binomial parameter is explained for example in Boland, P. J. (2007), Kotlebová, E. (2009).or Pacáková, V. (2012, 2013).

For estimation of a binomial probability θ from a single observation X with the prior distribution of θ being beta with parameters α and β, we will investigate the form of the posterior distribution of θ. Prior beta density function by assumption and omitting the constant is

$$f(\theta) \propto \theta^{\alpha-1} (1-\theta)^{\beta-1}, \; 0 < \theta < 1 \tag{4}$$

Note that the uniform distribution on (0,1) is a special case of the beta with $\alpha = 1$ and $\beta = 1$. This corresponds to the non-informative case. Omitting the constant $\binom{n}{x}$ likelihood is

$$f(x/\theta) \propto \theta^{x} (1-\theta)^{n-x}, \; x = 0, 1, \ldots, n \tag{5}$$

By (3) we get the posterior density of θ in the form

$$f(\theta/x) \propto \theta^{x} (1-\theta)^{n-x}\, \theta^{\alpha-1} (1-\theta)^{\beta-1} = \theta^{\alpha+x-1} (1-\theta)^{\beta+n-x-1} \tag{6}$$

Apart from the appropriate constant of proportionality, that it is the posterior beta density function of θ with parameters

$$\begin{aligned} \alpha' &= \alpha + x \\ \beta' &= \beta + n - x \end{aligned} \tag{7}$$

By minimizing the quadratic loss the Bayesian estimator of θ is the mean of this posterior distribution, that is

$$\theta_B = \frac{\alpha + x}{(\alpha + x) + (\beta + n - x)} = \frac{\alpha + x}{\alpha + \beta + n} \tag{8}$$

We can rewrite the Bayesian estimator of θ in the form of credibility formula by Gogola, J. (2013), Pacáková, V. (2013):

$$\theta_B = Z \cdot \frac{x}{n} + (1 - Z) \cdot \mu \tag{9}$$

where $Z = \frac{n}{\alpha+\beta+n}$ and the mean of the prior beta distribution $\mu = \frac{\alpha}{\alpha+\beta}$.

Let θ be the probability of injury, or any insurance claim related to an injury, for example death, permanent invalidity etc. To estimate the probability θ we have found the data about the number of insurance agreements on accident insurance and the number of claims in these insurance contracts from Slovak insurance companies giving exposure to the accident risk. Data covering the period 1999-2010 were submitted to the National Bank of Slovakia based its Decree No. 20/2008 on submitting of actuarial data and statistical data of insurance company and branch of a foreign insurance company, on the basis of which it started to gather statistical data about insured people from insurance undertakings in 2009. The data were gathered in classification according to gender, age and thirteen insurance risks. Among them there are also the risks related to accidents, namely risk of death as the result of accident, risk of permanent consequences of accident, risk of loss of regular income as the result of accident.

3 Results and Discussion

Let θ is unknown probability of death as the result of accident. To estimate this probability we have found the data about the number of claims x and risk exposure n in the years 1999-2010 from dataset of NBS (2012). These data were also used in Jindrová, P. (2013) to estimate the probability θ of a critical illness.

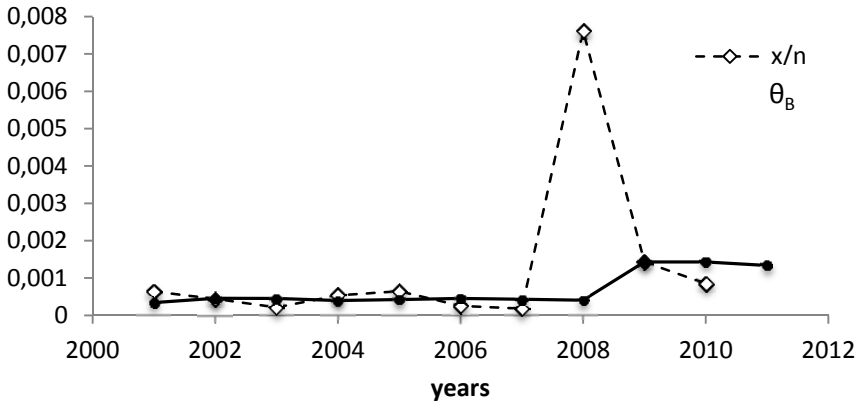
Before data collecting we have no information at all about this probability θ. In this situation if we aim the Bayes estimate of θ, we will use a "non-informative" prior distribution, which is uniform distribution on interval <0;1>, or beta distribution with parameters α = 1 and β = 1. This prior distribution of the parameter θ we will use in the first year, for which we need to do estimation. In each of subsequent year we will update the parameters α and β according to the expression (7). These updated estimates of parameters of posterior distribution for men include the Table 1 and for women the Table 2. These tables also contain updated Bayesian estimates θ_B for men and women in years 2000-2011 according to the formula (9).

Table 1 Updated Bayesian estimation probability of accidental death for men

year	x/n	α	β	θ_B
1999	0.000433168	1	1	0.5
2000	0.000178936	5.00	9231.30	0.000541342
2001	0.000638305	7.00	20406.51	0.00034291
2002	0.000440649	15.00	32931.70	0.000455281
2003	0.000213322	21.00	46541.97	0.000451002
2004	0.000535207	24.00	60602.21	0.000395868
2005	0.000644345	31.00	73674.26	0.000420594
2006	0.000254388	39.00	86081.96	0.000452851
2007	0.000178715	42.00	97871.97	0.000428948
2008	0.007623786	44.00	109060.98	0.000403281
2009	0.001431386	182.00	127024.22	0.001430748
2010	0.000846382	216.00	150743.43	0.001430848
2011		241.00	180255.91	0.001335203

Source: own calculations based on data NBS (2012)

Figure 1 Maximum likelihood and Bayesian estimation probability of accidental death for men



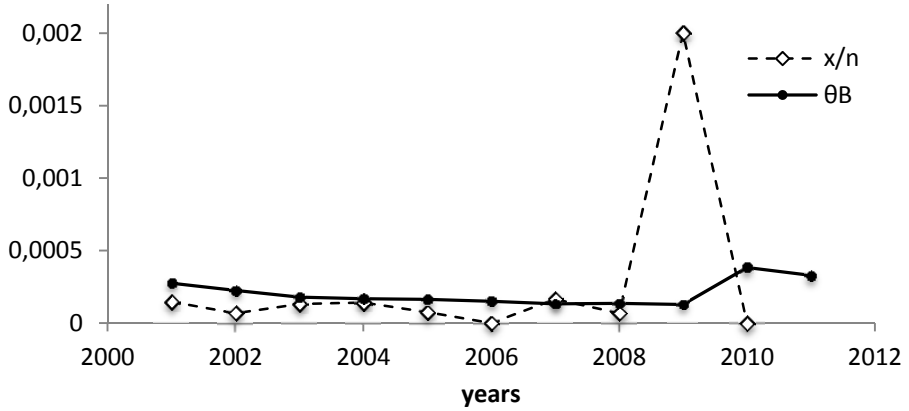
Source: Table 1, columns named x/n and θ_B

Table 2 Updated Bayesian estimation probability of accidental death for women

years	x/n	α	β	θ_B
1999	0.000204478	1	1	0.5
2000	0.000248617	3.00	9779.98	0.000306655
2001	0.000146166	6.00	21843.71	0.000274603
2002	6.7102E-05	8.00	35524.82	0.000225144
2003	0.000130928	9.00	50426.50	0.000178446
2004	0.000140744	11.00	65700.03	0.0001674
2005	7.43452E-05	13.00	79908.21	0.00016266
2006	0	14.00	93357.98	0.000149938
2007	0.000164017	14.00	106123.25	0.000131905
2008	6.76014E-05	16.00	118315.09	0.000135214
2009	0.002002964	17.00	133106.68	0.000127701
2010	0	59.00	154033.61	0.000382887
2011		59.00	179479.53	0.00032862

Source: own calculations based on data with prior B(1;1)

Figure 2 Maximum likelihood and Bayesian estimation probability of accidental death for women



Source: Table 2, columns named x/n and θ_B

Maximum likelihood and Bayesian estimates are graphically compared up to from third period under review, which is the year 2001. In the first two years differences of these

two estimates are too large, because of the a priori estimate by the value 0,5 in the first year 1999 highly overstates real value of the probability of accidental death for men and women (see first two rows of Table 1 and Table 2). To eliminate this drawback, instead of interval <0;1> for a priori estimate of probability of accidental death need to propose more realistic interval in which we assume a uniform prior distribution. Such interval and the algorithm for its use in Bayesian estimation of the probability of random event can be found in the article Kotlebová, E., Láska, I. (2014). The proposed procedure is as follows:

- We set the interval (θ_{min}, θ_{max}), at which we want to get a better estimate.
- We denote by the symbol *s* the mean of beta prior distribution, which is the center of this interval: $s = \frac{x_{min}+x_{max}}{2}$.
- We mark as θ_0 the more distant boundary of the interval (θ_{min}, θ_{max}) from the value of 0,5.
- Calculate the allowable error $h_B = |\theta_0 - s|$.
- We calculate q according to the formula

$$q = \frac{2n\theta_0(1-\theta_0)}{nh_B^2 - \theta_0(1-\theta_0)}$$

- We estimate the parameters α, β of the a priori beta distribution as follows:

$$\alpha = q \cdot s,$$

$$\beta = q - q \cdot s$$

- Bayesian estimation we obtain by the formula

$$\theta_B = \frac{\alpha + x}{\alpha + \beta + n}$$

According to the proposal of experts we selected the interval $\langle 0{,}00001; 0{,}2\rangle$ for a priori estimate of parameter θ. Following the procedure described above, we obtain a new estimate of the a priori probability of accidental death.

1. $\pi_{\min} = 0,00001;\ \pi_{\max} = 0,2$
2. $s = \frac{0,00001+0,2}{2} = 0,10001$
3. $\pi_0 = 0,00001$
4. $h_0 = |0,00001 - 0,10001| = 0,1$
5. $q = \frac{2 \cdot 9234,3 \cdot 0,00001 \cdot (1-0,00001)}{9234,3 \cdot 0,099995^2 - 0,00001 \cdot (1-0,0001)} = \frac{0,184684}{92,33376} = 0,00200018$
6. $\alpha = 0,002000018 \cdot 0,100005 = 0,00020003$

   $\beta = 0,00200018 - 0,00200018 \cdot 0,100005 = 0,00180015$
7. $\vartheta_B = \frac{0,0020003+4}{0,0020003+0,00180015+9234,3} = 0,00043$

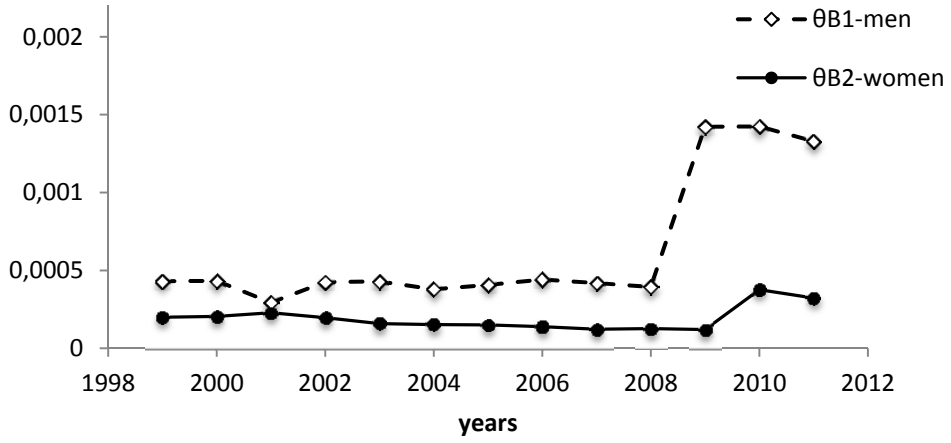
Table 3 Comparison of Bayesian estimations of probability of accidental death of men and women with new a priori estimates

year	θ_{B1}-men	θ_{B2}-women
1999	0.00043	0.00020
2000	0.000433189	0.000204499
2001	0.000293962	0.000228866
2002	0.000424961	0.000197018
2003	0.000429549	0.000158629
2004	0.00037939	0.000152189
2005	0.00040704	0.000150154
2006	0.000441252	0.000139233
2007	0.000418746	0.000122487
2008	0.000394125	0.000126767
2009	0.00142291	0.000120192
2010	0.001424244	0.000376403
2011	0.001329678	0.000323055

Source: own calculations with new a priori estimates

By an analogous procedure we get upgraded estimate of the a priori probability θ of death resulting from an accident for women as $\theta = 0{,}0002$. Using these new a priori estimates we have made new updated Bayesian estimates for men and women from Tables 1 and 2. They are listed in Table 4, which allows their graphical comparison by gender in Figure 3.

Figure 3 Graphical comparison probability of death as the result of accident by gender



Source: Bayesian estimations in Table 3

On the figure 3 are noticeable distinct differences in the probability of accidental death to the detriment men. This fact must necessarily reflect in the amount of the premium.

4 Conclusions

Bayesian estimation theory provides methods for permanently updated estimates of the event probability for each coming year in insurance company. Bayesian approach combine prior information that are known before collected of any data and information provided by the sample data, which are in our case number of concluded insurance contracts and number of claims in previous n years. Probability of the claims which are the subject of insurance contracts is for insurance company necessary to know especially when calculating premiums for next year.

The insurance company can correctly determine premiums only if use correctly estimates probabilities of claims. This article is both theoretical and practical demonstration of permanently updated Bayesian estimates of event probability which in this case is accidental death. This procedure has of course general use and provides better estimates of probabilities as a method of maximum likelihood.

As shown in the Tables 1 and Table 2, the maximum likelihood estimate is assigned to period which has already expired, while Bayesian probability estimate is for next period. This is undoubtedly an advantage for premium calculating. The possibility to express Bayesian estimate of binomial parameter in the form of credibility formulas by expression (9), allow easy application of not quite trivial theory in insurance practice.

The weakest point of Bayesian estimation is the choice of parameters of prior distribution and the associated a priori estimate of the parameter. Article also provides an algorithm to improve the a priori estimates.

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How Do Risk Free Investment Options Change our Decisions under Risk?

Jana Peliova

University of Economics
Faculty of National Economy, Department of Finance
Dolnozemska cesta 1, 852 35 Bratislava, Slovakia
E-mail: jana.pelioval@euba.sk

Abstract: *Financial decisions of investors do not essentially depend only on the amount of expected reward and it´s probability but as well as on the probability and amount of potential loss. Appropriate presentation of investment options may influence investors' decisions. The article aims to test the sensitivity of perception of economic subjects to the probability and amount of potential losses in decisions under risk. We conducted a laboratory experiment with 67 students of the University of Economics in Bratislava. The results of economic experiment show that the introduction of a risk-free investment opportunity increases the attractiveness of less risky option on the one hand but on the other hand it motivates some of the risk-averse subjects to choose a risk-free alternative. While approximately same share of population of male and female subjects changed their decision after implementation of risk-free option, results support higher level of risk-aversion among female population.*

Keywords: decision, risk, investment

JEL codes: G02

1 Introduction

We can find questions about rationales for decision making of economic agents in Smith's Theory of moral sentiments. He realized that people are more sensitive to decrease in their wealth, as if their wealth increases. This range of problems is addressed in the area of economic research in behavioral economics. It is based on the assumption that economic agents do not behave rationally, and their decisions are often influenced by factors other than utility maximization (Leonard and Hsu, 2001, Wilkinson- Klaes, 2012). Two basic approaches to decision making are based on the theory of expected utility and prospect theory.

The existence of gender differences in willingness to undertake risks has been documented in a number of large scale surveys and in incentivized experiments (Byrnes, Miller and Schafer 1999, Eckel and Grossman 2008, Croson and Gneezy 2009). These studies generally conclude that men are more willing to take risks than women are. Focusing on financial risk-taking, Charness and Gneezy (2012) reanalyze data from 15 experiments in which subjects decide on how much Money to invest into a risky asset as opposed to cash. They conclude that there is a robust gender difference with men investing more of their money into the risky asset in comparison to women. Market specific survey on insurance market done by Pastorakova et al (2013) supports previous findings on data from central Europe.

Fehr-Duda and de Gennaro (2006) used for analysis abstract and contextual environment. They stated that gender differences in risk taking may be due to differences in subjects' valuations of outcomes or due to the way probabilities are processed. Published results of their experiment indicate that men and women differ in their probability weighting schemes; however, they did not find a significant difference in the value functions. Women tend to be less sensitive to probability changes and also tend to underestimate large probabilities of gains to a higher degree than do men, i.e. women are more pessimistic in the gain domain. The combination of both effects results in significant gender differences in average probability weights in lotteries framed as investment decisions. The analysis concludes that women's relative insensitivity to probabilities combined with pessimism may indeed lead to higher risk aversion.

Such findings have an important message for real-world investment decisions. Due to increasing education levels and labor force participation of women, together with their longer lifespans relative to that of men, investment decisions of individuals, households or firms are more and more often done by women (Jianakoplos and Bernasek 1998). If women indeed are more risk-averse investors than men, this will have important implications for equilibrium portfolio allocations, wealth levels, asset prices and rates of return.

Financial decisions of investors do not essentially depend only on the amount of expected reward and it´s probability but as well as on the probability and amount of potential loss. The article aims to test the sensitivity of perception of economic subjects to the probability and amount of potential losses in decisions under risk.

The remaining part of the paper is structured as follows. Section 2 describes the experimental design we used and data collected. Section 3 presents the results and section 4 concludes.

2 Methodology and Data

To elicit the risk preferences we conducted controlled experiment using a paper-based questionnaire. We used an economic laboratory experiment conducted at the University of Economics in Bratislava. 67 subjects participated in filling out the questionnaires; all of them were master students in Finance program within Experimental economics course. Gender structure of subject pool was significantly favoring female subjects (49) to male subjects (18) copying the population structure of finance students. Subjects were answering questions anonymously and payments were hypothetical (students participation was considered for final grade). Questions presented in questionnaire are listed in Table 1. Each question was printed on separate paper and answers were collected by experimenter one by one and followed by demographic survey.

Table 1 Experimental questions

1. Imagine that your account is € 1,000 and you must choose one of the following investment options for your money: a) 30% probability of loss of € 300 and a 70% probability of profit € 500 b) 10% probability of loss of € 900 and a 90% probability of profit € 389 c) Random selection from a) or b) – choice does not matter After marking the answers turn the paper blank side up, and place it on the opposite side of the table. 2. Imagine that your account is € 1,000 and you must choose one of the following investment options for your money: a) 30% probability of loss of € 300 and a 70% probability of profit € 500 b) 10% probability of loss of € 900 and a 90% probability of profit € 389 c) 30 € with probability 100 % After marking the answers turn the paper blank side up, and place it on the opposite side of the table.

Source: Excerpt from paper based laboratory experiment questionnaire.

Expected values for options a) and b) in the first question are equal. Based on the Expected Utility Theory we can calculate:

$$EV_{a)} = 0{,}3 \times (-300) + 0{,}7 \times (500) = 260 \quad (1)$$

$$EV_{b)} = 0{,}1 \times (-900) + 0{,}9 \times (389) = 260 \quad (2)$$

Any economic subject should be indifferent in deciding between option a) and option b). Prospect theory proved that into the decision also psychological factors are entering. In formulating this question, we therefore assumed that subjects will choose option A or B, depending on whether their risk aversion is more influenced by the probability of outcome (profit or loss), or the absolute level of potential income. For subjects that do

not have preference, we introduced the option c), to limit the forced choice of subjects and to increase the explanatory power of the results.

In the second question, we replaced the indifferent c) option from the first question, by guaranteed gain of € 30. This option provides significantly lower expected value than the EV of options a) and b), but no risk of loss. This option also makes the decisions of subjects more real as people often have to choose between financial products that are more risky and have higher expected value and the options that are guaranteed with a much lower expected value. The amount of € 30 was set so that it is lower than the expected value of unguaranteed options and that the difference between risky and safe options is large enough to compensate the profit guarantee.

3 Results and Discussion

The data consist of 134 decisions (two decisions from each subject). Aggregate behavior is displayed graphically in Figure 1 and Figure 2 and summarized in Table 2. According to the results presented in Table 2 none of the subjects in our sample has chosen option c) in Question 1. All participating students had clear preferences and 54 of them (over 80 %) decided for option a) that has a higher probability of loss and at the same time a lower amount of possible loss.

Table 2 Decision made by subjects

Option	Question 1		Question 2	
a)	54	80.6	39	58.21
b)	13	19.4	18	26.87
c)	0	0	10	14.93
Total	67	100 %	67	100 %

Source: experimental data

In Question 2 the option c) was replaced with a guaranteed gain of € 30, but this gain significantly lower profit than the risky options a) and b), € 500 and € 389. In Question 2 the majority of subjects decided for option a), but it was only 58,21 % of all students. For option c) decided 10 participants. The inclusion of safe option paradoxically increased the proportion of students who chose option b) (the option with less probability of loss, but with the higher absolute amount of loss). This trend was more noticeable in subgroup of men, when the portion was doubled (from 22,22 % in Question 1 to 44,44 % in Question 2)

Of the 10 subjects who decided for option c) in Question 2, eight of them were preferring option a) in Question 1 and two of them option b). Thus the majority of the subjects who chose option c) in Question 2 have opted for a) in Question 1. We assume that these subjects were not deciding according to the probability of loss and in this respect they considered option a) in question 1 as less risky.

Option a) (30 % probability of loss of € 300 and a 70 % probability of profit € 500) is perceived as less risky than option b), even though the expected values of both options are the same. On this basis, we can summarize that subjects in this case are more sensitive to the amount of potential loss then to the probability of its occurrence.

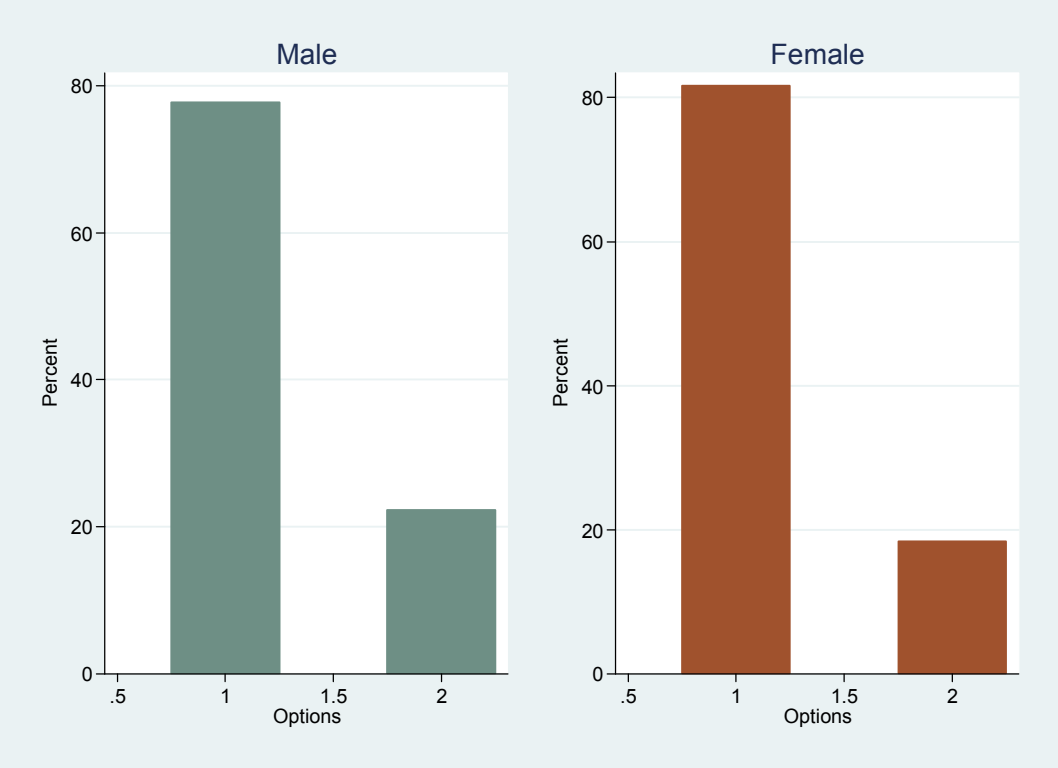
Table 3 Decision made by male and female subjects

Option	Question 1				Question 2			
	Male	**%**	**Female**	**%**	**Male**	**%**	**Female**	**%**
a)	14	77.78	40	81.63	9	50	30	61.22
b)	4	22.22	9	18.37	8	44.44	10	20.41
c)	0	0	0	0	1	5.56	9	18.37
Total	18	100%	49	100 %	18	100 %	49	100 %

Source: experiment data

The results presented in Table 3 express that the distribution of decisions in Question 1 between male and female subject is similar (for option a) decided slightly more female (81.63 %) than male subjects (77.78 %) in the studied sample).

Figure 1 Distribution of decisions in Question 1



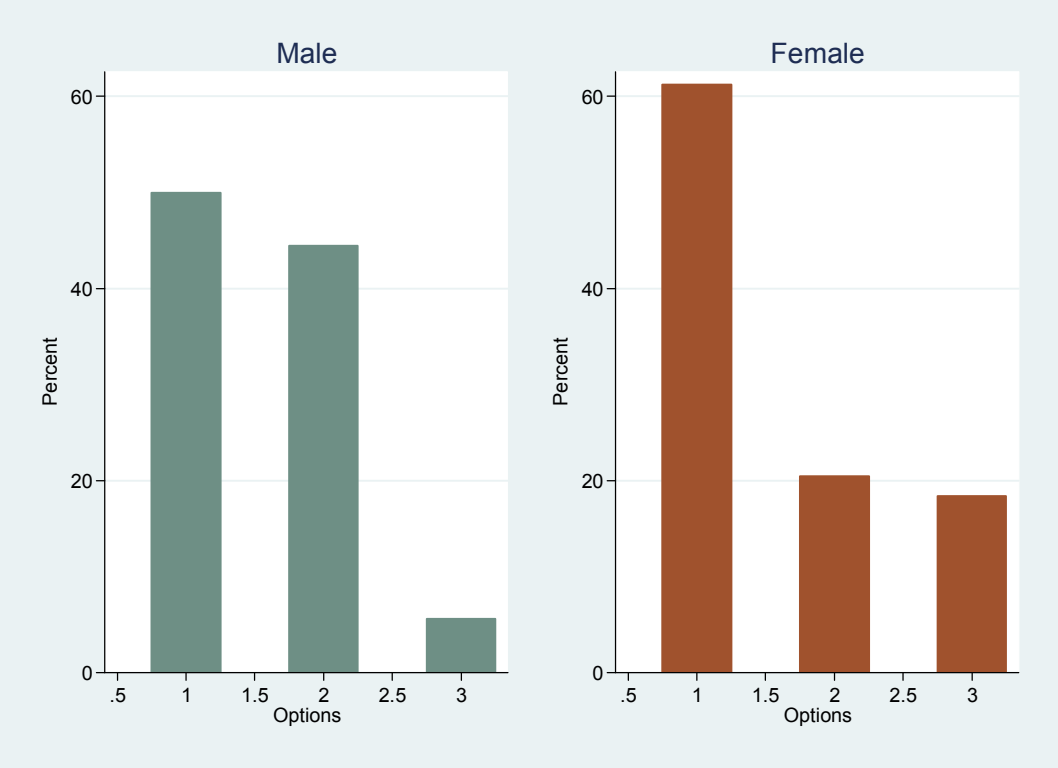
Source: Data from experiment; 1 = option a) 2 = option b) 3= option c)

Comparing Figure 1 and 2 we come to the interesting finding that while 9 women who chose in the second question option c), was only 7 choosing in the first question you option a) and 2 who decided for b). Within male subjects, there was a change decisions between options more often in favor to move from a) to b) (4 men) than from a) to c) (1 man).

General results for the whole sample indicate that there is statistically significant relationship between the answers in Question 2 and Question 1 (chi-square with two degree of freedom = 29,4; p = 0,000; Fisher's exact = 0,000). Based on Cramer´s V we can classify the relationship between decisions in both questions as very strong (0,663 p-value less than 0,001). Chi square does not indicate the direction of relation; however based on rational prediction that Q2 follows Q1 we assume that this is the direction of relationship.

Further investigation of data based focused on gender differences indicate that there is statistically significant relationship between the answers in Question 2 and Question 1 within male subjects (chi-square with two degree of freedom = 6,43 ; p = 0,040; Fisher's exact = 0,041); however the results are not that strong as for the whole sample. Based on Cramer´s V the strength of relationship between is considered to be strong (0,598 p-value is 0,040). Female subjects demonstrated strong statistical significance (chi-square with two degree of freedom = 24,619; p = 0,000; Fisher's exact = 0,000. Based on Cramer´s V the strength of relationship between is considered to be strong enough (0,79 p-value is 0,000).

Figure 2 Distribution of decisions in Question 2



Source: Data from experiment; 1 = option a) 2 = option b) 3= option c)

4 Conclusions

Financial decisions of investors do not essentially depend only on the amount of expected reward and it´s probability but as well as on the probability and amount of potential loss. The existence of gender differences in willingness to undertake risks has been documented in a number of papers, both experimental and large scale surveys. In most of the analysis females are considered to be more risk averse, e.g. Fehr-Duda and de Gennaro (2006) conclude that women's relative insensitivity to probabilities combined with pessimism may indeed lead to higher risk aversion.

Increasing education levels and participation of women in labor force, together with their longer lifespans relative to that of men, investment decisions of individuals, households or firms are more and more often done by women. Due to this fact, we analyzed in this article gender differences in decisions under risk. To simulate real world we conducted laboratory experiment.

The results of economic experiment report that the introduction of a risk-free investment opportunity increases the attractiveness of option with lower probability of loss on the one hand but on the other hand it motivates some of the risk-averse subjects to choose a risk-free alternative. While approximately same share of population of male and female subjects changed their decision after implementation of risk-free option, results support higher level of risk-aversion among female population. Introduction of risk free option increased number of male subjects deciding for option b) in Question 2. Female decided to change their decision in Question 2 in favor of safe option changing from the option with existing probability of loss (7 of them from option a) and 2 from option b)).

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The Establishment of VIG Group as a Marketing Strategy on the Insurance Market in the Czech Republic

Lenka Přečková

Silesian University in Opava
School of Business Administration in Karviná, Department of Finance
Univerzitní nám. 1934/3, 733 40 Karviná, Czech Republic
E-mail: preckova@opf.slu.cz

Abstract: *The issue of the establishment of insurance groups relates to up-to-date trends on the present insurance market. The VIG group is a major insurance group on the Czech insurance market. The insurance companies Kooperativa Pojišťovna, ČPP Pojišťovna and Pojišťovna ČS are its three subsidiaries. The aim of this paper is to determine the influence of the establishment of the insurance group VIG on selected indicators of the insurance market. The paper describes the establishment and development of the insurance group VIG in the Czech Republic. The article characterizes business cooperation of insurance companies within the insurance group VIG and cooperation with commercial banks under the terms of bancassurance products. The paper includes an analysis of the insurance market of the insurance group VIG according to selected indicators for the period 2005 -2012 and evaluates their development.*

Keywords: insurance group, life insurance, non-life insurance, written premium

JEL codes: G22

1 Introduction

The article focuses on the establishment of insurance groups in the Czech Republic and its issues and it analyses the market in the period between 1996 and 2013. The object of my research is the insurance group Vienna Insurance Group (hereinafter referred to as VIG), which, thanks to its market share, belongs to the most significant in the Czech Republic. The group consists of these parts: Kooperativa pojišťovna, a.s., Vienna Insurance Group (hereinafter referred to as KOOP), Česká podnikatelská pojišťovna, a.s., Vienna Insurance Group (hereinafter referred to as ČPP) and Pojišťovna České spořitelny, a. s., Vienna Insurance Group (hereinafter referred to as PČS). Because these companies have not been parts of the VIG Group since its establishment itself, this article presents a brief summary of their history as well as the most important dates for their strategic development. Emphasis is put on property links and strategic cooperation among the members of the VIG group. These facts are later used as sources for an evaluation of the insurance market of the insurance group VIG in the period from 2005 and 2013.

Insurance companies use various marketing strategies on the insurance market. Among the most significant strategies are the growth strategy and market positioning strategy. The growth strategy is represented by offering new or innovated insurance products. Another way is finding inspiration in developed insurance markets and the potential of the Czech insurance market and increasing of supply and variability of investment life insurance. The growth strategy is interwoven with the market positioning strategy. For insurance companies, widening and maintaining their position on the market is a priority. Insurance companies could not attain lasting profits without increasing their market share. It is also important to mention the bancassurance strategy within which the insurance companies use synergic effects and development of their distributional network. (Řezáč, 2009)

The establishment of the VIG group demonstrates current trends on the insurance markets. Within insurance groups, aforementioned marketing strategies can be fulfilled in full. It is a manifestation of globalization tendencies connected with how much insurance companies cooperate with one another within groups on the basis of bancassurance or other strategic treaties. According to Ducháčková, Daňhel and Radová (2009) the financial crisis caused that trends of intersectoral integrations and

implementation of more effective regulation projects commenced in the nineties have been recently undergoing serious corrections. According to Ducháčková and Daňhel (2009), fusions and acquisitions on the Czech, relatively fragmented, insurance market, are taking place outside the intersectoral integration. The development of the VIG group cannot be foreseen and there is no telling in what ways the holding is going to develop. (Ducháčková, Daňhel, 2009)

2 Methodology and Data

The aim of this article is to find out how large is the influence of the establishment of the insurance group VIG on selected indicators of the insurance market. This article also summarizes history of the VIG group in the Czech Republic remembering dates which meant the most significant changes. Sources for this information were found on the websites of the VIG, KOOP and in the KOOP's annual report.

Subsequently, the article evaluates each insurance company belonging to the VIG group by a method of description. This can be done by using information from the websites of insurance companies and their annual reports. An analysis for each insurance company for the period from 1996 to 2013 is then conducted based on the written premium. This prepares the way for a consequent calculation of market shares. The data on the written premium was collected from the Czech Insurance Association's statistics. Based on the aforementioned analyses conducted for all insurance companies, dissimilar attributes are chosen and compared. This evaluation takes significant changes during the development of the VIG into account.

The last part of the research is focused on an analysis and evaluation of the VIG group. An analysis of the VIG based on the growth rate of the VIG's written premium (year-on-year growth of the written premium expressed as a percentage) is conducted for the period from 2005 to 2013 which opens the way for a comparison with the Czech insurance market in its totality. Subsequently, the article tries to find out what caused discovered differences. Finally, VIG's market share for the period from 2005 to 2013 is calculated.

3 Results and Discussion

VIG on the Czech Insurance Market

VIENNA INSURANCE GROUP AG Wiener Versicherung Gruppe (VIG) was established by Georg Ritter von Högelmüller as the k.u.k. priv. wechselseitige Brandschaden Versicherung in 1824. During its existence, it has become the largest Austrian insurance group whose majority owner is Wiener Städtische Wechselseitige Versicherungsanstalt-Vermögensverwaltung. (www.koop.cz, 2014)

VIG expanded into Central and Eastern Europe (CEE) in 1990. The VIG was the first Western European insurance company to make a cautious, risk-conscious move into the CEE region. In 1990, the Wiener Städtische AG entered the German insurance market with the formation of a company and began its expansion to the East with a first stake in the newly formed Kooperativa insurance in the former Czechoslovakia. Conversion into a joint-stock company with the name Wiener Städtische Allgemeine Versicherung Aktiengesellschaft took place in 1992. "Wechselseitige" continued as Wiener Städtische Wechselseitige Versicherungsanstalt Vermögensverwaltung and assumes the functions of a financial holding company. In the course of the separation of the former Czechoslovakia into the Czech Republic and the Slovak Republic, Kooperativa was divided into three successor companies with registered offices in Bratislava, Brno and Prague in 1993. In 1999 the offices in Brno and Prague were merged into the "Kooperativa pojist'ovna a.s". Since 1996, the Wiener Städtische AG has gradually continued its expansion direction into CEE. In 2006, introduction of the umbrella brand "Vienna Insurance Group" was renamed "Wiener Städtische Allgemeine Versicherung AG" into "WIENER STÄDTISCHE Versicherung AG Vienna Insurance Group". (www.vig.com, 2014)

In 2008, VIG increased its capital from 105 million shares to 128 million shares by issuing 23 million new shares in order to be able to successfully continue its growth strategy. The capital increase was used to finance the acquisition of the insurance operations of the Erste Group, including the long-term reciprocal distribution partnership with the Erste Group. Acquisition of the insurance operations of the Erste Bank Group at the beginning of 2008, VIG acquired the entire insurance business of the Erste Bank Group in Austria, the Czech Republic, Slovakia, Hungary, Croatia and Romania. As a result of this acquisition, VIG has risen to the top position among insurers that are internationally active in the CEE region and is a leading provider of life insurance. Furthermore, VIG founded a Group reinsurance company in the Czech Republic in 2008. The formation of the company VIG RE that has its registered office in Prague is a clear signal for the CEE region as core market of VIG with excellent growth potential. In 2009, the corporate name was changed into "VIENNA INSURANCE GROUP Wiener Städtische Versicherung AG". With effect from 3 August 2010 the company's operational insurance business in Austria is legally segregated from the holding functions of the Group. WIENER STÄDTISCHE Versicherung AG Vienna Insurance Group, as the largest single company, therefore continues to handle the property/casualty, life and health insurance business in Austria. Besides exercising the usual international control functions of a listed group, VIENNA INSURANCE GROUP AG Wiener Versicherung Gruppe is also active in the reinsurance and international wholesale insurance business. In the course of the reorganisation the listed holding company gets the new company name "VIENNA INSURANCE GROUP AG Wiener Versicherung Gruppe". (www.vig.com, 2014)

The VIG group with its registered office in Vienna, Austria, is one of the largest international insurance groups in central and eastern Europe. The VIG is one of the most prominent listed insurance companies in Austria and in central and eastern Europe. It employs approximately 24'000 workers and its volume of premium is approximately 9.7 billion EUR. The VIG has been dealing with insurance for more than 190 years. Currently, the VIG group is a leading specialist in insurance in Austria and in central and eastern Europe. The business concern consists of approximately 50 companies in 24 countries. The VIG is listed on the Vienna Stock Exchange having the highest rating within the main index of the Vienna Stock Exchange's ATX. The company is listed also on the Prague Stock Exchange. (KOOP's annual report, 2012)

Kooperativa pojišťovna, a.s. (KOOP), Vienna Insurance Group

KOOP was established in 1991 as the first commercial insurance company on the territory of former Czechoslovakia. KOOP is part of the VIG. In early 2004, KOOP concluded a strategic partnership contract with Česká spořitelna, a.s. (hereinafter referred to as ČS). The combination of business activities of both and the ability to sell products of both meant broadening and greater offer of financial and insurance products for clients of both companies on the territory of the Czech Republic. Clients can have their family financial analysis conducted. Sales representatives of KOOP offer, apart from insurance products, also financial products of the ČS, namely the building society account and credit, individual retirement account, mortgage accounts and so-called American mortgage accounts. The ČS also offers a variety of KOOP's insurance products. (www.koop.cz, 2014)

The strategic partnership of KOOP and ČS is connected to historical events dating back to the establishment of the ČS-Životnostenská pojišťovna, a.s. The insurance company was established in 1992 using Czech private capital of the ČS. In 2000, a new shareholder entered ČS-Životnostenská pojišťovna. It was the largest Austrian life insurance company, Sparkassen Versicherung, a member of the financial group Erste Bank. Since 2001, the company has been using a new name: Pojišťovna České spořitelny (PČS). Bankassurance products have extended in the form of sales of insurance products offered by PČS in the network of ČS's branches. Because ČS and Erste Bank specialized in life insurance and bancassurance, shareholders sold the non-life part of PČS to KOOP in 2003. Since 2004, PČS has been specializing in sales of life insurance using the ČS's network and selected external networks. (www.pojistovnacs.cz, 2014)

In the portfolio of KOOP, there are 3.8 million insurance contracts and 2.02 million clients. (KOOP's annual report, 2012). KOOP is owned by three companies, namely VIENNA INSURANCE GROUP AG Wiener Versicherung Gruppe (96.32%), VLTAVA majetkoprávní a podílová spol. s r. o. (2.07 %) and Svaz českých a moravských výrobních družstev, Praha (1.61 %). (www.koop.cz, 2014)

The table below (table 1) shows the development of written premium (WP) and insurance market share (MS) in the period from 1996 to 2013. In 2004, it overran the market share of 20% and it has never gone below ever since. The data shows that the KOOP had the highest market share (22.9%) in years 2005 and 2006. 2010 meant a significant drop to 20.4%. In 2013, KOOP has its market share of 22.8%.

Table 1 KOOP's written premium and market share on the insurance market in the period from 1996 to 2013

	1996	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**
Total WP in MS, mil CZK	40243	47986	55088	62796	70589	80745	90939	105940	112575
Total WP of KOOP, mil CZK	3902	4586	6814	7565	11991	13570	16369	20024	24167
MS KOOP, %	9.7	9.6	12.4	12.0	17.0	16.8	18.0	18.9	21.5
WP non-life KOOP, mil CZK	3862	4465	6403	6827	10504	11484	13313	15518	18706
WP life KOOP, mil CZK	40	121	411	738	1487	2086	3056	4506	5461
	2005	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**
Total WP in MS, mil CZK	115712	119857	130269	136574	139915	151135	122680	121950	120410
Total WP KOOP, mil CZK	26528	27427	29011	30730	30992	30895	27741	27106	27490
% KOOP's market share	**22.9**	**22.9**	22.3	22.5	22.2	20.4	22.6	22.2	**22.8**
WP non-life KOOP, mil CZK	20491	21155	22110	23318	23296	22538	21742	20846	20847
WP life KOOP, mil CZK	6037	6272	6901	7412	7696	8357	5999	6260	6643

Source: Own work based on ČAP's data (www.cap.cz)

Česká podnikatelská pojišťovna, a.s. (ČPP), Vienna Insurance Group

ČPP is an all-purpose insurance company. It has been on the Czech insurance market since 1995. ČPP has had a historically firm position in the area of car insurance, particularly third-party vehicle insurance. In this area, it is the third largest insurer on Czech market with more than one million insured vehicles. ČPP administers approximately 1.5 million insurance contracts. It has 850 thousand clients. Since 2005, this insurance company has been an integral part of one of the largest European insurance groups, the VIG. The insurance company is owned by a single company, Kooperativa pojišťovna, a.s., Vienna Insurance Group. (www.cpp.cz, 2014)

The following table (table no. 2) shows the development of written premium (WP) and market share (MS). It is obvious that the market share was on the increase during the monitored period. In 2009, the insurance company exceeded 4% and its market share has been increasing ever since. In 2013, it reached its all-time high of 4.95%.

Table 2 ČPP's written premium and market share on the insurance market in the period from 1996 to 2013

	1996	1997	1998	1999	2000	2001	2002	2003	2004
Total WP in MS, mil CZK	40243	47986	55088	62796	70589	80745	90939	105940	112575
Total WP of ČPP, mil CZK	15,5	43,3	129,5	225,7	834,5	1366	2082	3036	3706
MS ČPP, %	0.04	0.09	0.24	0.36	1.18	1.69	2.29	2.87	3.29
WP non-life ČPP, mil CZK	10.9	40.6	124.0	216.3	777.8	1024	1402	2250	2903
WP life ČPP, mil CZK	4.6	2.7	5.5	9.4	56.7	342	680	786	803
	2005	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**
Total WP in MS, mil CZK	115712	119857	130269	136574	139915	151135	122680	121950	120410
Total WP ČPP, mil CZK	4011	4345	4751	5425	6186	6372	5842	5779	5965
% ČPP's market share	3.47	3.63	3.65	3.97	**4.42**	4.22	4.76	4.74	**4.95**
WP non-life ČPP, mil CZK	3122	3262	3536	4025	4508	4520	4679	4573	4693
WP life KOOP, mil CZK	889	1083	1215	1400	1678	1852	1163	1206	1272

Source: Own work based on ČAP's data (www.cap.cz)

Pojišťovna České spořitelny, a. s. (PČS), Vienna Insurance Group

What was previously said about the establishment of the ČS-Živnostenská pojišťovna, a.s. in 1992 is very important in order to understand the development of PČS itself. In 2004, PČS started specializing in sales of life insurance using ČS's distributional network and chosen external networks (more information in the article on KOOP). Since 2001, the insurance company has been using its current name having developed its activities in bancassurance especially.

In 2008, the insurance company became part of the insurance group VIG. PČS administers 790 million insurance contracts. It has 1'900 thousand clients. The insurance company specializes in life insurance products. As far as non-life insurance is concerned, the insurance company offers injury and illness insurance and various financial loss insurance products. PČS is one of the largest insurance companies dealing with bancassurance on the Czech market. Sales of its products are performed using two distributional networks, namely the branch network belonging to ČS and also PČS's external network. PČS is owned by three companies, the majority shareholder is VIENNA INSURANCE GROUP AG Wiener Versicherung Gruppe (90%), followed by Kooperativa pojišťovna, a.s., Vienna Insurance Group (5%) and Česká spořitelna, a.s. (5%). (KOOP's annual report, 2012)

The following table (table no. 3) shows the development of written premium (WP) and market share (MS). 2004 reflects sale of the non-life insurance stem. PČS's market share reached 3.46% in that year. In 2005 it dropped to its all-time low of 2.12%. The period from 2006 to 2013 shows growth of the market share. It reached 5.08% in 2013.

Table 3 PČS's written premium and market share on the insurance market in the period from 1996 to 2013

	1996	1997	1998	1999	2000	2001	2002	2003	2004
Total WP in MS. mil CZK	40243	47986	55088	62796	70589	80745	90939	105940	112575
Total WP of PČS. mil CZK	942	1318	1770	2169	3022	3660	6282	6937	3894
MS PČS. %	2.34	2.75	3.21	3.45	4.28	4.53	6.91	**9.55**	3.46
WP non-life ČPP. mil CZK	903	1201	1631	1993	2699	2618	2736	3120	628
WP life PČS. mil CZK	39	117	139	176	323	1042	3546	3817	3266
	2005	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**
Total WP in MS. mil CZK	115712	119857	130269	136574	139915	151135	122680	121950	120410
Total WP ČPP. mil CZK	2451	4428	6454	6680	6963	9203	6098	5862	6116
% PČS's market share	2.12	3.69	4.95	4.89	4.98	**6.09**	4.97	4.81	**5.08**
WP non-life PČS. mil CZK	11	24	53	87	107	683	788	133	127
WP life KOOP. mil CZK	2440	4404	6401	6593	6856	8520	5310	5729	5989

Source: Own work based on ČAP's data (www.cap.cz)

Comparison of KOOP, ČPP and PČS

On the basis of the previously performed description and analysis of insurance companies which belong to the VIG group, this article will now summarize important data and it will compare them (see table 4). It is obvious that sale of the non-life insurance stem (to KOOP) which PČS opted for in 2003 had significant consequences on figures which the following table presents.

In 2008, all insurance companies became part of the VIG group. PČS specializes in life insurance in form of bancassurance. ČPP and KOOP offer life insurance and non-life insurance products, whilst ČPP has, ever since its establishment, always focused on car insurance.

Premium value in the period from 2005 to 2013 has changed by 4.06%. KOOP shows a very similar figure (3.63%). PČS and ČPP show completely different, significantly higher figures.

Table 4 Comparison of KOOP, ČPP a PČS according to selected indicators

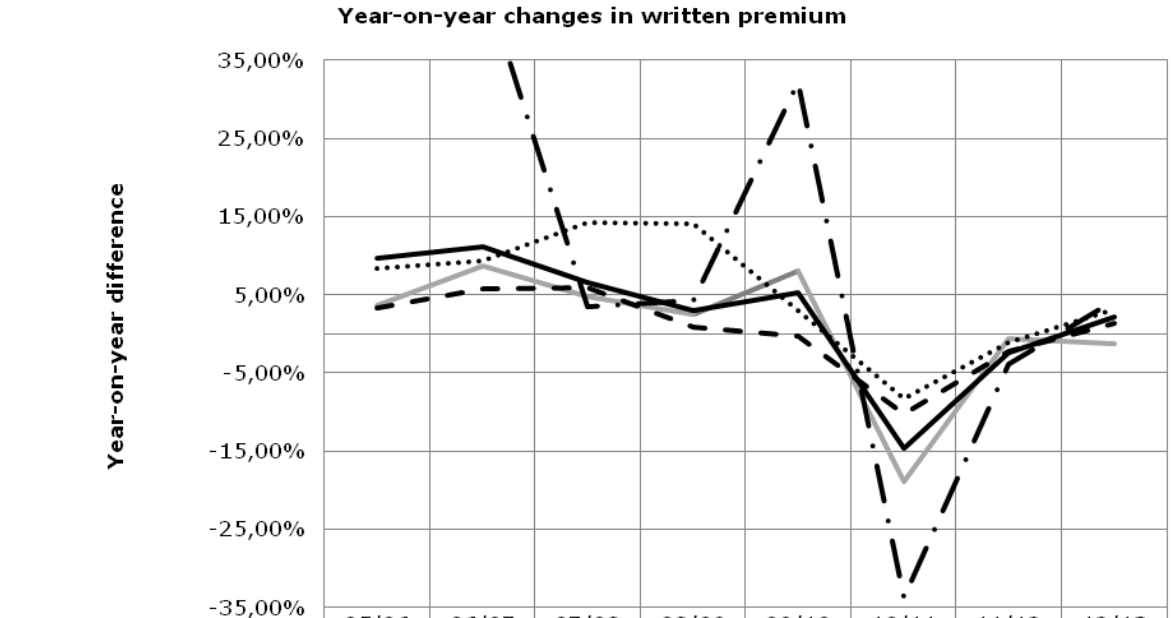
	KOOP	ČPP	PČS
Number of clients in 2012, mil	2.02	0.85	1.9
Belonging to VIG since	Since establishment	2005	2008
Specialization in insurance products	Strategic partnership with ČS	Specialization – car insurance	Specialization - life insurance and bancassurance
Maximum market share, %	22.93 2005	4.95 2013	9.55 2003
Minimum market share, %	9.6 1997	0.04 1996	2.12 2005
Market share in 2013	22.8	4.95	5.08
Average market share in the period 2005-2013 in total written premium, %	22.32	4.2	4.62
Difference of premium value between 2005 and 2013, %	3.63	48.73	149.51
Difference in market share between 2005 a 2013, %	-0.44	42.65	139.62

Source: own work

Analysis of the Insurance Group VIG

The following analysis focuses on VIG in the period from 2005 to 2013. Graph 1 shows the development of year-on-year changes of VIG's and also KOOP's, ČPP's and PČS's written premium (WP) on global insurance market (IM).

Graph 1 Development of year-on-year changes in written premium in the period from 2005 to 2013



	05/06	06/07	07/08	08/09	09/10	10/11	11/12	12/13
IM - change of WP	3,58%	8,69%	4,84%	2,45%	8,02%	-18,83%	-0,59%	-1,26%
VIG - change of WP	9,73%	11,09%	6,51%	3,05%	5,28%	-14,61%	-2,35%	2,12%
KOOP - change of WP	3,39%	5,78%	5,92%	0,85%	-0,31%	-10,21%	-2,29%	1,42%
ČPP- change of WP	8,34%	9,35%	14,17%	14,03%	3,00%	-8,32%	-1,07%	3,22%
PČS - change of WP	80,64%	45,76%	3,51%	4,23%	32,17%	-33,74%	-3,86%	4,31%

Source: Own work based on ČAP's data (www.cap.cz)

On the basis of year-on-year changes of the written premium in the period from 2005 to 2013, we can summarize that the development of the VIG's and KOOP's market follows the development of the global insurance market. ČPP and PČS indicate a different development.

The growth rate of ČPP's written premium is, throughout the whole monitored period, higher than growth rate of the insurance market. ČPP shows a significantly different development in the period from 2007 to 2009, compared to the global insurance market. Growth rate is significantly higher reaching almost 14%. Judging from information provided in annual reports and ČAP's statistical data, this development was caused by growth of life but also non-life insurance with life insurance growth being higher. Non-life insurance recorded high growth rate in the area of car insurance and business insurance. These insurance products, however, do not represent a significant part within non-life insurance portfolio. A significant part of ČPP's non-life insurance is formed by third-party car insurance. In 2008, third-party car insurance represented 66% and 64% in 2009. According to data in annual reports from 2006 to 2009, the insurance company showed very good results in car insurance and also in life insurance, thanks to newly introduced products. In 2007, it introduced a new own product of investment life insurance which allows clients to create their own investment strategy. This product received a great public reaction. In 2008, the insurance company focused on new insurance product which combines third-party car insurance and car accident insurance. (ČPP's annual reports, 2006-2009)

As far as growth rate is concerned, PČS shows fluctuations in the monitored period. In the period from 2005 to 2007, the insurance company showed growth above average which then started decreasing and in the period from 2007 to 2009, it dropped to the level of global insurance market. According to PČS annual reports and according to the previously described development, this can be explained as follows. From 2005, PČS was specializing exclusively in life insurance and in sales in the form of bancassurance. From 2005, life insurance started to grow. In 2008, PČS became part of the VIG group and in 2009, it concluded a long-term contract on mutual partnership and support in sales of insurance products using the ČS's branch network. These demanding strategic changes led to decreasing growth rate in the period from 2007 to 2009. The corroboration with ČS in the following year (2010) led to higher year-on-year growth of the written premium. (PČS's Annual reports, 2007-2012)

Table 5 complements the development of VIG's market share in the period from 2005 to 2013. It is obvious that the market share was growing and in 2013, it reached its all-time high of 32.86%. The difference between 2005 and 2013 is +15%. Average growth rate in this period is 1.83%.

Table 5 Development of the VIG group's market share on Czech insurance market

	2005	2006	2007	2008	2009	2010	2011	2012	2013
WP in MS, mil CZK	115712	119857	130269	136574	139915	151135	122680	121950	120410
WP within VIG, mil CZK	32 989	36 200	40 216	42 835	44 141	46 469	39 680	38 748	39 571
VIG's market share, %	28.51	30.20	30.87	31.36	31.55	30.75	32.34	31.77	32.86

Source: own work based on ČAP's data (www.cap.cz)

4 Conclusions

The article focuses on analysis of the insurance market constituted by the insurance group VIG. It describes the insurance group VIG and also insurance companies KOOP, ČPP and PČS within the Czech insurance market and it accents significant strategic changes in their developments. It presents analysis of KOOP's, ČPP's and PČS's written premium and market share in the period from 1996 to 2013 and deals with basic differences of selected parameters. The crucial part of this article consists of an analysis of the VIG group which includes growth rate (year-on-year difference in percents) of the written premium in the period from 2005 to 2013. The article also compares growth rates of each insurer's and the VIG group's written premium with the global insurance market. Finally, the article elaborates on the development of VIG's market share in the period from 2005 to 2013.

The aim of this article is to find out how large is the influence of the establishment of the insurance group VIG on selected indicators of the insurance market. These indicators are the amount of written premium and its growth rate in the period from 2005 to 2013. In this period, PČS joined the VIG group (2008). By means of an analysis and a consequent comparison, the article finds out that the VIG's and KOOP's development follows the global insurance market. ČPP and PČS show differences.

In the monitored period, ČPP always showed higher growth rate reaching the highest figures in the period between 2006 and 2009. This is caused mainly by the development of life insurance products and third-party car insurance after the introduction of new insurance products. In general, ČPP can be assessed as an insurance company with a significant growth of business production.

PČS shows significant fluctuations during the monitored period. Especially from 2007 to 2009, growth rate of written premium was decreasing. This was caused by strategic changes connected with PČS's decision to join the insurance group VIG.

VIG's market share shows a growing trend in the period from 2005 and 2013 reaching its all-time high of 32.86% in 2013. The average growth rate in this period was 1.83%.

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IFRS as a Tax Base in a Small Open Economy

David Procházka, Jan Molín

University of Economics, Prague
Faculty of Finance and Accounting, Department of Financial Accounting and Auditing
Nám. W. Churchilla 4, Prague 3, 130 67, Czech Republic
E-mail: prochazd@vse.cz, jan.molin@vse.cz

Abstract: *The IFRS adoption has improved the quality of accounting information significantly. However, huge costs are incurred by all subjects involved. The process has significant consequences for tax systems, too. State authorities are solving how to ensure the control over tax duty fulfilment under a new financial reporting system. As corporate income tax systems in code law countries are tightly bound up with accounting regulation, governments are forced to decide whether and in which way companies preparing financial statements under the IFRS shall reflect the IFRS based figures in their income tax returns. The paper focuses on specifics of a small open economy, such as the Czech Republic. The empirical analysis addresses four cardinal research issues relating to the eligibility of the IFRS as a tax base. Three issues are already assessed with the reference to publicly available data; the last one is still under scrutiny, as non-public data from tax returns are needed for the analysis.*

Keywords: IFRS, tax base, small open economy, comparative advantages

JEL codes: M41, H25

1 Introduction

Regulation (EC) 1606/2002 on International Accounting Standards was approved as an outcome of accounting harmonisation efforts within the European Union. As unintended effect, the implementation of IFRS influences tax systems, as many countries oblige or allow companies to apply the IFRS in their individual financial statements, too. Governments are forced to decide whether and in which way companies preparing their statutory accounts under IFRS regime shall reflect the IFRS based figures when calculating their income tax duty. The IFRS can possess decision-usefulness not only for financial reporting purposes, but they may be also an alternative tool of tax policies. We hypothesise that introducing the IFRS as a tax base may be an attractive option for public budgets of small open economies, which struggle to offer favourable economic environment. The paper presents some empirical data on corporate income tax in the Czech Republic, with focus on listed companies. Czech listed companies are obliged to apply the IFRS in their statutory accounts, but they are not allowed to use the IFRS for taxation. The paper outlines a hypothetical situation, what would happen, if the IFRS were applicable also for corporate income tax calculations. More precisely, we assess the share of IFRS companies on total tax revenues and scrutinise, whether the choice of different level of accounting income (excluding or including Other Comprehensive Income) would influence tax collection significantly.

2 Methodology and Data

Introducing the IFRS as a proper basis for taxation is the subject of a rich and stormy debate, prominently in German-speaking countries, which are characterised by a deep level tax-accounting dependence. However, the authors deal not only with local perspectives, but also in international context (Oestreicher & Spengel, 2007). Following Regulation (EC) 1606/2002 and first mentions on potential consolidation of corporate taxes, theoretical arguments in favour and against an alternative system of accounting standards relevant for corporate taxation have been discussed. A comprehensive overview of relevant literature analysing all advantages and disadvantages can be found in Eberhartinger & Klostermann (2007). The economic logic behind the decision, whether to allow the usage of IFRS for taxation, refers to the (modified) concept of comparative

advantages originally introduced by Ricardo (1817). This institute may be relevant especially for small open economies, such as the Czech Republic.

The Czech Republic is a small open economy with a significant share (around 40 %) of foreign capital on the ownership of Czech-domiciled companies. The ownership structure reduces an ability of public authorities to collect corporate income taxes in required amount effectively. Companies under foreign control can enter with other companies within the group into transfer pricing (Gordon & MacKie-Mason, 1995) and licencing (Overesch & Heckemeyer, 2013) in order to shift profit outside local tax jurisdiction. Any negative change in tax policy can induce a departure of foreign investors (Tvaronaviciene, 2002) and thus result in a crush of tax collection. On the other hand, any profit shifting is always connected with increased administrative burden of an optimising company. The introduction of IFRS as tax basis can thus attract companies in many ways. It can mitigate their willingness to profit shifting from domestic companies outside the country, as a material difference in tax base in favour of IFRS can occur. In addition, the shift to IFRS can encourage profit shifting from foreign entities into the country, as the taxation system is more transparent and predictable. Schanz & Keller (2013) showed on a sample of German parent companies that optimal tax structures were created by establishing of new subsidiaries in foreign countries with favourable tax regime. This may bring some benefits for an open small economy. However, Spengel et al. (2012) investigated that introduction of IFRS as a tax basis could lead to the change in the effective tax rate, as the definition of taxable income and its conformity with accounting income is blurred.

The provisions of Regulation (EC) 1606/2002 were incorporated in the Act No. 563/1991, on accounting. The obligation to prepare consolidated financial statements according to the International Accounting Standards (as adopted by the EU) by companies listed on the EU capital markets is included in §23a, Article 1. However, the Czech regulator went a step further and set up a duty for listed companies to prepare their individual financial statements according to the IFRS, too. However, pursuant §23, Article 2 of Act 586/1992, on income taxes "*the determining of the tax base is based on the accounting income, always without the influence of international accounting standards .... A taxpayer, who prepares its statutory financial statements in accordance with International Accounting Standards, as approved by the European Union, shall determine its accounting income for the purposes of this Act with reference to specific legal act"*.

Act on accounting, which governs financial reporting in compliance with the Czech Accounting Standards, is referred to by the Act on income taxes, when dealing with calculation of tax base. It could be therefore concluded that IFRS are not relevant for tax purposes at all, even though they are applied in statutory individual financial statements, *e.g.* by Czech listed companies. All Czech companies have to apply Czech GAAP in order to compute an accounting profit, which is relevant for filling-in the tax returns. This obligation is in force also for companies listed on EU stock exchange, even though they must use the IFRS for their statutory individual financial statements. Additional (complex) evidence is thus needed to comply with tax duties.

Fact that all corporate taxpayers use the same accounting principles for taxation brings benefits esp. to tax authorities. Theoretically, supervision over all types of entities can be processed in the same pattern, as entities uses the same accounting and tax rules, as they fill-in the same tax form, etc. However, the reality is not so simple. Regulatory framework does not encompass any binding method, which has to be followed by listed companies. Therefore, listed companies choses different ways, how to compute accounting income according to Czech GAAP for the purpose of tax filling, *e.g.* using supplementary evidence in data spreadsheets, by making notes on accounting documents or by keeping two sets of books within their accounting software. Regardless which method is used, tax supervisor is always challenged to assess, whether the conversion of IFRS individual financial statements (used by listed companies for statutory purposes) to Czech statements is complete and accurate.

Regarding checking the correctness of financial statements conversion by listed companies for accounting income calculation used as basis for the tax base, accounting transactions can be split up into four groups:

- transactions occurring only in IFRS statements;
- transactions occurring both in IFRS and Czech GAAP statements, but differently classified and/or measured;
- transactions occurring both in IFRS and Czech GAAP statements, with same classification and measurement;
- transactions occurring only in Czech GAAP statements.

Tax officers can check first three types of transactions easily, as they are posted directly in accounting soft-ware, which keeps transactions in compliance with IFRS of course. If these are accompanied with corresponding documents, possible differences can be analysed quickly with reference to distinct provisions in Czech GAAP compared to IFRS. On the other side, the last group of transactions is not included at accounting system of a listed company at all, as they cannot be shown under IFRS statements. However, this type of transactions is important for the calculation of tax base. There are no accounting records; there could be no underlying documents. During tax base computation, these transactions could be omitted (either intentionally or unintentionally). Is the tax authority able to reveal such omissions? The answer is yes, but it is not an easy job. A detailed knowledge about the differences between Czech GAAP and IFRS is then inevitable. In addition, tax officers have to possess some kind of forensic skills to uncover all omissions, mistakes and evasions caused by a wrong conversion from IFRS to Czech GAAP.

To summarise, the current system does not bring any presumed advantages for tax authorities. Furthermore, necessary double evidence by certain entities elicits additional administrative costs, which usefulness from macroeconomic point of view is doubtful. The only advantage of current status quo is that it preserves an equal access of state to all taxpayers. However, the Czech Republic is a typical example of country with hybrid system, where government uses not only tax law, but also accounting rules to influence and ease the tax collection (Ištvánfyová et al., 2010). This approach produces high costs both on corporate and national economy level, which surely outweigh benefits of state institutions starving for the retention of control over tax system and predictable tax collection.

Unsatisfactory shape of taxation system in the Czech Republic seems to be resolvable apparently by a change in Act on income taxes by allowing IFRS to be basis for the calculation of tax base, too. It means that accounting profit from statutory accounts, whatever set of principle is used, should serve as a starting point for income tax calculation. A considerable number of advantages for companies can emerge. Furthermore, a taxation based on IFRS may attract internationally operating holdings to place their subsidiaries or even headquarters, as this kind of relation between accounting and taxation is more transparent than if based on local GAAP. However, before any fundamental change, an appropriate analysis of possible opportunities and risks shall be performed. Following questions shall be answered:

- *Q1:* Is the topic relevant at all? Is corporate income tax an important source of tax revenues?
- *Q2:* Are entities with statutory IFRS statements significant in terms of income taxes?
- *Q3:* If IFRS are allowed for income tax calculation, which level of income shall be used? Should it be Profit & loss, or comprehensive income?
- *Q4:* Are any important differences in profit & loss between Czech GAAP and IFRS?

For answering above mentioned research questions, both macro- and microeconomic data is needed. Macroeconomic dataset capturing the development of gross domestic product (GDP), total tax revenues and tax revenues from corporate income taxes are retrieved from national accounts administrated by the Czech Statistical Office.

Microeconomic data on financial figures of the IFRS entities were extracted manually and directly from corresponding individual financial statements.

3 Results and Discussion

Tab. 1 elucidates a possible answer to *Question 1* about the importance of corporate income tax on total tax revenues of the Czech Republic.

Table 1 Share of corporate income taxes on total tax revenues and GDP

Year	1995	1996	1997	1998	1999	2000
Tax rate	41%	39%	39%	35%	35%	31%
CIT (millions CZK)	67.255	56.510	69.357	67.464	79.458	75.155
Share on tax revenues (%)	12.3%	9.4%	10.6%	9.8%	10.8%	9.8%
Share on GDP (%)	4.4%	3.2%	3.7%	3.3%	3.7%	3.3%
Year	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
Tax rate	31%	31%	31%	28%	26%	24%
CIT (millions CZK)	94.393	106.731	118.882	128.665	134.909	153.627
Share on tax revenues (%)	11.4%	12.0%	12.5%	12.2%	12.1%	13.0%
Share on GDP (%)	3.9%	4.2%	4.4%	4.4%	4.3%	4.6%
Year	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
Tax rate	24%	21%	20%	19%	19%	19%
CIT (millions CZK)	171.071	161.948	132.327	131.710	129.031	127.371
Share on tax revenues (%)	12.2%	12.2%	10.5%	10.3%	9.7%	9.5%
Share on GDP (%)	4.7%	4.2%	3.5%	3.5%	3.4%	3.3%

Source: Authorial calculation using data published by the Czech Statistical Office (CSO) http://apl.czso.cz/pll/rocenka/rocenkavyber.gov_s?mylang=CZ

Despite a steep reduction in tax rate (from 41 % in year 1995 to 19 % in year 2012), the relative share of corporate income tax on total tax revenues (including social security) remains stable; 11.2 % on average. A decrease in last three years can be attributed to an economic downturn. Corporate income tax is not the most important tax of the Czech taxation systems; however, it forms a significant source of financing public expenditures. A change in design of corporate income tax system therefore may influence tax collection significantly from the perspective of public budgets.

The empirical testing of the next two issues requires data from individual financial statements of those entities, which report under the IFRS regime. An empirical analysis is performed for years 2010 and 2011, for which two sets of data are available. Firstly, the development of total revenues from corporate income tax is used. Secondly, there was extracted information about profits and taxation from financial statements of those entities, which apply IFRS as accounting principles in their statutory individual financial statements. There were selected all those companies, which prepared their statutory individual financial statements in compliance with IFRS, *i.e.*:

- companies listed on the Prague Stock Exchange (further "PSE");
- companies, which opted to use IFRS on voluntary basis.

There were listed 46 corporate issuers on PSE during analysed years, from which 33 have legal and therefore tax domicile in the Czech Republic. Remaining 13 issuers are foreign domiciled. However, in six cases, their primary economic environment is and original legal domicile was the Czech Republic. These emitters decided to move their legal domiciles to "tax paradises". In order to investigate homogenous sample, additional five entities were excluded from the analysis. To conclude, 28 issuers listed on PSE entered the analysis. Furthermore, two companies used the option to apply IFRS voluntarily. Therefore, the sample encompasses 30 entities in total.

An issue raised by *Question 2* can be assessed using data in Tab. 2.

Table 2 Share of corporate income taxes by IFRS entities on total corporate taxes

Year	2010	2011
Tax rate	19%	19%
CIT (millions CZK)	127.404	128.789
Share on tax revenues (%)	10.1%	9.8%
Share on GDP (%)	3.4%	3.4%

Source: Authorial calculation using data published by the CSO and data from companies' financial statements

From financial statements of analysed companies, data on current income tax expense was extracted manually and it was related to total tax collection of corporate income taxes. The share is about 17 %, which is not decisive, but also not immaterial. A rapid growth of number of companies reporting under IFRS cannot be excluded, if it shows to be favourable. Recalling the IFRS option, it has to be mentioned that parent companies listed on PSE control 334 Czech subsidiaries in total. All these companies can shift to IFRS in their individual financial statements voluntarily pursuant §19a, article 7 and 8, as they are consolidated under IFRS regime. Moreover, there are a significant number of other Czech companies, which are subject of IFRS consolidation (as they are under control of foreign parent companies, which are listed on other EU stock exchanges). The estimates of companies eligible for the IFRS option differ, ranging from 2 000 (estimate of the Ministry of Finance) to 200,000 (number of companies under foreign control according to the statistics of the CSO) companies.

Question 3 raises an issue whether, provided that IFRS are allowed for taxation, profit and loss or comprehensive income should be the basis for taxable income. Alternatively, the *Question* scrutinised whether other comprehensive income (further "OCI") is a material performance measure of Czech companies and whether it should be included or excluded from taxation. In present, Czech GAAP does not recognise other comprehensive income in financial statements. There are some differences compared to IFRS in terms of other comprehensive income:

- some items are not applied in Czech accounting at all (revaluation model under IAS 16 and IAS 38);
- some items are recognised directly in equity (cash flow hedge, available-for-sale instruments);
- actuarial gains and losses are not dealt explicitly by Czech GAAP, but according to general principles in Act on accounting they shall be classified in profit & loss.

The resulting impact on taxation is unclear, as there can be all types of movements of OCI components, which might be or might not be displayed in Czech financial statements.

Tab. 3 shows profit and loss, comprehensive income and the relative share of other comprehensive income on total comprehensive income for both analysed years. For year 2011, other comprehensive income is zero (*i.e.* OCI contains no items) in 14 out of 30 cases. In year 2010, a similar situation happened in 14 out of 29 cases. Financial institutions report the most of cases of non-zero OCI, which corresponds to intuitive expectations (as financial institutions deal in financial instruments, which changes in value is reported under OCI under certain conditions). However, six cases of non-zero OCI appears by non-financial entities. Moreover, two biggest Czech companies (Škoda Auto; ČEZ) report a significant amount of OCI not only in relative, but also in absolute terms. If IFRS are allowed for taxation, the question, whether to apply tax rate on profit & loss or on comprehensive income, have to be addressed in advance, as OCI is quite material item by half of "IFRS companies".

Table 3 Components of total comprehensive income

Company	FI	P&L 2011	CI 2011	P&L 2010	CI 2010	OCI 2011 %	OCI 2010 %
CETELEM ČR	yes	1,392,529	1,133,437	678,087	388,982	-22,86%	-74,32%
CPI	no	-261,985	-223,115	-351,649	-348,529	-17,42%	-0,90%
ČEZ	no	37,337,000	29,543,000	34,762,000	40,058,000	-26,38%	13,22%
Česká pojišť.	yes	4,158,000	2,100,000	11,860,000	10,699,000	-98,00%	-10,85%
Česká spoř.	yes	18,316,000	15,078,000	14,317,000	11,992,000	-21,47%	-19,39%
ČSOB	yes	11,148,000	5,627,000	13,572,000	14,688,000	-98,12%	7,60%
Dalkia	no	2,397,874	1,900,682	5,566,785	5,155,523	-26,16%	-7,98%
Energoaqua	no	171,559	133,079	114,353	107,310	-28,92%	-6,56%
GREENVALE	no	2,531,110	2,531,110	60,236	60,236	0,00%	0,00%
Hypoteční banka	yes	3,253,000	2,631,000	2,288,000	1,845,000	-23,64%	-24,01%
Raiffeisenbank	yes	2,851,830	2,223,017	2,319,712	1,821,454	-28,29%	-27,35%
UniCredit Bank	yes	1,334,000	3,287,000	3,473,000	2,251,000	59,42%	-54,29%
Komerční banka	yes	9,380,000	14,234,000	14,417,000	12,769,000	34,10%	-12,91%
Sberbank CZ	yes	346,000	300,000	271,000	254,000	-15,33%	-6,69%
Wüstenrot	yes	38,477	6,135	75,063	75,063	-527,17%	0,00%
ISTROKAPITAL	yes	-2,849	-2,849	16,188	16,188	0,00%	0,00%
Jáchymov Property Management	no	4,107	4,107	37,375	37,375	0,00%	0,00%
Philip Morris	no	2,543,000	2,543,000	2,427,000	2,427,000	0,00%	0,00%
Pražské služby	no	82,611	82,611	98,144	98,144	0,00%	0,00%
SM plynárenská	no	1,010,050	1,010,050	1,682,870	1,682,870	0,00%	0,00%
SMVaK Ostrava	no	362,480	362,480	352,814	352,814	0,00%	0,00%
Sp pro chem. a hutní výrobu	no	186,061	186,061	130,084	130,084	0,00%	0,00%
Telefónica	no	7,648,000	7,648,000	12,696,000	12,696,000	0,00%	0,00%
TOMA	no	52,503	52,297	31,889	31,652	-0,39%	-0,75%
UNIPETROL	no	256,551	256,551	512,121	512,121	0,00%	0,00%
Vč plynárenská	no	791,468	791,468	1,030,207	1,030,207	0,00%	0,00%
VET ASSETS	no	-1,165	-1,165	-2,646	-2,646	0,00%	0,00%
Wüstenrot	yes	244,987	244,987	268,832	268,832	0,00%	0,00%
Škoda AUTO	no	14,288,000	9,427,000	9,404,000	8,797,000	-51,56%	-6,90%
Tamero invest	no	114,083	114,083	N/A	N/A	0,00%	N/A

Source: Authorial calculation using data from companies' financial statements
Note: FI – financial institutions

Question 4 captures a crucial issue in all deliberations about allowing IFRS to be relevant for tax base. Four possible approaches can be utilised:

- a qualitative analysis of differences between IFRS and Czech GAAP;
- a model of generalised equations, which will encompass benefits and costs for each party under current situation compared to conditions after switch to IFRS;
- an empirical model of Spengel et al. (2012) in the individualised version of Roggeman et al. (2013);
- a quantitative analysis of differences between Czech GAAP and IFRS profit & loss figures actually reported by Czech companies, which could be done as follows:
    - by analysing publicly available financial statements for the period of the first IFRS implementation (pairing of comparative information based on IFRS with Czech GAAP statements published a period earlier);
    - by extracting needed data from tax returns in periods following the first implementation.

A deeper analysis of this problem has to be made yet. The crucial limitation is public unavailability of tax returns. A proper proxy measure, which would substitute needed

individual tax data, should be explored. Alternatively, a survey among IFRS entities may be underwent to obtain data directly from companies on anonymous basis.

4 Conclusions

Allowing IFRS for tax purposes may be an acceptable political choice, how to face to an increasing pressure from foreign owners of Czech companies to be allowed:

- to prepare financial statements in compliance with IFRS solely;
- to use statutory accounts also for income tax calculation because of higher understandability and transparency of IFRS compared to Czech GAAP.

The first issue has been already fulfilled by amending the Act on accounting effective from 2011, which offers an IFRS option in statutory individual financial statements for those companies, which are consolidated under IFRS regime. The second claim addresses a need to have not only comparable and transparent accounting, but also taxation rules, *e.g.* by allowing particular companies to apply IFRS in their tax returns. The process is not about the question "yes or no", but rather an issue of "when". An empirical study on the population of Czech companies reporting under the IFRS in their individual statements showed that these companies create around 17 % of income tax revenues. The IFRS option embedded in the Act on accounting may substantially affect the tax collection, if the IFRS were permitted for taxation purposes.

The benefits and costs of "what happens, if IFRS were a tax base" can be found in some EU countries. *E.g.* Slovakia enables companies, preparing statutory statements in compliance with IFRS, to decide, whether their tax filling will refer to local GAAP or IFRS. The switch to a new system of taxation may generate one-time effects. Some countries prefers inclusion of these transition costs/revenues into the tax base in the year of transitions (*e.g.* Slovakia and Iceland), other countries allow spreading the effects over a longer period (*e.g.* Ireland over 5 years and Luxemburg over 2-5 years). Even if IFRS will remain irrelevant for taxation, tax officers should be trained to gain knowledge of IFRS principles. As soon as IFRS are applied by accounting entities, tax authorities have to be able to check the correctness of conversion to local GAAP.

Based on previous reasoning, a proposal permitting the IFRS to be tax relevant is justifiable at least from companies' point of view. Allowing "IFRS companies" to derive their income tax duty with reference to the IFRS pre-tax income may not only reduce costs relating to the financial statement conversion, but it may have additional positive benefits on macroeconomic level, too. As a small open economy with a decisive share of foreign capital on the company's ownership, the Czech Republic may benefit from this step by increasing understandability and transparency of taxation system in its relation to accounting. The IFRS are worldwide expected and their major principles are well known. In addition, the IFRS are published by a body, which is independent on national governments. From this point of view, a level of state discretion in income tax system is supposed to be reduced (Morais and Curto, 2007) and investors can expect a higher transparency, stability and predictability of future influences on their current tax expenses. Taxation based (fully or partly) on the IFRS in combination with other favourable conditions may attract foreign investors to open new facilities in the Czech Republic, or even to shift some current operations here (including domicile of the group).

While implementing the IFRS, national states lose power to control effectively the collection of taxes in order to meet their fiscal needs. As the IFRS are published for the purposes of capital markets and investors in their decision-making, they do not address tax issues. A single change in whatever standard may lead to an extreme variance in accounting profits and thus in tax collection. This is a severe risk, which arises in the connection with allowing the IFRS to be a tax base. A preliminary analysis performed that "IFRS companies" generate significant part of income tax revenues, with possibility of sharp increase of the share, if IFRS option is utilised by eligible non-listed companies defined by Czech Act on accounting.

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Funding Social Services in the Czech Republic in the Light of EU Legislation

Ladislav Průša[1], Mirka Wildmannová[2]

[1] The University of Finance and Administration
Estonská 500, 100 00 Prague 10, Czech Republic
E-mail: ladislav.prusa@vsfs.cz

[2] Masaryk University
Faculty of Economics and Administration, Department of Public Economics
Lipová 41a, 602 00 Brno, Czech Republic
E-mail: mirkaw@econ.muni.cz

Abstract: *The Czech Republic joined the European Union in May 2004 and one of the conditions for membership was to reconcile the legal environment in the Czech Republic so that it would be in synergy with the single market of the EU. Since then, the legal environment has evolved in response to newly arising changes. In 2006, the Directive on services in the internal market was adopted, which among other things specifies the rules governing fair competition. These state aid rules limit the funding schemes that founders of organisations providing social services have available for the financing of these organisations. Attention will be paid to obstacles created by EU legislation to the schemes available for social services funding in the Czech Republic.*

Keywords: social services, subsidies from the state budget, care allowance, social services funding, public services

JEL codes: H53, I39

1 Introduction

Adoption of Social Services Act No. 108/2006 Coll. led to significant changes in the system of social services funding. A new social welfare benefit - care allowance - was devised in the area of social welfare services with the aim to strengthen effective demand and thus contribute to the creation of market attributes within the system of public services. It was also assumed that demand would grow and the pressure to increase the quality of social services would increase especially as regards terrain or ambulatory services.

However, according to the existing findings (Průša, 2013) these objectives have not been fulfilled and the money spent has not been used in accordance with the will of the legislature. Various solutions have been proposed for the issue, however, some of them face obstacles created by EU legislation, i. e. especially how services of general economic interest, including social welfare services, are interpreted. The aim of this paper is to analyse the existing knowledge and identify the most serious contradictions arising from the differences between the schemes of social services funding as set according to the national legislation of the Czech Republic and the EU legislation.

2 Methodology and Data

Services of general interest are not standard services provided on the market, but services of a *special character*. These services are usually secured by the state, regional or municipal authorities in the public interest (i.e. in the interest of the general public) and it is typical for them that if they were not financially supported by public authorities, they would not be provided on the market at all or would be provided at a lower quality level or in a reduced scope. The financial support provided to services of general interest by public authorities is justified by failures of the market as regards the supply of these services.

Services of general economic interest (hereinafter referred to as "**SGEI"**) are a sub-category of services of general interest. Their identification refers to the fact that they are of an economic (or financial) nature.

It should be emphasized that the economic nature of SGEI refers to the character of these activities, not to their interest or objective. This implies that some services in the social area can be perceived as SGEI. Services of an economic nature are subject to the fair competition rules and therefore also the state aid rules (Office for the Protection of Competition, 2014).

State aid means any aid that:

- is provided in any form by the state or from state funds,
- distorts or threatens to distort economic competition by favouring certain undertakings or industries, and
- affects trade between Member States.

An aid is considered to be a state aid if all four conditions are met concurrently (The guide to services of general economic interest, 2013).

The aim of this paper is to analyse the existing knowledge and identify the most serious contradictions arising from the differences between the schemes of social services funding as set according to the national legislation of the Czech Republic and the EU legislation. EU stipulates certain conditions that the legislation in the Czech Republic is obliged to follow. The current situation shows there are unresolved issues regarding some elements of the scheme set for providing social services that will have to be addressed in the future.

The paper is mainly based on the following documents: Directive 2006/123/EC on services in the internal market, the judgement of the Court of Justice of the European Communities in the Altmark case, the EU framework for state aid in the form of compensation for public service obligations, materials of VÚPSV (The Research Institute for Labour and Social Affairs) on social services.

3 Results and Discussion

One of the ways how to address the issue of state aid is the **public service obligation**. This institute is used when the required capacity is known and the public service obligation defined. The financial support that can be received by a service provider from public funds is determined by the amount of compensation. The amount of compensation may not exceed the amount necessary to cover net costs incurred in discharging the public service obligation, including a reasonable profit (the provision of a reasonable profit is not compulsory). In simple terms, the financial compensation may not exceed the amount necessary to cover additional costs incurred due to the public service obligation.

There are two critical points related to this:

- a provider must be selected on the basis of an official selection procedure
- how to determine the amount of compensation objectively? Parameters in social services are set individually depending on the neediness of a client (some activities are client-tailored) so it is difficult to objectify the criteria for social welfare services and social prevention.

The case-law of the Court of Justice of the European Communities makes it clear that compensation for public service obligation does not constitute state aid within the meaning of Article 87(1) of the EC Treaty provided it meets certain criteria. Commission Decision 2005/842/EC of 28 November 2005 on the application of Article 86(2) of the EC Treaty thus establishes the conditions under which certain types of compensation for public service obligation constitute state aid compatible with that provision (European Union, 2014).

In its judgment in Altmark, the Court of Justice laid down the conditions under which public service compensation does not constitute state aid. The conditions are as follows (European Union, 2005):

- the recipient undertaking must actually have public service obligations to discharge, and the obligations must be clearly defined.
- the parameters on the basis of which the compensation is calculated must be established in advance in an objective and transparent manner, to avoid it conferring an economic advantage which may favour the recipient undertaking over competing undertakings.
- the compensation cannot exceed what is necessary to cover all or part of the costs incurred in the discharge of public service obligations, taking into account the relevant receipts and a reasonable profit,
- where the undertaking which is to discharge public service obligations, in a specific case, is not chosen pursuant to a public procurement procedure which would allow for the selection of the tenderer capable of providing those services at the least cost to the community, the level of compensation needed must be determined on the basis of an analysis of the costs which a typical undertaking, well run and adequately provided with means of transport so as to be able to meet the necessary public service requirements, would have incurred in discharging those obligations, taking into account the relevant receipts and a reasonable profit for discharging the obligations (Průša, 2013).

Regardless of the legal status of the provider and of whether the service is provided on the basis of free economic competition, the responsibility for framing the criteria and conditions for the provision of services is borne by public authorities.

Responsibility for the provision of services of general economic interest must be entrusted to an undertaking concerned by one or more official acts, the form of which may be determined by Member States. The act or acts must specify in particular the following:

- the precise nature and duration of the public service obligations,
- the undertaking and territory concerned, the nature of any exclusive or special rights assigned to the undertaking,
- the parameters for calculating, controlling and reviewing the compensation,
- the arrangements for avoiding and repaying any over-compensation (Průša, 2013).

One of the ways how to release oneself from the framework of the state aid in the form of public service compensation is that "public service compensation would not be considered to be state aid at all" (Dvořák, 2011).

The Guide gives the following recommendations for defining the public service obligation:

- to bind such services with such specific obligations that are assigned to their provider but are not assigned to other entities
- not to use the public service obligation for activities that are or may be provided satisfactorily and under conditions that are consistent with the needs of the public sector (e.g. the price and quality of the service)
- not to use the services for operations in territories where private investors have invested heavily in the infrastructure serving the same purpose as is the purpose to be secured by the respective public service because that could render the invested funds worthless.

An illustrative example is the distribution of food to the elderly: the service of general economic interest may consist in ensuring the service accessibility for a clearly defined group of people (according to the list of eligible recipients of the service). The securing of accessibility of the service is an obligation which the other undertakings in the market do not have. (But if there already was an undertaking providing the service to the defined

target group in a satisfactory manner, there would be no reason for the service of the general economic interest to be provided).

The most frequent legal form of entities in the field of social care provision is the allowance organisation established by municipalities, towns or regions. The guide to services of general economic interest (The handbook for public administration, 2013) ascribes the following competency to public authorities: absolute discretion in deciding whether the public authority will provide the service concerned itself or will entrust a third party to do so. In practice, public authorities take decisions depending on whether they have certain ownership rights in relation to an organisation that has already been securing such activities. In such a case, which is usually a reflection of a previous historical development, it is the organisation owned by a public authority (e.g. an allowance organisation) that is given preference and selected as a provider of the service. This preference is theoretically permitted, provided that it does not violate rules on public procurement.

Today, social services may be rendered by any entity that meets the conditions for registration. It follows that an allowance organization providing social services under EU rules is in competition with other registered providers of public social services. The conflict of interests between the functions of a public authority as a founder and contracting authority is evident and exists in practice. Allowance organisations do not manage their own property but the property of their founders, which is in conflict with European state aid rules.

One of the ways how public authorities can secure services of general economic interest (public services) is through their own organization, i.e. a service is secured by an internal provider, so called **in-house procurement** (Marek, 2014). This is a situation where a public authority provides the service itself, but acts through a legally independent organization. The condition, however, is that the public authority exercises the same control over the concerned provider as it exercises within its own administrative procedures, and that the concerned legally independent organisation performs a substantial part of operations for the public authority.

An example of in-house procurement can be a project of social housing: a municipality decides to implement a project of social housing for persons who are unable, because of the limited solvency, obtain housing at market conditions. The social housing project should take the form of affordable housing rented for a favourable price. In the conditions of the Czech Republic, the constructing and selling of housing units as well as rental housing are considered to be common (usual) commercial activities. The public service obligation in this case lies in ensuring the availability of social housing exclusively for disadvantaged people, including persons with long term disability, certain groups of seniors, homeless persons, low-income persons and long-term unemployed persons. Such a concept of public service obligation represents an obligation that normal economic entities do not have as they may also offer housing to solvent people.

In order to implement the project, a municipality establishes a company to which it allocates funds for the construction management. The company will then ensure administration of the housing complex for social housing (the concept of the in-house procurement). (The guide to socially responsible public procurement, 2013). The terms of funding - compensation parameters are stipulated in a legal act, articles of association of the company (this agreement is approved by resolution of the municipal council). The terms and conditions of financial assistance stipulate that the compensation is intended solely for the purpose of covering the difference between costs and revenues. If a company implementing the project receives any other financial support from public resources, it may not include the costs for which the financial support was provided into the calculation of compensation.

Table 1 Description of parameters defined by a client (municipal council) and used for calculating the compensation

Costs:
- one-off costs related to construction management, - costs of interest and principal payments on a loan that the company will take to finance the construction, - operating costs of the housing complex for social housing
Revenues:
- figuring in all revenues, which means primarily the income from the housing units rental - social welfare benefits of persons whom social housing is secured for may be used to pay the rent for the social housing
Profit:
- not provided with regard to the absence of the company's economic risks (the project risks are borne by the municipality)
Compensation:
- cannot be limited by means of any total sum. Its actual amount will reflect economic results of the project over time.

Source: The guide (2013, p. 67)

4 Conclusions

The following proposition was made in monographs on the financing of social services: "A social service is perceived as efficient both by the state and the founder when the amount of the payment made by a client for the provided type of services together with the amount of the social welfare benefit and health care reimbursement made by a health insurance company covers the average countrywide costs of the given type of service, and in case when costs are higher in a specific facility for good reasons, the difference could be paid by the founder of the service" (Průša, 2008). However, the experience gained since 2007 shows that the existing system of social services funding based on this principle does not work and is ineffective in particular due to the following:

- because of the dependency of social services providers on the amount of subsidies allocated from the state budget,
- because of so called price regulation through which the state controls the amount of payments for accommodation and meals in residential and outpatient facilities and for different tasks performed as a part of terrain social services,
- because of long-term underfunding of nursing and rehabilitative care in residential social care facilities when the share of health insurance companies in the covering of the costs of this care indicated by a physician and provided by care personnel is only about 20% (Průša, 2010).

If the system of social services funding worked in the manner that a client obtaining a social service was able to "piece together" related financial costs using his or her own income (his or her earned income or social benefits), and incomes from a health care company and the social welfare care system, then the system of social services funding would not generate losses and would be financially self-sufficient. Due to the dependency of providers of social services on the amount of granted subsidies, the system may be getting into conflict with the framework of the EU legislation.

The solution for social services may be cancellation of the direct subsidy system. The state aid to social services rendered to an eligible client needs not to be granted in the form of direct subsidies to providers (direct subsidies are contrary to European legislation), but can be based on other instruments. One of the solutions may be transition from the system of subsidies for providers of social services to the system of aid to payments for a service provided to an eligible client.

This proposed method of aid to social services can be secured through alternative methods or their combinations: (Marek, 2014)

- increased social welfare benefits
- vouchers
- subsidies to the "price" for all providers in the same amount
- contribution from social insurance (introduction of the insurance covering utilization of social services).

If all the above specified EU rules are consistently and strictly enforced, then allowance organisations providing social services are endangered. Another question is whether the contribution of the founder of a social service is in accordance with state aid rules if the given service is provided on the given territory by an entity of a legal form other than the given allowance organisation.

The conclusions of this paper generate a lot of other issues which the system of social services will have to address in the future to comply with European legislation.

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Malaysia and Taiwan Acquiring Firms' Short-run Performance in Cross Border Mergers and Acquisitions

Kamal Fahrulrazy Rahim[1], Noryati Ahmad[2], Ismail Ahmad[3], Fahmi Abdul Rahim[4]

[1,2,3] Arshad Ayub Graduated Business School
University Teknologi MARA
40450 Shah Alam, Selangor, Malaysia
E-mail: kamal791@johor.uitm.edu.my, noryatia@salam.uitm.edu.my, drismailahmad@salam.uitm.edu.my

[4] Faculty Business Management
Kampus Bandaraya Melaka
University Teknologi MARA
Off Jalan Hang Tuah, 75300 Melaka, Malaysia
E-mail: fahmi029@melaka.uitm.edu.my

Abstract: *Economic of Asian countries are growing faster than other region of the world and the emerging of new market has creating a cross border mergers and acquisitions (CBMA) opportunity toward international trade, global investment and overseas expansion. Malaysia and Taiwan are categorised as two advanced emerging market in Asian by FTSE. Malaysian and Taiwanese firms have been reported involve aggressively in CBMA deals as early 1990s. This research aims to examine the short-run performance of Malaysian and Taiwanese acquiring firms listed on both countries bourse by using abnormal return (AR) and cumulative abnormal return (CAR). Event study method and regression analysis are applied for the study period 2000-2011. The result shows that CBMA have created a significant positive value to the shareholders for Malaysian and Taiwanese acquiring firms with the mean CAR for event window (-90,90) is 8.24% and 2.76% respectively. Finally, the evidence exhibits six determinants influence or contribute to the shareholder value creation and are statistically significant for Malaysia. In the case of Taiwan, three determinants contribute to shareholder value creation.*

Keywords: cross border mergers and acquisitions, shareholder value creation, determinants, event study, regression analysis

JEL codes: G34

1 Introduction

Roger and Ali (2006) affirmed that the investment climates of many Asian countries have changed substantially over the last ten years. Many changes such as deregulation, privatization, new free trade agreement and new incentives for foreign direct investment have had very positive impact on cross border mergers and acquisitions in Asia. Ashoka and Shoko (2001) explained that CBMA in Asian countries such as Indonesia, Korea, Malaysia and Thailand rose sharply in value from US$3 billion in 1996 to US$22 billion in 1999, before falling slightly to US$18 billion in 2000. In 2004, Japan, China and ASEAN regions together accounted for 15.9 percent of the world's M&A deals and 7.7 percent of the world's M&A transactions value (Roger and Ali, 2006). Asian countries are foreseeable as the faster growing in terms of economy compared to other regions in the world and are playing important roles in the international trade and global investment. As a result, there will be more CBMA involving the companies from Asian countries in the future. There are nine countries that are categorised under advanced emerging market by global index provider FTSE namely Malaysia, Taiwan, South Africa, Brazil, Mexico, Poland, Turkey, Czech Republic and Hungary. Malaysia is one of the developing countries that experienced rapid growth which transformed it from an agriculture-based economy to an industrial based economy. Malaysia has been classified as an advanced emerging market in June 2011 by FTSE Group. For decades Malaysia has been following prudent macroeconomic policies, focusing on low inflation, strong external reserves and current account surpluses. Taiwan has also experienced rapid growth and quick industrial with dynamic, capitalist, export-driven economy through gradually decreasing state

involvement in investment and foreign trade. Therefore, this study focuses on Malaysia and Taiwan short run performance into CBMA of the advanced emerging market in Asian region.

The study on short-run performance of acquiring firms in mergers and acquisitions (M&A) is not new in developed countries such as United States and United Kingdom. In Malaysia, Jaaman (2007) urged that there is a lack of empirical research on the economic consequences of the firms involved in M&A, particularly in an emerging market. She also suggested future researchers look into CBMA of Malaysian firms which are also lacking. Her suggestion is supported with the statement made by Bhagat, Malhotra and Zhu (2011) on the very few academic papers focusing on the financial impact on the emerging market companies of CBMA. The increasing trend toward CBMA by firms from emerging market and lack of research in this area creates the need to address whether the extant conceptual framework and empirical evidence on international CBMA are relevant for acquirers outside the developed countries. Therefore, this study is to fill in the research gap by exploring the determinants within the advanced emerging market acquiring firms, for example, financial data as suggested by Bhagat et al. (2011) and external factors, for example, economic factors as suggested by Jaaman (2007). There are inconclusive findings on shareholder value creation from mergers and acquisitions. Conn, Cosh, Guest and Hughes (2005), Black, Carnes, Jandik, and Henderson (2007), and Francis, Hasan, Sun (2008), Soongswang (2010), Mann and Kohli(2011), Bhagat et al. (2011) found out that the announcement of cross-border acquisitions resulted in positive cumulative abnormal returns. Meanwhile, Gregory and McCorriston (2005), Moeller and Schlingemann (2005), Wooster (2006), and Aybar and Ficici (2009), Rahahleh and Wei (2012) show that there was no significant effect relating to the announcement of acquisitions on shareholders' wealth.

2 Methodology and Data

An event study is carried out to examine the share price behaviour of bidding firms and target firms over the specified period of time. This study focuses on how security prices respond to the information released during a public announcement of a specific event of a firm in the case of M&A. Franks, Broyles and Hecht (1977) commented that the market begins to anticipate mergers on average of at least 3 months prior to the announcement date. Daily historical prices for the stock of acquiring companies as well as market index are obtained from data-stream. The final sample comprises 403 transactions of CBMA throughout 2000 to 2011 for Malaysia and Taiwan. The daily realised returns (Rit) for each day t for the event window [-90; +90] are computed. The daily abnormal returns (ARit) are obtained as differences of realised and predicted returns on day t in the event period.

$$ARit = Rit - (\alpha + \beta i\, Rmt) \quad (1)$$

where, $Rit = (P1 - P0)/P0$ (2)

Where: Rit is the return of stock i at time t, Rmt is the market index return at time t

According to Campbell, Lo and MacKinley (1997) the market model represents a potential improvement over the traditional constant mean-return model, because by removing the portion of the return that is related to a variation in the market's return, the variance of the AR is reduced. This can lead to an increased ability to detect event effects. The daily average abnormal returns (ARt) and cumulative abnormal returns (CARt) for each day t for the event window [-90; +90] are computed as follows:

$$AR_t = \frac{1}{n}\sum_{t=1}^{n} AR_{it} \quad (3)$$

$$CAR_t = \sum_{t=t1}^{n} AR_t \quad (4)$$

Where: t1 represents the first day of event window, t2 represents the last day of the event window and n represents the number of transactions in the sample.

This research is also using hypothesis testing to test relationship between the dependent variable with independent variables. The dependent variable is cumulative abnormal returns (CAR). CAR is used to measure the short-run shareholder value creation. Bhagat et al. (2011) used CAR to test the determinants of cross sectional variation with classical factors and governance factors. Other researchers that employed CAR in their studies are including Chen and Young (2010), Soongswang (2010), Mann and Kohli (2011), Rahahleh and Wei (2012). The independent variables in this research are board size (BS), independent board of director(ID), market-to-book ratio(MTB), free cash flow(FCF), financial leverage(FL), liquidity(L), firm age(FA), firm size(FS), sales growth(SG) gross domestic product(GDP), corporate tax rate(TAX) and foreign exchange(FOREX). Table 1 shows the hypotheses for this study.

Table 1 Hypotheses

H1**:**	BS is positively related with shareholder value creation of the acquiring firms in CBMA**.**
H2:	ID is positively related with shareholder value creation of the acquiring firms in CBMA.
H3:	MTB is positively associated with shareholder value creation at acquiring firms in CBMA.
H4:	FCF is positively associated with the shareholder value creation of acquiring firm in CBMA.
H5:	FL is a positively related with the value creation of acquiring firm in CBMA.
H6:	L is positively related with the shareholder value creation of acquiring firm in CBMA.
H7:	FA is positively related with the shareholder value creation of acquiring firm in CBMA.
H8:	FS is positively related the with the shareholder value creation of acquiring firm in CBMA
H9:	SG is positively related with the shareholder value creation of acquiring firm in CBMA.
H10:	GDP is positively related with the shareholder value creation of acquiring firm CBMA
H11:	TAX is negatively related with the shareholder value creation of acquiring firm in CBMA.
H12:	FOREX is negatively related with the shareholder value creation of acquiring firm in CBMA

Lastly, a cross sectional regression analysis is applied to show the relationship between dependent and independent variables at one period or point in time. The determinants of acquiring firms in CBMA are examined with shareholder value creation (CAR) through cross-sectional regression analysis. The general cross-sectional regression model as follows:

$$CAR = ai + \beta 1\ BS + \beta 2\ ID + \beta 3\ MTB + \beta 4\ FCF + \beta 5\ LEV + \beta 6\ L + \beta 7\ FA + \beta 8\ FS + \beta 9\ SG + \beta 10\ GDP + \beta 11\ TAX + \beta 12\ FOREX + e_{it} \quad (5)$$

3 Results and Discussion

Descriptive Analysis

Table 2 presents the descriptive statistics on completed CBMA of Malaysia and Taiwan public listed firms from 2000 to 2011. The researcher uses the Bloomberg and Osiris database in order to indentify the completed deals.

Completed deals are defined as deals that have complete status and completion date. During the study period, the researcher has indentified 403 completed deals from Malaysia and Taiwan. Bhagat et. at. (2011) employed 698 samples for the period 1991 to 2008. Table 2 has also provided annual distribution of the volume of acquisitions of the Malaysia and Taiwan. By inspection, the number of transactions by the advanced emerging market is not evenly distributed across years.

Table 2 Descriptive Statistic on Annual distribution of sample No. of Completed Acquisitions by Advanced Emerging Market.

Years	No. of Completed Acquisitions by Advanced Emerging Market	
	Malaysia	Taiwan
2000	1	4
2001	2	3
2002	5	3
2003	21	4
2004	9	8
2005	24	9
2006	26	8
2007	24	23
2008	26	29
2009	36	25
2010	46	21
2011	32	14
Total	252	151

Sources: Bloomberg and Osiris Databases

Table 3 report the cumulative abnormal return (CAR) of acquiring firms from Malaysia and Taiwan during the period 2000 to 20011. It includes 403 firms listed on the respective bourses of Malaysia and Taiwan. Both countries have a positive and a significant result by referring to the mean or average CAR for event window (-90,90). Malaysia shows the highest mean of 8.24% and follow by Taiwan of 2.76%. The finding is similar with Soongswang (2010), Mann and Kohli (2011) and Bhagat et.al. (2011) that reported an emerging country acquirer experience a positive and a significant market response. Malaysia acquiring firms have the highest level of dispersion in term of CAR which is the value of the standard deviation is 0.3532. While, Taiwan acquiring firms have the lowest level of dispersion of Car with the standard deviation for Taiwan is 0.2197. The skewness for Malaysia acquiring firms is 5.1190 and the skewness for Taiwan acquiring firms is 0.6386. Another normality test is using Kurtosis. In this study, the Kurtosis result for Malaysia and Taiwan are 42.8166 and 4.3828 respectively. Further, the Jarque-Bera test can be used to provide evidence on the distribution series as this test intends to show statistics of difference of skewness and kurtosis of the series with those from the normal distribution on all CAR in Malaysia and Taiwan. The result of Jarque-Bera test indicate that the null hypothesis of a normal distribution can be rejected at 0.01 significant levels.

Table 3 Descriptive statistic on cumulative abnormal return (CAR) within the window event of (-90, 90)

Countries	Cumulative Abnormal Return for Event (-90,90)	
	Malaysia	Taiwan
Mean	0.0824	0.0276
Median	0.0509	0.0132
Maximum	3.2081	0.9003
Minimum	-1.1805	-0.5219
Std. Dev.	0.3520	0.2197
Skewness	5.1190	0.6386
Kurtosis	42.8166	4.3828
Jarque-Bera	17535.5700	22.2934
Probability	0.0000***	0.0000***

***Significant at 0.01 level

Findings for Malaysia Acquiring Firms for the Event Window (-90, 90)

Table 4 provides the statistical results of the event window (-90,90) the based on 252 CBMA transactions of Malaysian acquiring firms by using E-Views statistical package. The cross section regression model is spelt out as follows:-

$CAR_{(-90,90)}$ = 5.8686 + 0.1445 BS + -0.0103 ID + -0.0088 MTB + 0.0000000354 FCF + -0.0009 FL + 0.6207 L + 0.0896 FA + -0.3803 FS + 0.1524 SG + -0.0132 GDP + -0.1086 TAX + 0.7958 FOREX + e_{it} (6)

The F-value statistic for this regression is significant at 1% level (78.35806; p-value =0.0000) implying that the model is significantly fitted. As indicated by the R^2, only 59% of the independent variable is able to explain the shareholders value creation. BS and ID are as a proxy to corporate governance. BS has a positive relationship (Coefficient = 0.1445) with CAR whereby an increase in the number of BS would increase shareholder value creation and statistically significant (prob. = 0.0000) at 1% significant level. This fails to reject hypothesis 1 that the board size of Malaysian acquiring firms contribute positively to the shareholder value creation. The result is similar to that of Coles, Daniel and Naveen (2007), Bauguess and Stegemoller (2008) and Dalton, Daily, Jonson and Ellstrand (1999) that BS affects firm and market performance. The ID has a negative relationship (Coefficient = -0.0103) with CAR and statistically significant (prob. = 0.0934) at 1% significant level. This result rejects hypothesis 2 that independent board of directors is positively related to the shareholders value creation. Based on financial ratio variables, MTB, LEV and FS have negative relationship with CAR. Therefore, the result rejects hypothesis 3, 5 and 8. From the result, FCF has a positive relationship (Coefficient = 0.0000000354) with shareholder value creation and statistically significant (prob. = 0.0000) at 1% significant level. L has a positive relationship (Coefficient = 0.6207) with shareholder value creation and statistically significant (prob. = 0.0000) at 1% significant level.

Table 4 The White Heteroskedasticity Ordinary Least Square for event window (-90,90) of Malaysia Acquiring Firms

Variable	Coefficient	Prob.
C	5.8686	0.0000***
BS	0.1445	0.0000***
ID	-0.0103	0.0934***
MTB	-0.0088	0.3038
FCF	3.54E-08	0.0000***
FL	-0.0009	0.0011***
L	0.6207	0.0000***
FA	0.0896	0.0000***
FS	-0.3803	0.0000***
SG	0.1524	0.0000***
GDP	-0.0132	0.0017***
TAX	-0.1086	0.0000***
FOREX	0.7958	0.0000***
R-squared	0.5900	
F-statistic	78.3580	
Prob(F-statistic)	0.0000	

Significant level of ***1%, **5% and *10%

The FA has a positive relationship (Coefficient = 0.0896) with CAR, and is statistically significant (prob. = 0.0000) at 1% significant level. The last determinant from financial information is SG which has a positive relationship (Coefficient = 0.1524) with CAR and statistically significant (prob. = 0.0000) at 1% significant level. Hence, the result fails to reject hypothesis 4, 6, 7 and 9 that the FCF, L, FA, AND SG are positively related to the shareholders value creation. On the macro economic factors, GDP has negative relationship with CAR and FOREX has positive relationship with CAR. This outcome rejects hypothesis 10 and 12. TAX has a negative relationship (Coefficient = -0.1086) with CAR,

a reduction in tax would decrease CAR and statistically significant (prob. = 0.0000) at 1% significant level. This fails to reject 11 that the TAX contributes negatively to the shareholder value creation which is similar with the finding of Markides and Ittner (1994) and Cakici, Hessel and Tandon (1996).

Findings for Taiwan Acquiring Firms for the Event Window (-90,90)

Table 5 provides the result from the sample data by using the E-Views statistical package applying the event window (-90,90) based on 151 CBMA transactions of Taiwan acquiring firms. The cross section regression model is spelt out as follows:

$CAR_{(-90, 90)}$ = 2.1580 + 0.0058 BS + -0.0072 ID + -0.0012 MTB + -0.0370 FCF + 0.0006 FL + 0.0544 L + -0.0029 FA + 0.0182 FS + -0.0013 SG + -0.0212 GDP + 0.0561 TAX + -0.0242 FOREX + e_{it} (7)

The results show that the model as a whole perform well in terms of the joint significance of variables, F-value is 3.5953 (Prob. > F=0.0001). In other word, the model is significantly fitted and this research has value to proceed. On the other hand, the low R^2 (20%) suggests that the dependent variable is explained by factors other than independent variables. At the governance variables of Taiwan acquiring firms, BS has a positive relationship with CAR and is statistically not significant. This fail to reject hypothesis 1 that the board size of Taiwan acquiring firms contribute positively to the shareholder value creation but not significant. The ID has a negative relationship with CAR and statistically not significant too. This result rejects hypothesis 2. Based on financial ratio variables, the MTB, FCF, FA, FS and SG have negative relationship with CAR. Therefore, the result rejects hypothesis 3, 4, 7, 8 and 9. For FL (Coefficient = 0.0006) and L (Coefficient = 0.0544), both of the variables have positive relationship with CAR at 5% significant level. The result for FL and L fail to reject hypothesis 5 and 6 which influence to the shareholders value creation of Taiwan acquiring firms. On the macro economic factors, GDP has a negative relationship with CAR but for TAX and FOREX have positive relationship with CAR. Therefore, the outcomes reject hypothesis 10, 11 and 12.

Table 5 The White Heteroskedasticity Ordinary Least Square for event window (-90,90) of Taiwan Acquiring Firms

Variable	Coefficient	Prob.
C	2.1580	0.0000***
BS	0.0058	0.4501
ID	-0.0072	0.8293
MTB	-0.0012	0.4803
FCF	-0.0370	0.0524*
FL	0.0006	0.0388**
L	0.0544	0.0413**
FA	-0.0029	0.0396**
FS	0.0182	0.2166
SG	-0.0013	0.0043***
GDP	-0.0212	0.0016***
TAX	0.0561	0.7682
FOREX	-0.0242	0.0672*
R-squared	0.2023	
F-statistic	3.5953	
Prob(F-statistic)	0.0001	

Significant level of ***1%, **5% and *10%

4 Conclusions

This study tries to examine whether CBMA create shareholder value as measured by cumulative abnormal return (CAR). Based on the CAR, all countries have a positive and a significant mean CAR for event window (-90,90). Malaysia exhibits the highest mean of

8.24%, follow by Taiwan of 2.76%. The finding is similar with Soongswang (2010), Mann and Kohli (2011) and Bhagat et.al. (2011) that reported an emerging country acquirer experience a positive and a significant market response. This study also aims to identify the relationship between firm specific determinants and macroeconomic factors with shareholder value creation as measured by cumulative abnormal return (CAR) for event window periods (-90,+90). For Malaysia, six determinants support the hypotheses and statistically significant namely BS, MTB, LIQ, FA, SG and TAX. Hence, the study fails to reject six hypotheses out twelve hypotheses being tested. For Taiwan, FL, L and FOREX are only three determinants that fail to reject the hypotheses and statistically significant.

For future research, it is recommended that study on this area to incorporate other variables such as financial ratios of target firms, political risk and other event windows. The results can contribute to the body of the existing literature on CBMA particularly on advanced emerging markets for academicians, investors, policymakers and regulators.

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Price vs. Performance Index – Comparison of the Czech PX with the DAX 30 and the EuroStoxx 50

Svend Reuse[1], Martin Svoboda[2]

[1] Head of Controlling Department, Sparkasse Mülheim, Germany
FOM University of Applied Science, Essen, Germany
DIPS – Deutsches Institut für Portfoliostrategien
Luxemburger Allee 121, 45481 Mülheim
E-mail: svend.reuse@fom-dips.de

[2] Masaryk University
Faculty of Economics and Administration
Institute for Financial Market
Lipová 41a, 602 00 Brno, Czech Republic
E-mail: svoboda@econ.muni.cz

Abstract: *The Czech PX is – as most of the indices – a price index. Nevertheless, a performance index of the PX is developed as well. This articles analyses risk/return of the PX in comparison to the German DAX 30 and the EuroStoxx 50. Diversification effects as well as the tests onto normal distribution are analyzed. The aim is to give investors concrete hints for the investment in the Czech market.*

Keywords: price index, risk, return, correlations, asset allocation

JEL codes: G11, G12, G15, G32

1 Introduction

Performance is defined as the sum of dividends and price development of shares (see e.g. Sievi/Wegner/Freundorfer (2011), pp. 69; Reuse (2011), pp. 144). For a rational investor, it is not important whether he gets the performance in form of price increase or a dividend. But only the performance or total return indices are useful for an asset allocation and risk/return calculation. In this article, we want to find out, if the Czech market is an efficient market compared with the German or the European market. Efficient markets are defined as those that offer a good RORAC (Return on Risk Adjusted Capital, see section 2.3) Therefore we analyze:

- the risk/return ratios of all indices,
- the distribution of the yields,
- the correlations between the indices,
- the dividend yield of all indices.

The results will lead to concrete hints for an investor who wants to buy Czech shares.

2 Methodology and Data

2.1 Price vs. Performance Index

In order to separate the dividend effect, price and performance indices of the PX, the DAX 30 and the EuroStoxx 50 are analyzed (see e.g. Affleck-Graves/Money/Troskie (1980), pp. 34 for the different types of indices). Tab. 1 sums up the main aspects of the indices.

Table 1 Main aspects of the used indices

Index	Kind	ISIN	Description
Czech PX Index	Total Return	CZ0160000019	Index deals with the most liquid stocks of the Czech market, it consists of 14 shares, maximum weight per share: 20%.
	Price	XC0009698371	
EuroStoxx 50	Total Return	EU0009658152	Consists of 50 blue chips of supersector leaders in the Eurozone. Covers Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal and Spain.
	Price	EU0009658145	
DAX 30	Total Return	DE0008469008	Consists of the 30 biggest blue chips of the German market. Maximum weight of a single share: 10%.
	Price	DE0008467440	

Source: own table based on Svoboda (2008), pp. 2, 14, 66, PSE (2014c), PSE (2014d), Stoxx (2014c), DAX (2014).

2.2 Used Data

For the analysis, we use data for the longest time period available for all indices. This period is from 2006-03-20 to 2014-03-10, so a history of nearly 8 years is analyzed. We use data free available from Bloomberg (2013), PSE (2014a), PSE (2014b), Stoxx (2014a), Stoxx (2014b), Yahoo (2014a), Yahoo (2014b). If some prices were not available, they were interpolated linear between available prices some days before or after the missing value. As a consequence, 2,053 historical prices are available for all six indices.

2.3 Description of Methodology

First, the definition of a yield has to be defined. Even though a lognormal yield is used often in literature, discrete yields (y), defined by the absolute differences of the prices (P) are dominant in practice. Therefore we define the daily yields of all 6 indices as:

$$y_t = \frac{P_t}{P_{t-1}} - 1 \tag{1}$$

Second, we analyze the indices according to their distribution. We use Kolmogorov-Smirnov, KS Lilliefors, Shapiro-Wilk and Jarque-Bera tests to analyse normal distribution (see e.g. Darling (1957), pp. 823; Jarque/Bera (1980), pp. 255; Reuse (2010), pp. 85).

Third, the kind of distribution leads to the question which type of risk measurement has to be applied. Only if a normal distribution can be assumed, the volatility is a good indicator for the risk. Otherwise, a variance/covariance approach would underestimate risk and return and has to be refused. In this case, a historical simulation in the form of a Value at Risk (VaR) at a 99% confidential level is defined as:

$$\mathrm{VaR}_{99\%} = \left[99\%\,\mathrm{quartile}\left(\mathrm{y_t}\right)\right] \tag{2}$$

Fourth, the linear correlation between indices is calculated by using the standard deviation σ and the covariance COV where y is the daily yield, μ the average and T the time.

$$\sigma = \sqrt{\sum_{t=1}^{T} \left(y_i - \mu_i\right)^2} \tag{3}$$

$$COV = \frac{1}{T} \cdot \sum_{t=1}^{T} \left(y_{it} - \mu_i\right) \cdot \left(y_{jt} - \mu_j\right) \tag{4}$$

$$\rho_{i;j} = \frac{COV}{\sigma_i \cdot \sigma_j} \tag{5}$$

Further, the dividend yield is defined in a simplified way as the difference between the yearly yield of the price (P) and performance index (TR):

$$y_{DIV} = \left(\frac{P_{TR_Y}}{P_{TR_{(Y-1)}}} - 1 \right) - \left(\frac{P_{P_Y}}{P_{P_{(Y-1)}}} - 1 \right) \tag{6}$$

Last, the RORAC is defined (see e.g. Rolfes (2008), p. 68); using a 3% risk free rate (see Reuse (2011), p. 175) and scaling risk and return onto a yearly value (see Reuse/Svoboda (2013), pp. 699):

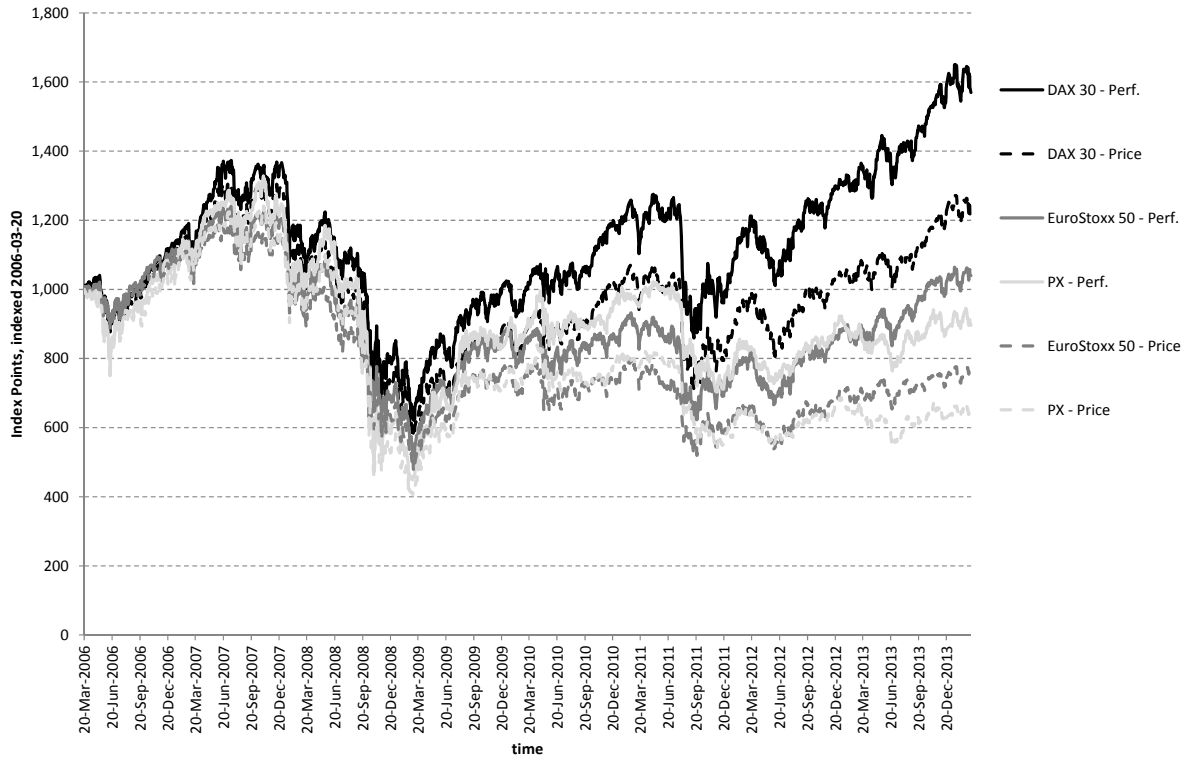
$$RORAC = \frac{250 \cdot y_t - 3\%}{VaR_{99\%}} \tag{7}$$

3 Results and Discussion

3.1 Indexed Performance Analysis

First, the absolute performance of all indices, indexed at 2006-03-20 is analyzed. This is shown in fig. 1.

Figure 1 Indexed performance of all 6 indices



Source: own calculations based on PSE (2014a), PSE (2014b), Stoxx (2014a), Stoxx (2014b), Yahoo (2014a), Yahoo (2014b).

It is not surprising that all performance indices show a better development compared to the related price index. But only the DAX indices and the EuroStoxx performance index show a positive yield during the last 8 years. The main reason is the financial crisis in 2008, when all indices went down. From 2008 on, the performance of every index is positive, even though the PX Price index shows the worst performance. This can be seen in tab. 2 as well, where all descriptive data of the 1 day yields are summed up.

Table 2 Basis Analysis of the Indices

Index	Descripitive Analysis of the 1 day yields						
	Average	St. Dev.	Skew-ness	Curtosis	Max.	Min.	df
EuroStoxx 50 - Price	0.00%	1.54%	0.23	6.1603	11.00%	-7.88%	2,052
EuroStoxx 50 - Perf.	0.01%	1.55%	0.22	6.0842	11.00%	-7.86%	2,052
DAX 30 - Price	0.02%	1.48%	0.25	7.1808	11.40%	-7.23%	2,052
DAX 30 - Perf.	0.03%	1.48%	0.24	7.1657	11.40%	-7.16%	2,052
PX - Price	-0.01%	1.60%	-0.32	11.9562	11.73%	-14.94%	2,052
PX - Perf.	0.01%	1.59%	-0.32	12.1116	11.76%	-14.94%	2,052

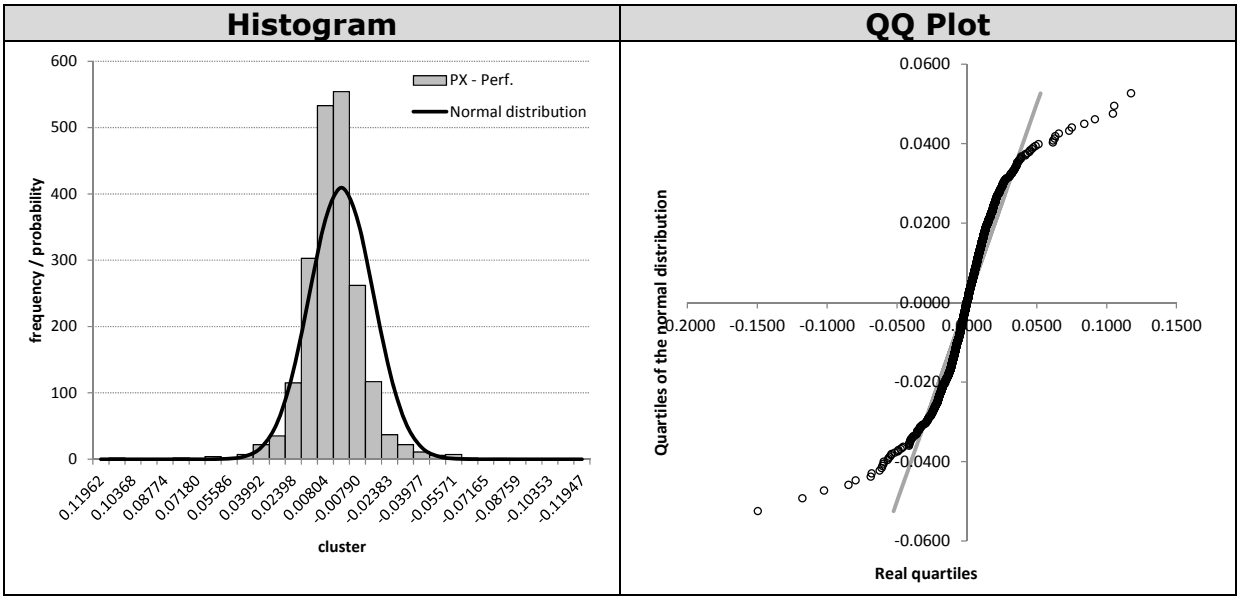
Source: own calculations based on PSE (2014a), PSE (2014b), Stoxx (2014a), Stoxx (2014b), Yahoo (2014a), Yahoo (2014b).

Only looking at the total performances, DAX and EuroStoxx performed better. In addition, they show a lower volatility than the PX. Only looking at performance and the volatility would not lead to the conclusion that an investment into the PX is useful. But this analysis has to be extended according to the Value at Risk.

3.2 Tests onto Normal Distribution and Results for Risk Management

Therefore, the distributions of the indices are analyzed. At the example of the PX Performance index, we show a histogram and a QQ plot. This is done in fig. 2.

Figure 2 Histogram and QQ Plot at the Example of the PX Performance



Source: own calculations based on PSE (2014a), PSE (2014b), Stoxx (2014a), Stoxx (2014b), Yahoo (2014a), Yahoo (2014b). QQ Plot based on Van der Waerden cluster.

Both histogram and QQ plot show that the index is not normal distributed, the normal distribution underestimates the risk. Extending this analysis onto all indices leads to tab. 3 that sums up the results for all tests applied onto all indices.

Table 3 Aggregated Tests onto Normal distribution

Index	Tests on normal distribution at 5% significiance											
	Kolmogorov Smirnov			KS Lilliefors			Jarque Bera			Shapiro Wilk		
	Statistic	Sign.	Normal distr.	Statistic	Sign.	Normal distr.	Statistic	Sign.	Normal distr.	Statistic	Sign.	Normal distr.
EuroStoxx 50 - Price	0.0769	0.030	NO	0.0769	0.000	NO	3,244	5.991	NO	0.9300	0.000	NO
EuroStoxx 50 - Perf.	0.0747	0.030	NO	0.0747	0.000	NO	3,164	5.991	NO	0.9317	0.000	NO
DAX 30 - Price	0.0800	0.030	NO	0.0800	0.000	NO	4,404	5.991	NO	0.9223	0.000	NO
DAX 30 - Perf.	0.0792	0.030	NO	0.0792	0.000	NO	4,385	5.991	NO	0.9226	0.000	NO
PX - Price	0.0917	0.030	NO	0.0917	0.000	NO	12,192	5.991	NO	0.8826	0.000	NO
PX - Perf.	0.0900	0.030	NO	0.0900	0.000	NO	12,510	5.991	NO	0.8824	0.000	NO

Source: own calculations, partially using SPSS based on PSE (2014a), PSE (2014b), Stoxx (2014a), Stoxx (2014b), Yahoo (2014a), Yahoo (2014b).

The result is clear, a normal distribution cannot be assumed, so the risk analysis has to be done by using the VaR based onto the historical simulation.

3.3 Risk and Return

This is done in tab. 4, where the RORAC is analyzed. In addition to the 99% quartile of the historical simulation, the normal distribution value ($2.326 \cdot \sigma$), scaled by using the square-root-of-time rule (see Reuse/Svoboda (2013), pp. 699) is shown as well.

Table 4 RORAC for all indices

Index	p.a. values for the indices				
	yield	st. Dev	$2.326 \cdot \sigma$	99% quartile	RORAC
EuroStoxx 50 - Price	-0.50%	24.42%	-56.79%	-74.35%	*-0.047*
EuroStoxx 50 - Perf.	3.47%	24.48%	-56.95%	-74.24%	***0.006***
DAX 30 - Price	5.00%	23.35%	-54.30%	-74.11%	***0.027***
DAX 30 - Perf.	8.21%	23.34%	-54.29%	-74.18%	***0.070***
PX - Price	-2.27%	25.29%	-58.82%	-75.96%	*-0.069*
PX - Perf.	1.85%	25.20%	-58.62%	-73.81%	*-0.016*

Source: own calculations based on PSE (2014a), PSE (2014b), Stoxx (2014a), Stoxx (2014b), Yahoo (2014a), Yahoo (2014b).

It becomes clear that the normal distribution underestimates the risk. Further, only the DAX shows a positive price and performance index RORAC. The PX shows the worst relation. This supports the first arguments in section 3.1.

3.4 Correlations

Even though the PX shows an underperformance, a good asset allocation consists of low-correlated assets. Therefore the correlation coefficients are analyzed, as shown in table 5.

Table 5 Correlations between the indices

Correlations of 1D yield		Eurostoxx 50		DAX 30		Czech PX	
		EuroStoxx 50 - Price	*EuroStoxx 50 - Perf.*	*DAX 30 - Price*	*DAX 30 - Perf.*	*PX - Price*	*PX - Perf.*
Eurostoxx 50	*EuroStoxx 50 - Price*	1.000	0.997	0.949	0.949	0.634	0.633
	EuroStoxx 50 - Perf.	0.997	1.000	0.951	0.951	0.635	0.634
DAX 30	*DAX 30 - Price*	0.949	0.951	1.000	0.999	0.619	0.618
	DAX 30 - Perf.	0.949	0.951	0.999	1.000	0.620	0.619
Czech PX	*PX - Price*	0.634	0.635	0.619	0.620	1.000	0.996
	PX - Perf.	0.633	0.634	0.618	0.619	0.996	1.000

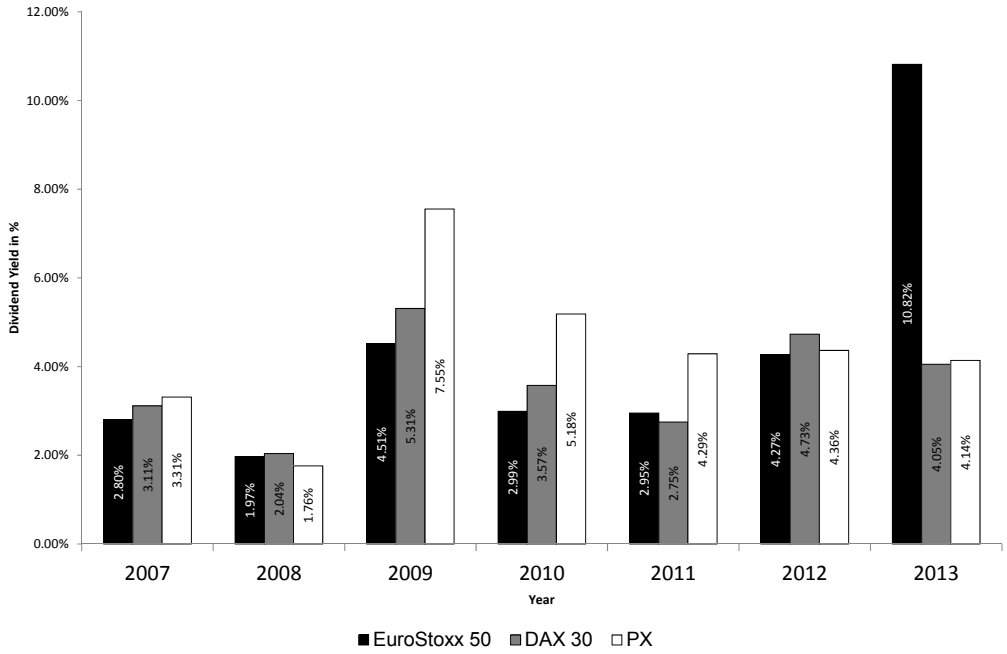
Source: own calculations based on PSE (2014a), PSE (2014b), Stoxx (2014a), Stoxx (2014b), Yahoo (2014a), Yahoo (2014b).

It is quite understandable that the correlation between price and performance index is always near 1. It is positive to see that the PX diversifies a DAX or a EuroStoxx investment. Correlations are always about 0.65. Mixing a low part of PX to a German/European portfolio makes sense.

3.5 Dividend Yields

Last, the dividend yield of each index is calculated. This is shown in fig. 3.

Figure 3 Dividend yield of all indices



Source: own calculations based on PSE (2014a), PSE (2014b), Stoxx (2014a), Stoxx (2014b), Yahoo (2014a), Yahoo (2014b).

It becomes clear that this simplified analysis of the dividend yields leads to a good result for the Czech index. Dividends are always at the same level compared to the DAX or the EuroStoxx; during 2009 – 2011 they seem to be higher. Only in 2013, the EuroStoxx shows a total overperformance in the dividends. So the PX is at least as good as the other indices – but it has to be kept in mind that the method how the dividend yield was defined is only a first and simplified idea.

4 Conclusions

Summing up the main results leads to the following conclusions:

1. The PX performed not as good as the other indices; DAX and EuroStoxx show a better performance in an 8 year horizon.
2. As a normal distribution has to be refused for all indices, the VaR in the form of a historical simulation has to be applied.
3. This leads to a worse RORAC for the Czech PX. Only looking at risk and return, an investment does not make sense.
4. Extending this analysis onto the correlation leads to a different result. Mixing a German or European portfolio with the PX makes sense as the correlation is about 0.65.
5. Last, the dividend yield of the PX seems to be good as well. It is often at least as good as those of the DAX and EuroStoxx, so investing into the PX makes sense, if dividends are the main aim of an investor.

Surely, the analyses have to be extended. First, the time period has to be longer, 8 years is perhaps too short. Second, the yield measurements have to be adjusted by introducing monthly or yearly yields. Third, the definition of the dividend yield has to be adjusted, analyzing the real dividends of the past. We will do this later, using the presented results as the basic for further research.

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Mergers of Business Corporations at the Czech Acquisition and Merger Market

Jaroslav Sedláček, Alois Konečný

Masaryk University
Faculty of Economics and Administration, Department of Finance
Lipová 41a, 602 00 Brno, Czech Republic
E-mail: sedl@econ.muni.cz, alois@econ.muni.cz

Abstract: *This paper monitors development trends at the global merger and acquisition (M&A) market and analyses the development of the Czech merger market in detail. The aim of this paper is to compare mergers implemented in 2010-2013 as regards the types of the Czech mergers, the legal forms of the participating companies, and their combinations. Attention is devoted to the changes in timing of mergers within the calendar year. The hypotheses were tested using the regression and correlation analyses as well as graphical analysis. The research results have confirmed a positive relation between the development of the Czech economic environment and activities at the merger market. It has been proved that traditional as well as newly implemented forms of mergers have increased and the range of combinations of legal forms of participating corporations has expanded.*

Keywords: company transformations, development of mergers and acquisitions, mergers on the Czech market, temporal distribution of mergers, regression and correlation analysis, decisive date of merger

JEL codes: E30, F01, G30, M21

1 Introduction

The historical development of business corporations has been accompanied by their transformations that have been implemented with the aims to stabilize their financial position and improve their financial performance. The final aim of transformations, i.e. including M&A, is the achievement of higher economic gains for their owners. Transformations can take a form of an internal (organic) growth of business corporations, such as e.g. reinvestment of incomes, construction of new plants, implementation of up-to-date technologies, etc., or an external form in which the corporation is combined with another or, by contrast, divided into more corporations. The reason is the assumption (Brealey and Myers and Allen 2006) that a transformation has the potential to improve the current situation and that the resulting business corporation will be stronger, more efficient, and will use its advantages better at the available markets. Business combinations lead to the concentration of capital accompanied by the formation of a stronger economic group; the ownership structure changes, new organizational systems and various human resources projects are implemented and developed, a global company culture and corporation philosophy is born (Cassiman and Colombo, 2006).

Studies dealing with analyses of the development in the M&A market are predominantly based on global database systems, such as Mergerstat or Thomson Reuters, which largely contain data on combinations of enterprises traded in public markets. To measure activities in the M&A market these studies use time series reflecting the number of company combinations implemented in the investigated period and the value of the total equity entering a combination. Markets usually do not distinguish between acquisitions and mergers, which are then considered synonymic. An agreement on a combination of two or more enterprises into one, which thus gains more advantages than if the companies did business separately, is usually referred to as a merger. According to West's Encyclopedia of American Law (2011) is a merger or acquisition a combination of two companies where one corporation is completely absorbed by another corporation. 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, privileges, and liabilities of the

merged corporation. A merger is not the same as a consolidation, in which two corporations lose their separate identities and unite to form a completely new corporation.

The Czech trade law defines a merger as a combination in which one or more companies cease to exist without liquidation and their equity, including rights and duties following from labour-law relations, are transferred to another existing or a newly established successor company. It means this is a legal combination which requires an agreement of all participating companies. On the other hand, an acquisition is a transaction in which one company (the bidder) gains a decisive share of the basic equity of another (target) business. The acquisition can have a character of a capital investment (capital acquisition) or a property acquisition, in which the entire company or its part is purchased. By this a group of companies connected by their capital arises and the legal position of individual companies does not change (Beranová and Martinovičová, 2010; Kocmanová and Šimberová, 2011). Unless this is a hostile takeover, also a legal takeover can take place in case of property acquisition or capital acquisition by one owner. The differences between mergers and acquisition will mainly stand out in accounting procedures (Bohušová, Svoboda and Nerudová, 2012; Malíková and Brabec, 2012).

As regards legal regulations, mergers in the Czech Republic are regulated by Act no. 125/2008 Coll., on transformations of trading companies and cooperatives. The regulation defines two basic types of mergers (Sedláček and Křížová and Hýblová, 2012):

a) a merger while no new company is formed, during which one of the companies legally ceases to exist without liquidation and its equity is transferred to another existing (successor) company (merger type 1);
b) a merger while a new company is formed, during which two or more companies cease to exist without liquidation and their equity is transferred to a newly established successor company (merger type 2).
   Pragmatically, also transformations described as follows can be considered mergers while no new company is formed:
c) division of a company by amalgamation, during which some of the divided companies amalgamate with other existing companies and the remaining divisions become new companies (division type 1). The original company ceases to exist.
d) division of a company by demerger and amalgamation, during which a demerged company amalgamates with another existing company (division type 2);
e) transfer of equity to a partner, during which a company ends without liquidation and the equity is taken over by a partner. In capital corporations, the partner who takes over the equity of a capital company has to own at least 90 % share of the original capital of the ending company (equity transfer).

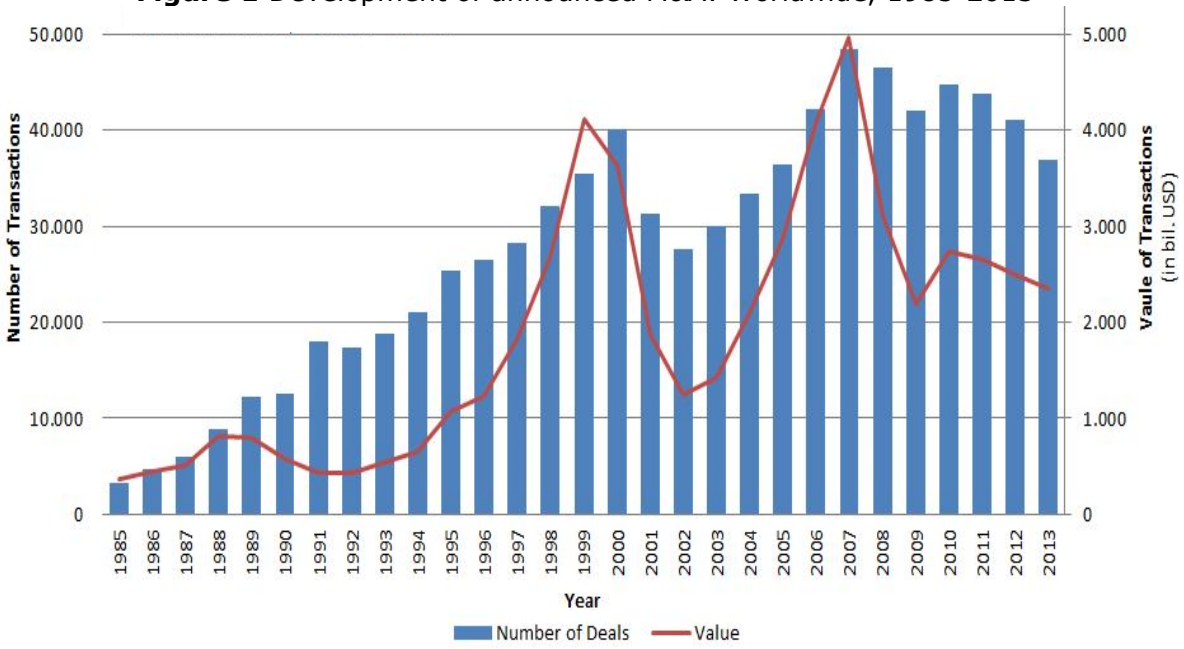
The aim of this paper is to expand the knowledge gained through project Grant Agency of Czech Republic no. 403/11/0447 by the current development trends at the Czech merger market as regards the number of implemented mergers, the legal forms of the participating companies and their combinations, as well as the timing of merger implementation.

2 Analysis of the Development of Activities at Global and Czech M&A Markets

The study of the historical development of corporation combinations has shown that activities at the M&A market have not appeared evenly but fluctuated in dependence on the economic environment, the development of financial markets and mainly bidders' and target companies' ideas about the purchase price. Some authors use the term waves for this development of mergers and acquisition. The waves come at specific levels of economic development. E. g. Levy and Sarnat (1999) identified three waves, Bobenic-Hintosova (2009) identified four waves, Bruner (2004) divided the fourth wave into two a) and b), Martynova and Rennebook (2008) distinguished five waves, Lipton (2006) found six waves of mergers and acquisitions.

Just like the studies of leading audit companies and economic institutes (for more details see e.g. IMAA 2014), our previous research (Sedláček and Valouch and Konečný, 2011) proved a strong correlation between the recent development of global economy and the volume and number of activities at M&A markets. The graph at Fig. 1, which presents the numbers and the volumes of activities at the global M&A market in the past years, confirms that there are more mergers and acquisitions at periods of economic prosperity and fewer at periods of depression or stagnation. The greatest slumps in the activities are always recorded in the periods of financial and economic crises. According to the study performed by The Boston Consulting Group in 2012 (Kronimus 2012), the cyclic character of M&A is related to the prices of assets, which cause higher demand for mergers and acquisitions at the times of long-term price growth at the stock exchange. The price growth at financial markets is usually related to periods when entire economy grows. Investors also respond to government incentives, attractiveness of the target countries, and the risk levels. To simplify the investors' decision-making processes concerning entry to new markets, evaluation systems have been devised, e.g. The Cass MARC Maturity Index (Cass Business School 2010). Recently, the investors' attention has shifted to developing economies in Europe, Asia and South America.

Figure 1 Development of announced M&A: Worldwide, 1985-2013



Source: IMAA Institute (2014)

The studies published so far have not analysed development trends of mergers as independent transformation forms, i.e. without acquisitions. Therefore, our empirical research focuses on mergers of business-corporation implemented at the Czech market in the last four years. We compare the development of the number of mergers in the monitored period with the economic development of the external environment. The data sources are Trade Bulletin (2014), Trade Register (2014) and CZSO (2014), which publishes GDP temporal series. To investigate the development trends, the relative proportions (p) of the captured quantities in particular years of the selected time interval were calculated by equations:

$$p_{xt} = \frac{100\,X_t}{\frac{1}{n}\sum_{t=1}^{n} X_t} \tag{1}$$

$$p_{yt} = \frac{100\,Y_t}{\frac{1}{n}\sum_{t=1}^{n} Y_t} \tag{2}$$

To describe the development trend of the temporal series, the equations of regression linear functions were calculated:

$$y = 0.0379x + 0.4432 \quad \text{(mergers)} \tag{3}$$

$$y = 0.0118x + 0.4824 \quad \text{(GDP)} \tag{4}$$

The two lines are closely correlated and thus we can say that the Czech merger market was strongly influenced by the economic development in the monitored period, similarly to merger and acquisition markets.

3 The Comparison of the Development of the Structure and the Timing of Mergers at the Czech Market

In total, 737 transformations of business corporations were entered in the Trade Register last year. Besides classical mergers, there were 141 divisions type 2 (division of a company by demerger and amalgamation), 10 divisions type 1 (division of a company by amalgamation), and 10 equity transfers to partners. Besides transformations with a form of a merger, there were 142 divisions while a new company was formed, 4 demergers while a new company was formed, 1 change of legal form and 4 more complicated transactions. The number of mergers of business corporations headquartered in the Czech Republic increased between 2010 and 2013. The structure of mergers changed abruptly, as is shown in Tab. 1. The majority of the mergers were conducted among companies within the Czech Republic; only a negligible number were cross-border mergers (3% in 2010 and 3.4% in 2013). From the perspective of the successor company, only one merger took a direction abroad in 2010, while seven companies merged into a foreign successor company in 2013.

Table 1 The development of merger structure implemented by companies headquartered in the Czech Republic

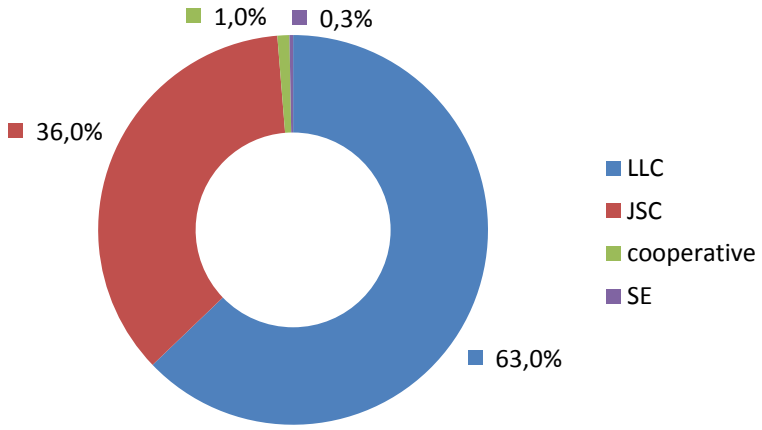
Merger type	2010	Proportion %	2013	Proportion %	Increment
Merger type 1	375	95.2	416	71.0	41
Merger type 2	19	4.8	9	1.5	-10
Division type 2	0	0.0	141	24.1	141
Division type 1	0	0.0	10	1,7	10
Equity transfer	0	0.0	10	1,7	10
Total	394	100	586	100	192

Source: Kučerová (2012), Trade Register (2014)

The Trade Register shows that 1397 corporations participated in mergers in 2013, which is 396 more than in 2010. As regards the legal form, the range of participating companies expanded by e.g. state-funded institutions, endowment funds, private persons and limited partnerships. The prevailing form of business corporations merging in the target year were limited liability companies (LLC) - 925 corporations, followed by joint-stock companies (JSC) - 436 corporations. By contrast, we have only found one merger of a public trading company. The percentages of particular legal forms of participating corporations calculated for 2010 and 2013 are presented in Fig. 1 and 2. Comparing both graphs, we can see that there was the greatest increase in the number of limited liability companies, which maintain their dominant position at the Czech merger market. The percentage of the newly appearing legal forms of business corporations was nearly two percent.

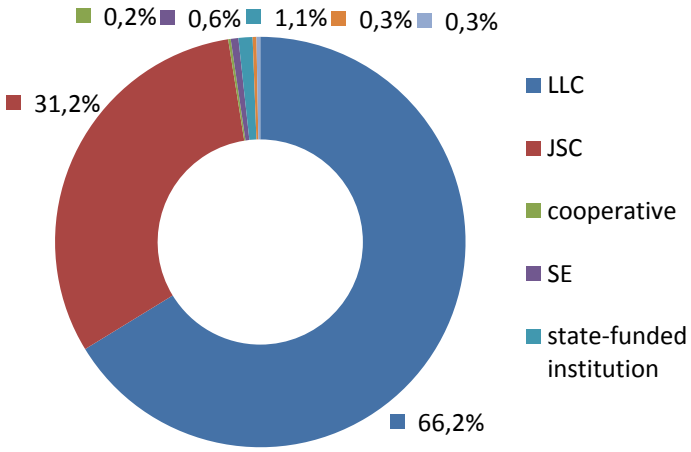
Czech legal regulations allow not only mergers of companies with the same legal forms but also "cross mergers", i.e. mergers of companies with different legal forms. It is important to respect the partial resemblance of the companies to be combined. It means there can be mergers of both types among capital companies (joint-stock and limited liability companies) or among business partnerships (limited partnership, public trading companies) but not between these two groups.

Figure 1 Legal forms of corporations participating in mergers in 2010



Source: Kučerová 2012

Figure 2 Legal forms of corporations participating in mergers in 2013



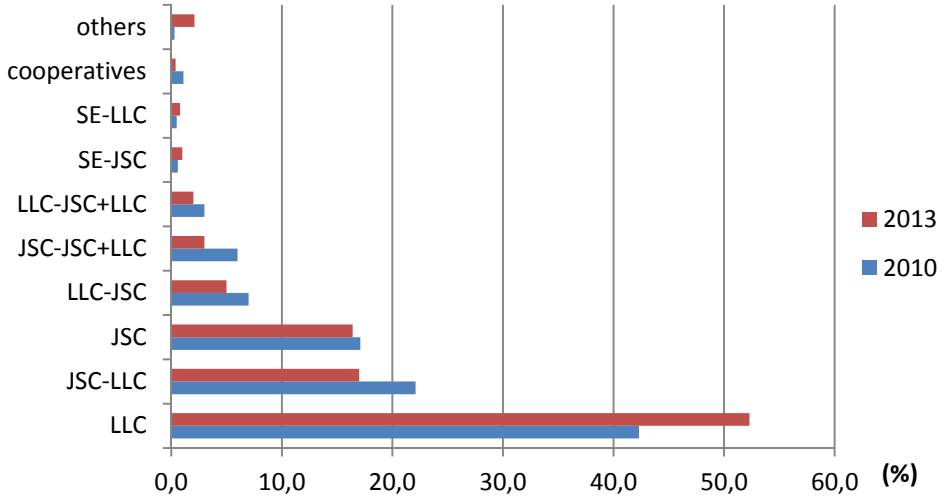
Source: authors

The reason is the differing essence of these two types of companies. Capital corporations demand partners' property interests either in the form of shares or stocks, while business partnerships demand the partners' personal participation in the business but there is no obligatory investment in the company. Each of the groups represents a different type of creditor protection and this type may not be changed or combined. An exception is cooperatives, which can only be combined with each other. However, a domestic merger of housing cooperatives can only consist of housing cooperatives. A European company (SE) can be combined with other capital corporations during a domestic merger but it can only become a successor company in the case of a cross-border merger (see also Sedláček, Valouch and Hýblová et al., 2014).

The analysed dataset included 14 combinations of business corporations with different legal forms. Ten combinations with the highest frequencies are presented in the graph at Fig. 3, which also shows their development between the two monitored years. There were new combinations of legal forms of participating companies in 2013 and their proportion in the number of mergers implemented was 2.1%. They were mergers between state-funded institutions, public trading companies, endowment funds, and limited liability company equity transfers to private persons. The vertical axis legends

show the legal form of the successor company in front of the hyphen and the dissolved company past the hyphen. We need to add that there were often more companies participating in the mergers, both successor and dissolved ones. There was also a merger in which 12 parts divided from a joint-stock company and these parts were then combined with existing limited liability companies. Fig. 3 shows that the most frequent type was a merger among limited liability companies - 52% of all implemented combinations in 2013, followed by a combination in which dissolved limited liability companies entered a successor joint-stock company. A high increase in combinations among limited liability companies is probably related to the increasing popularity of this legal form of capital-corporation. According to ČEKIA (2013), the increase in limited liability companies between 2010 and 2012 was 65,232, while there were only 3,428 more joint-stock companies in 2012. There is also a positive change as regards the ES and other combinations in consequence of new legal forms penetrating the economic practice.

Figure 3 Combinations of legal forms of corporations participating in mergers

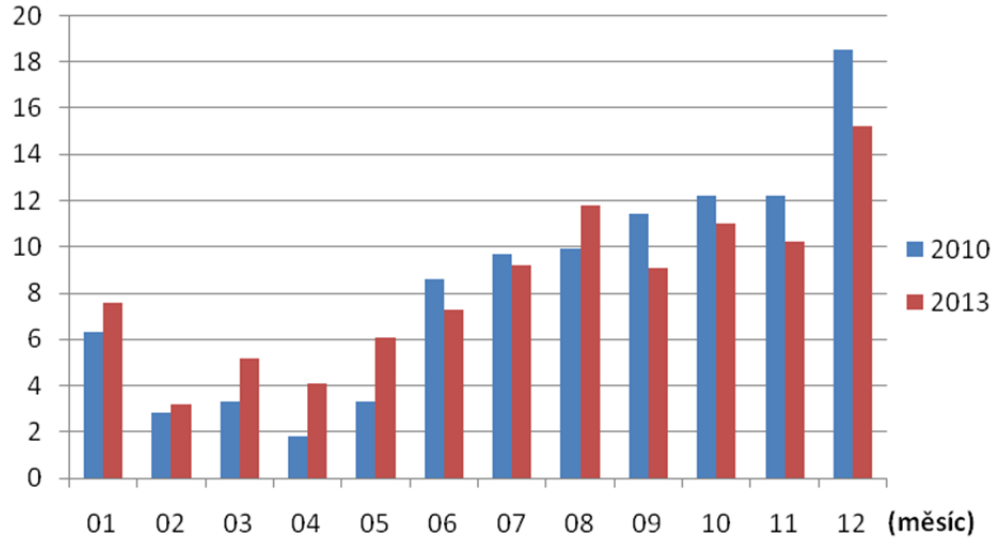


Source: authors

A merger comes into effect when it is recorded in the Trade Register; i.e. the dissolved companies are deleted and new ones are created or the existing ones are changed. The temporal distribution of mergers recorded in the Trade Register during the monitored years is presented in the graph, Fig. 4. The graph shows that the corporations proposed to be recorded in the Trade Register at the end of the calendar year because the majority of the mergers come into effect in the third and the fourth quarters. The differences between particular months were gradually diminished. The average value of absolute deviations of data points from their means was reduced from the original 4.03 to 2.75 in 2013.

The expenses related to mergers of business corporations are considerably affected by the right timing (Sedláček, Valouch and Králová, 2013). It depends on the choice of the merger decisive day, which is defined as the day starting from which activities of the dissolved legal person are considered activities of the successor legal person from the perspective of accounting. The decisive day can be established, with respect to the moment of the proposed transformation record in the Trade Register, in the past (i.e. the day preceding the preparation and approval of the transformation, but at most 12 months before the proposal) as well as in the future (the latest possible date is the moment of the merger being recorded in the Trade Register). In this way, the corporation can avoid the duty to submit extraordinary or interim financial statements by choosing the decisive day according to the first day of the new accounting period.

Figure 4 The development of mergers recorded in the Trade Register in particular months



Source: authors

For domestic mergers, it is the easiest to set the decisive day as the day when the merger is entered in the Trade Register, i.e. choose the same moment for legal and accounting effects of the merger. This would save corporations the many troubles related to having several accounting books - for the successor and the dissolved companies - during the interim period from the decisive day to the date of the merger being entered in the Trade Register. Our analysis has confirmed that the corporations underestimate the possible appropriate timing of the decisive day, as is shown in Tab. 2.

Table 2 Timing of the decisive day of mergers implemented by corporations at the Czech market

Decisive day timing in %	2010	2013	Change
As of another than the first day of month	0.50	1.62	+1.12
As of the first day of month	18.03	15.37	-2.66
As of the beginning of the accounting period	81.47	83.01	+1.54

Source: authors

Only a negligible number of mergers were recorded on the day of the beginning of a new accounting period during the monitored years. The majority of merger records were entered on a day different from the first day of month. This leads to the conclusion that the increase in mergers with decisive days different from the first day of month was caused by the fact that the corporations chose the decisive day to be the same as the day of the merger record in the Trade Register.

4 Conclusions

The analyses of the historical development of activities at the Czech merger market have confirmed a recovery in the period after the financial and economic crisis. It has been ascertained that the numbers of mergers of business corporations with the headquarters in the Czech Republic were strongly affected by the economic development, similarly to the global M&A market correlating with the development of the global economy. Besides the overall increase in the number of mergers at the Czech market, the structure of mergers changed, especially towards a larger application of mergers of components divided from corporations. In respect of legal forms of corporations participating in mergers, the dominants position remains held by limited liability companies. The high percentage of companies with this legal form is in proportion to the 93% share of these

companies within all capital companies in the Czech Republic. The comparison of legal forms of corporations participating in mergers has yielded 14 basic combinations. There was a considerable increase in mergers of limited liability companies; mergers of joint-stock companies slightly decreased. Corporations started to use cross mergers more often, in which various legal forms are combined, both in domestic and cross-border transformations (see also Sedláček and Hýblová and Konečný et al., 2013).

Business corporations are aware of the economic effects of the right merger timing - there were cases when the decisive day was planned for the moment of merger record in the Trade Register. To conclude, merger activities considerably increased in the last four years and they are still a big opportunity (Valouch and Králová, 2012) for business growth in the near future.

5 Acknowledgements

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Evaluation of the Use of Mediation to Resolve Disputes in Financial Services in the Czech Republic

Jindřiška Šedová, Romana Kalábová

Masaryk University
Faculty of Economics and Administration, Department of Law
Lipová 41a, 602 00 Brno, Czech Republic
E-mail: jsedova@econ.muni.cz, romanakalabova@gmail.com

Abstract: *The aim of this paper is to present the results of an analysis of contract enforceability and suitable methods of resolving disputes in the Czech Republic both in general terms and also focusing on the area of financial services. From this point of view, the main reasons of the low efficiency of dispute resolution from agreements are considered. In the Czech Republic most often a dispute resolution in court proceedings is used. In comparison with other countries, alternative dispute resolutions have been used rarely. In financial services, consumers can use the Financial Arbiter of the Czech Republic, which is competent to decide disputes in a wide range of financial services. In addition, arbitration, conciliation and mediation may be taken into consideration. Attention is focused on the criteria specification to express efficiency and consumer preferences in decision how to resolve a dispute. On the base of obtained results, conclusions on a possible use of mediation in the Czech Republic in resolving disputes in financial services, especially consumer credit, are formulated.*

Keywords: mediation, arbitration proceedings, judicial proceedings, contract enforceability

JEL codes: G3, K1

1 Introduction

Poor contract enforceability in the Czech Republic is a serious problem which has long limited the international competitiveness of the Czech economy, including its financial services. We have therefore focused on assessing contract enforceability through judicial proceedings. Judicial proceedings are the preferred and predominant means of enforcing contracts in the Czech Republic. To assess the effectiveness of judicial proceedings we used the World Bank index, which indicates that enforcing contracts in the Czech Republic is a lengthy and costly process. The first comparison of the effectiveness of enforcing contracts in the Czech Republic was made with countries which during the last two decades have witnessed a transformation in their economies, as well as the process of forming their national financial system. This is followed by a comparison of contract enforceability in the Czech Republic with countries which make successful use not only of the courts, but also a number of other alternative methods of privately settling disputes when enforcing contracts. This comparison was mde using the World Bank database, which is designed on the basis of the methodology of Djankov et al. The database is the result of the assessment of more than 180 countries around the world (Djankov et al., 2003).

In a later section we will focus on an alternative means of enforcing contracts as one possible way of making contract enforceability more effective in the Czech Republic. This alternative solution is so far not particularly popular amongst Czech entrepreneurs and consumers. In contrast, it is relatively widespread in the USA and a number of countries in western Europe. It is considered the fastest and at the same time an inexpensive means of resolving disputes, the success rate of which is around 75% (FACR, 2014). In the Czech Republic, one out-of-court method of resolving disputes that is gradually becoming common is arbitration proceedings, and, since 2012, another method too, known as mediation (Act No. 2002/2012 Coll.). Arbitration proceedings are an out-of-court method of resolving disputes by independent and impartial arbitrators. In the Czech Republic these proceedings may be held before one or more arbitrators appointed

by the parties to the dispute or a specific dispute or may take the form of proceedings before an institutional arbitration court. This method is most often used to resolve disputes arising from works contracts, purchase contracts or loan agreements (URMR, 2014).

The popularity of mediation and its success rate in enforcing contracts can be put down to that fact that it is essentially non-authoritative and, in comparison with other methods of dispute resolution, is characterised by the following advantages: extraordinary speed, confidentiality, the ability to maintain friendly relations, permanent bilateral control, guidance based on expertise, agreement and tolerance. However, the result of the negotiations may not be in accordance with the legal opinion on the matter. Mediation tends to be a concensus between the interests of the parties involved (URMR, 2014). Due to these advantages mediation is a highly effective and respected means of resolving conflicts, particularly in developed countries with a good justice system, e.g. the USA (Sander, 2006), France or Germany.

As these alternative methods are not often used by parties to disputes in the Czech Republic, there are no precise statistics on the numbers of disputes resolved out of court. According to estimates, there are a maximum of tens of thousands of cases dealt with every year by permanent and ad hoc arbitration courts or arbitrators. The situation is no better in the case of mediation. This means that it is not yet possible to compare their effectiveness with figures from abroad. The exception in the context of alternative dispute resolution from this point of view is the Financial Arbiter of the Czech Republic, whose work is regularly monitored (FA, 2013). Therefore, we are concentrating on assessing theoretical approaches and criteria used abroad to choose an effective method of resolving contractual disputes from the viewpoint of the conditions applicable in the Czech Republic (Hrnčiříková, 2012).

We have taken account of the theoretical approaches of J. Coben and N. Thompson (Coben, Thompson, 2007), (Coben et al.,2014), as well as those of Refedern, A., Hunter, M., Blackaby, N., Partesides, C. (Refedern et al., 2004) towards mediation and arbitration proceedings in the USA. The USA is seen as the founder of the Alternative Dispute Resolution movement (ADR), which was set up in the 1970s due to the courts being overburdened. Unlike the European approach, mediation and arbitration proceedings are conceptually linked as part of the ADR. According to A. Bělohlávek, and N. Rozehnalová (Bělohlávek, 2011), the Czech Republic is inspired by the concept of mediation in the United Kingdom, which is consistently based on the Convention on Human Rights (2004). The court may urge and motivate the parties to participat in mediation, but it cannot order them to do so. However, it is competent to rule that the costs be reimbursed by the party to the dispute that refused to enter mediation for no justifiable reason. An interesting approach to mediation has been taken in Italy. Mediation is mandatory for certain civil disputes. This is a radical approach which has been widely discussed at the international level (Kluwer Mediation, 2004), (Newsletter-Mediation News, 2014), (Tachtermann, 2008). Before the actual judicial proceedings, the parties must first contact a mediator. If it cannot be proved that mediation has taken place, the court will abort the proceedings in order to start mediation. The parties may also agree that the mediator issue a recommendation stating how that mediator would rule on the dispute. In that case, all the costs of the proceedings must be paid by the party that did not agree to mediation and the subsequent court judgment is identical to the mediator's recommendation (Hrnčiříková, 2012). Mediation is also compulsory in some cases in Germany, too. One source of inspiration for the Czech Republic could be the concept of mediation in France. There, mediation is possible in any part of judicial proceedings, assuming that the parties agree to it. If the disputing parties reach an agreement, the court will then confirm that agreement. Mediation has a high success rate, e.g. in disputes between banks and clients the success rate of mediation is around 65%. In the Czech Republic, the legal aspects of mediation are covered by the Act on Mediation (Act No. 2002/2012 Coll.) and the Code of Civil Procedure (Act No. 99/1963 Coll.). These laws are based on the the principle of the separation of mediation, arbitration and judicial proceedings (David et all., 2009). Mediation can be seen in the Czech Republic in

both instance and in enforcement judicial proceedings. The court may order the parties to enter mediation, or have their first meeting with a mediator, if it considers it appropriate and useful. However, it may not order mediation itself as, under the Act on Mediation, mediation commences the instant a mediation agreement is drawn up. The court cannot force the disputing parties to participate in mediation if the parties themselves do not agree to it (Winston, 1996). Alternative methods of dispute resolution are favoured under the new Civil Code, which enables deadlines to be set if the parties decide to resolve their dispute out of court (Act No. 89/2012 Coll.).

2 Enforcing Contract Methodology and Data

The level of enforcement of contracts in the Czech Republic was evaluated, as we already mentioned in the introduction, using the Doing Business database, created by the World Bank based on the methodology of Djankova et al. [20]. We have assessed the level of contract enforceability in the Czech Republic, as mentioned in the introduction, using the Doing Business database, created by the World Bank on the basis of the methodology of Djankov et al. (2003). This methodology is based on comparison of the conditions governing the enforcement of contracts in judicial proceedings. A total of 189 countries have been assessed. Their rankings are derived from three indicators:

- Time - Days taken to resolve a property dispute through the courts (33%)
- Cost –Attomey, court and enforcement costs as % of claim value (33%)
- Procedures – Steps needed to file a claim, obtain judgment and enforce it (33%)

The overall ranking of contract enforceability is calculated using the arithmetic average of the percentile ranking of each sub-indicator (Time, Cost, Procedures). More detailed information about this method is given by Djankov et al. (2003).

Table 1 Resolving disputes through the court

	Enforcing Contracts rank	Time (days)	Cost (% of claim)	Procedures (number)
Czech Republic	75	611	33.0	27
Slovak Republic	65	545	30.0	32
Poland	55	685	19.0	33
Hungary	15	395	15.0	35
Latvia	21	469	23.1	27
Slovenia	52	1270	12.7	32

Source: Doing Business (2014)

In terms of the level of contract enforceability, the Czech Republic is in 75th place out of all the countries in question (189). In comparison with EU member states who have seen their economies transformed during the last two decades, the Czech Republic has the worst rating. The low effectiveness of contract enforceability is attributed to the length of time it takes to resolve disputes (e.g. in Hungary the time taken to enforce contracts is almost half as long, even when more procedures are necessary, and half as costly as in the Czech Republic) and the high cost (the Czech Republic's index shows that it is the costliest of all the countries compared here).

The result of the assessment of the effectiveness of resolving disputes arising from contracts in the Czech Republic in comparison with countries which also used alternative methods of resolving disputes is considerably worse than with the comparison with the previous group of countries (Table 1). Once again, dispute resolution by the Czech courts is proven to be a lengthy and costly process compared with other countries. In some cases the criteria (Time, Cost) are almost double /Germany (394; 14.4%), France (395; 17.4%), United States (370; 18.4%)/ compared with the Czech Republic (611; 33%).

Table 2 Resolving disputes through the court

	Enforcing Contracts rank	Time (days)	Cost (% of claim)	Procedures (number)
Czech Republic	75	611	33.0	27
Russian Federation	10	270	13.4	36
Germany	5	394	14.4	30
France	7	395	17.4	29
United Kingdom	56	437	39.9	28
United States	11	370	18.4	32

Source: Doing Business (2014)

These results of the international comparison of the effectiveness of contract enforceability in the Czech Republic are also cause for concern with regard to the concept and existing results of the ongoing judicial reforms. So far the Czech Republic has not yet considered the creation of specialised tribunals for certain caseloads and magistrates for petty cases, e.g. following the example of France or the United Kingdom. There is no doubt of the need for these, particularly for consumer disputes concerning loans or other financial services. In the countries in question, contract enforceability is considerably more effective for cases such as these. Specialised tribunals abroad are more effective not only because they specialise in a certain type of case, but also because procedural rules are adapted and experts participate in the decision-making process in addition to judges.

Although the general courts are the keystone of the Czech justice system, a specialised administrative authority has been set up to resolve disputes in certain areas of financial services - the Financial Arbitrator of the Czech Republic, who is not part of the judicial system. In simple terms, he can be considered a kind of prototype of a specialised tribunal. In 2013, the Financial Arbiter started proceedings in 703 cases, of which 71% of disputes related to consumer loans. It was a dispute between creditors or intermediaries and consumers in the offering, providing or arranging consumer loans (FA, 2013). Consumers of financial services may take their suggestions, complaints, and notices to the Czech National Bank, to which the law has entrusted certain responsibilities in the sphere of consumer protection (Act No. 6/1993 Coll.,). Every year, most complaints concern shortcomings in the activities of insurance companies and insurance intermediaries. Provided that certain prerequisites are met, the Czech National Bank may initiate administrative proceedings and impose fines for breaches of duties relating to consumer protection. However, it is not competent to resolve disputes arising from contracts relating to damage compensation (CNB, 2014).

This institutional framework of contract enforceability is poor in comparison with systems abroad because judicial and administrative proceedings in the Czech Republic are not suitably backed up by ADR. There is also a lack of expertise in the form of publications and training in ways of determining which method of dispute resolution is suitable for a given dispute. One publication that is unique in its own way is Praktický průvodce mediací (A Practical Guide to Mediation) by R. Cholenský (2013). It provides a systematic insight into various aspects of mediation, including ways of determining a suitable dispute resolution method. The author refers to the work of Sander and Rozdeiczer from Harvard Law School (2006), which gives a detailed description of various procedures and criteria for choosing a suitable method of dispute resolution. The criteria for selecting the method are broken down into three areas, aimed at answering the following elementary questions:

1. Which of the parties' needs should a method of dispute resolution cater to?
2. What aspects of the dispute and its participants mean that the dispute in question may be resolved better and with greater success using a certain method than with another method?

3. How may a certain method of dispute resolution help to overcome obstacles impeding the effective resolution of that dispute?

These questions encourage a more detailed analysis of the factors which may influence the choice of method used to resolve a dispute. Under each question, Sander and Rozdeiczer formulate additional criteria intended to help the disputing parties decide on the advantages of a certain method. These criteria are applied and assessed for mediation, arbitration proceedings and judicial proceedings. The basic structure of the criteria in sections 1-3 is clearly described by R. Cholenský (2013). We were also inspired by this study. We used it to basically map out the approaches to determining a suitable method of resolving disputes relating to financial contracts. In this approach, the benefits of mediation over arbitration proceedings and judicial proceedings lie in the following advantages:

a) Mediation may be used to resolve most disputes.
b) Even if mediation does not lead to an agreement, it is a way towards another agreement to resolve the dispute. This is because mediation gives the disputing parties the chance to examine their dispute in detail and take other steps as a result.
c) Foreign research confirms that disputing parties generally tend to favour less authoritative and less costly methods.
d) Mediation has the greatest potential to overcome obstacles that prevent the parties from reaching an agreement.
e) Mediation is a very flexible process that can be adapted to the circumstances of the case so as to best suit the needs of the parties.
f) Mediation may also be useful when one of the parties is convinced that it will win in judicial proceedings. However, in many cases the disputing parties are willing to replace the uncertainty of judicial decision-making for the certainty of a solution agreed through mediation.
g) Unlike judicial or arbitral decisions, in most cases the parties voluntarily fulfill agreements made duing the mediation process.
h) International research shows that mediation is the method preferred by lawyers. Mediation results in a far higher level of client satisfaction than with other methods of resolving disputes.
i) Allow us to draw a brief conclusion concerning this issue. Much more space and attention must be devoted to foreign research in order to gain a more detailed insight into and understanding of the logic used to deduce criteria suitable to enable assessmentment of the preference for a certain method of dispute resolution over others. We should briefly point out that the foreign studies presented here have clearly shown that mediation is the least costly dispute resolution method in comparison with arbitration proceedings and judicial proceedings. This leads to the same conclusion as Sander and Rozdeiczer, who claim that mediation has the greatest potential for creating solutions with the highest added value. For this reason, according to R. Cholenský, mediation should logically be the first choice when seeking a suitable method of resolving a dispute. This is obviously with the exception of cases where there are contraindications or if the parties manage to resolve the dispute without the assistance of a mediator.

3 Results and Discussion

It is not possible to exactly quantify the economic benefits of mediation in comparison with judicial proceedings in the Czech Republic, as there are no comparative studies or statistics available. However, we may assume that the main economic benefits of mediation will generally be (Hrnčiříková, 2012):

- Reducing the overall duration of judicial proceedings (with property settlements and monetary payments, the parties save money on interest, interest on interest, penalties, etc.)

- Reducing the number of costly legal remedies, as the parties conclude an mediation agreement (appeals, extraordinary appeals, etc.)
- Reducing the number of enforcements of the subsequent performance of a court decision.

These benefits may obviously also apply to parties in disputes over consumer contracts in the field of financial services. The extent of this depends partly on how the new legal framework governing mediation will affect the behaviour of consumers and financial institutions and also their willingness to resolve potential conflicts out of court. Based on experience from the United Kingdom, the development of alternative ways of resolving disputes will depend on assumptions which are formed in two stages: 1. The existence of adequate legislation and training for mediators, 2. The creation of an institutional environment in society in which people will be willing to engage in mediation. In the United Kingdom, government support for mediation has also played an important role in the development of mediation. The government has made a public commitment to using mediation in cases where the government is one of the parties to a dispute, e.g. in disputes relating to contracts.

We assume that in the Czech Republic universities may play a crucial role in advocating mediation. In particular, methods of resolving disputes arising from contracts in the field of financial services through mediation may have a positive impact on training for university graduates studing courses with an economic focus. In April 2014 we performed a survey at ESF MU Brno amongst 300 students studying Finance and Business Economics, the aim of which was to map out students' opinions on out-of-court methods of resolving disputes and also to determine how they rate their knowledge and skills in terms of resolving disputes arising from contracts out of court.

Students were asked the following questions:

1. With regard to the information given here and your skills, which method of private dispute resolution so you consider to be the most suitable?
   /a) judicial proceedings, b) arbitration proceedings, c) mediation, d) other method/.
2. Do you know the specifics of arbitration proceedings in comparison with judicial proceedings? Rate your knowledge using one of the grades below.
   /a) excellent, b) average, c) low, d) 0/.
3. Do you consider mediation to be a suitable means of resolving disputes arising from contracts, assuming that the generally accepted prerequisites for this method of dispute resolution are met? Which of these options matches your idea about willingness to resolve a dispute through mediation?
   /a) I use mediation in the vast majority of disputes, b) I use mediation only in certain types of disputes, c) I use mediation only in exceptional cases, d) other variant/.
4. What method do you consider in situations where it is necessary to resolve a dispute? Which of these variants do you prefer?
   /a) it suits me when a dispute is resolved for me by someone authoritative, b) I like resolving disputes under my own control, with the option to choose from several variants, c) I believe in my communications skills and therefore welcome the option of mediation, d) I do not trust out-of-court methods of dispute resolution, so I would prefer to do it through the courts/.
5. How do you rate the scope and quality of the information you know about the principles, techniques and possibilities of using mediation as a means of resolving disputes out of court?
   /a) I have adequate knowledge of the fundamentals and advantages of mediation. I am not afraid to use mediation when necessary, b) the information and my skills are inadequate to enable me to opt for mediation as means of resolving a dispute, c) The information I have is too sparse. I would not dare to use mediation as a means of resolving a dispute, d) other variant /.

6. How important to your professional success are communication skills and knowledge of basic techniques of resolving disputes using alternative methods? /a) My success will depend largely on my ability to communicate and use effective dispute resolution techniques, b) I consider communication to be necessary, but only as a supporting part of my professional success, c) I count on my powers of analytical thought and the ability to create a formal and effective system of managing relations, d) I have no idea or opinion at the moment/.

An assessment of students' answers is given in Table 3.

Table 3 Student opinions of out-of-court methods of resolving disputes

	a)	b)	c)	d)
1. Choice of a suitable method of dispute resolution	84	58	108	50
2. Knowledge of arbitration proceedings	2	66	198	34
3. Assessment of mediation as a method of dispute resolution	42	178	72	8
4. Motivation to choose a certain method of dispute resolution	48	186	56	10
5. Knowledge of mediation and the option to use it to resolve disputes	74	144	62	20
6. Importance of communication skills and mediation techniques	102	122	38	38

Source: Authors' own work

Evaluation of the students' answers in Table 3 shows that students tend to see alternative methods of dispute resolution as a promising and suitable means of resolving disputes and therefore are not prejudiced against them (question 1). However, the students' preferences are not backed up by adequate knowledge and awareness of the specifics of arbitration proceedings. A high proportion of responses (198 students) show that they have a lack of information about arbitration proceedings compared to the previously predominant way of resolving disputes through the courts. This can therefore give cause for concern that, under the circumstances, a significant proportion of the students is not prepared to fully exploit the potential benefits of arbitration proceedings and face the risks that such proceedings could entail. Similar conclusions may also be drawn from an assessment of the answers to questions 4 and 5, which aimed at determining how motivated students are to select a certain method of dispute resolution. They were also asked to rate their competence for using mediation to resolve a dispute. The majority of students confirmed that when resolving disputes they prefer conditions that enable them to have the resolution process under their control and prefer to have the option of choosing from a number of different methods of reaching an agreement. However, this motivation and the attitude of students towards compromises when resolving disputes arising from contracts does not match the level of awareness and knowledge of the basic communication techniques needed for effective mediation. 162 students consider their competence to be inadequate to opt for mediation as a means of resolving a dispute, as in general this method of resolving disputes is seen as suitable by 196 of the total number of students surveyed. The answers to question 6 imply that students consider communication skills and knowledge of the basic techniques involved in resolving disputes through mediation to be important factors which may have a positive impact on their professional success. Most of the students tend to see the ability to communicate effectively as a fundamental prerequisite for professional success (132 students out of the total number of students surveyed). Many of the students (112) even believe that these abilities play a decisive role in their professional success.

This survey was the first step towards mapping out students' attitudes and also the criteria (values) that students favour when deciding whether to opt for an alternative method of resolving contractual disputes. We consider the results of this pilot survey to be very inspiring, as they indicates that the current preparation of university students on

economics courses still does not fully reflect practical needs, but also show students' attitude towards the various methods of resolving disputes. In order to bring studies more in line with practical needs, in the future we intend to focus greater attention on surveying students' attitudes and values (as well as those of clients of financial institutions) when choosing a method of resolving a dispute arising from a contract.

4 Conclusions

The comparison of mediation with dispute resolutions of the Financial Arbiter and in the court proceedings, shows a few fundamental differences which may affect disputants, by their preferences, more than it was in the past. It is mainly shorter duration of dispute resolution, lower proceedings costs, a possibility to deal with the entire proceedings and the fact that the mediator is a person of private law and his selection is available for both dispute parties. The mediation has a chance in disputes relating to non-life insurance, liability insurance, dispute in the area of savings and mortgage lending. Specified types of disputes are not in the Czech Republic for the time being in the responsibility of the Financial Arbiter.

In view of the Czech Republic's current interest in stabilising the development of financial services, we assume that adequate competency of university students in the field of out-of-court dispute resolution may be an effective investment in the development of financial services not only at the level of the actual national financial market, but also in terms of cross-border financial services. Early indications from the survey and from practice show that willingness on the part of not only financial institutions but also their clients to resolve potential disputes arising from contracts using through the entire spectrum of alternative approaches can help to re-establish good relations between financial institutions and their clients. The merits of this recommendation were recently highlighted in a dispute over load management fees, unsuccessfully taken to court against banks by more than 300 thousand clients. This case also showed that it will not be possible to effectively develop alternative methods of resolving disputes arising from contracts without proper respect for the functional and mutually acceptable interests of both parties, i.e. financial institutions and clients (consumers).

The prerequisites that must be met for the realization of this objective will be the subject of our next research. We see it as essential to carry out a more extensive analysis of the values that contracting parties prefer when resolving disputes arising from financial services contracts. We will use the results to draft educational programmes aimed at increasing student' competence for the effective application of alternative methods of resolving disputes in practice. Research into this topic in the Czech Republic does not take proper account of the issue. There is therefore the need for a broader platform for expert discussion, particularly concerning the fundamental values affecting disputing parties' decisions on methods of resolving their dispute and the choice of mediation.

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Topological Properties of European Banking Network in Light of the Single Supervisory Mechanism

Maria Siranova

University of Economics in Bratislava
Faculty of National Economy, Department of Banking and International Finance
Dolnozemska cesta 1, 852 35 Bratislava, Slovak Republic
E-mail: maria.siranova@euba.sk

Abstract: *In this paper we discuss the topological properties of the European banking network and its evolution over time based on the BIS consolidated banking statistics data exploiting information from complex network analysis. This method allows us to detect the key nodes of the system in a weighted network environment. Our conclusions are discussed in light of the soon-to-be-launched Single Supervisory Mechanism that takes into account, among others, significance of cross-border activities as a precondition for specifying the systemically important European credit institutions.*

Keywords: Single Supervisory Mechanism, network analysis, directed weighted network

JEL codes: G18, G21, G28

1 Introduction

The financial crisis has highlighted the need for analysis of complex economic structures in order to assess the systematic risk in a more accurate way. The network analysis is, in general, able to address two types of questions (Allen and Babus, 2008): (1) network effects of the particular network structure (resilience of a network towards systemic or idiosyncratic shock and related contagion effects); (2) network formation as a response to the external or internal shocks (how links between nodes are formed and destroyed). The topology of a network affects its functionality and stability (Albert and Barabasi, 2002; Newman, 2004). The scale-free networks (i.e. networks with a power law distribution of degrees) are extremely vulnerable to intentional attacks on their hubs (Albert et al., 2000) as well as to epidemics (Barthélemy et al., 2005).

In finance, most of the theoretical economic literature concentrates on the first question using network analysis to assess systemic risk and risk of contagion with respect to a particular network structure. The seminal paper in this area by Allen and Gale (2000) shows that better connected networks are more resilient to contagion and in case of a complete structure the system is fully resilient to contagious effects. Gai and Kapadia (2007) develop a model of contagion in financial network using literature on spreading the disease in epidemiological literature. While the greater connectivity reduces the likelihood of widespread default, the shocks may have a greater impact on entire system when they occur as in case of less connected network. The resilience of more connected network is highly dependent on shocks hitting fragile points associated with structural liabilities. On top of that, financial system tends to be fragile by its very nature when a behavior of one agent within a network may induce further distress to other agents (Cifuentes et al., 2005).

Empirically, network analysis is widely used for studying the structure of domestic interbank system (Cocco et al., 2009; Furfine, 2003; Iori et al., 2008), global banking network (Minoiu and Reyes, 2010; Hattori and Suda, 2007), international financial network (Cetorelli and Peristiani, 2009; Kubelec and Sa, 2010), global financial derivatives network (Markose, 2012) and other sectors of financial system. For a more detailed overview of the network analysis and its current stance see Allen and Babus (2008).

This study uses network analysis for investigation of topological structure of the European banking network in terms of the foreign claims, thus exposures toward country risk. In this sense, we focus on a systematic part of the financial system risk. As argued in Minoiu and Reyes (2010) the analysis of gross exposures can be a useful indicator of

the ***contagion potential***, thus ***measure of systemic risk*** while the cross-border flows of financial capital reflect liquidity conditions in international markets and as such can be an informative source of financial distress. In that sense, our study expands research done by Allen et al. (2011) and Schoenmaker and Wagner (2013).

The paper is structured as follows. In the introductory part we briefly characterize the European Single Supervisory Mechanism. In the following section we present topological network measurements that are used to characterize the banking network of the EU13 economic space. The results are discussed in the third section of this paper. Conclusions summarize our key findings.

European Single Supervisory Mechanism (SSM)

As one part of the solution to the European financial and debt crisis, the European Commission's proposal from 12 September, 2012 assigns the European Central Bank (ECB) new banking supervision tasks over the eurozone area's bank network. The Single Supervisory Mechanism represents first of the three-pillar system of the European Banking Union that creates supranational supervisory architecture for common bank supervision in the EU with ECB given the final supervisory power and national supervisors providing supporting roles.

Five basic conditions are given as the borderline between national and supranational jurisdiction: (1) the value of bank assets exceeds € 30 billions (*the size criterion*), (2) the value of bank assets exceeds both € 5 billions and 20% of the GDP of the member state in which it is located (*the economic importance criterion*), (3) the bank has large cross-border activities (*cross-border activities criterion*), (4) the bank receives assistance from a eurozone bailout fund (*direct public financial assistance criterion*), (5) the bank is among the three most significant banks of the country in which is located. These conditions are non-excludable and the bank can assume role of supervised entity under the ECB supervision on the basis of ***any*** of these conditions (ECB, 2014, Article 39).

Only the member states of the eurozone are obliged to follow the SSM scheme and become the members of the newly established European Banking Union. The non-eurozone member countries may enter and freely exit "close cooperation agreement" procedure. In that case the countries will act as a full member of the SSM and will be obliged to all rights and responsibilities.

By the Article 59 (ECB, 2014, §1-3) the supervised group may be considered significant by the ECB on the basis of cross-border activities only when parent undertaking of a supervised group has established subsidiaries, which are themselves credit institutions, in more than one other participating Member State. A supervised group may be considered significant by the ECB e basis of its cross-border activities only if the total value of its assets exceeds EUR 5 billion and: (a) the ratio of its cross-border assets to its total assets is above 20 %; or (b) the ratio of its cross-border liabilities to its total liabilities is above 20 %.

The definition of the cross-border assets and liabilities are specified in the Article 60 (ECB, 2014, §1-2). Cross-border assets', in the context of a supervised group, means the part of the total assets in respect of which the counterparty is a credit institution or other legal or natural person located in a participating Member State other than the Member State in which the parent undertaking of the relevant supervised group has its head office. Cross-border liabilities', in the context of a supervised group, means the part of the total liabilities in respect of which the counterparty is a credit institution or other legal or natural person located in a participating Member State other than the Member State in which the parent undertaking of the relevant supervised group has its head office.

2 Methodology and Data

Network analysis allows one to investigate complex structure of various economic relationships among different economic agents. In our terms, the sovereign countries

represent single economic agents that are connected to each other through foreign claims. Such a financial system can by visualized by a graph that consists from a list of nodes $\{1,2,\ldots,N\}$, where N stands for number of countries included into analysis, and a set of links with directed arrows connecting any two nodes. From the mathematical point of view, the financial network is represented by the $N \times N$ adjacency matrix $\mathbf{A}$, where $a_{ij} = 1$ indicates the existence of a link between nodes (countries) i and j, $a_{ij} = 0$ otherwise and with zeros on main diagonal as the self-interactions are not allowed (not economically sensible).

Weighted network allows one to attach a positive number (weight) to each connection in the network that typically captures the strength of interaction between two economic agents represented by network nodes. By the nature of the foreign banking claims we are able to create two weighted matrices, $\mathbf{W}^O$ for outward investments (foreign claims) and $\mathbf{W}^I$ for inwards investments (foreign liabilities). Any non-zero entry w_{ij}^O measures the share of foreign claims originating in country i and being transferred to country j on total financial assets of the financial corporations sector of country j. The matrix of outwards investments $\mathbf{W}^O$ is transpose of the weighted matrix of inward investments $\mathbf{W}^I$. Mathematically, the following must hold:

$$\mathbf{W}^I = \left(\mathbf{W}^O\right)^T \tag{1}$$

Topological Measures of the Banking Network

In our paper we deal with weighted directed networks. From this reason the following statistical measurements are employed.

The ***in-strength (out-strength) degree*** of a node i measures strength of dependency in form of a share of foreign claims received (issued) from (by) country i on total domestic credit provided by the banking sector in that particular country w_{ij} and is given by the following expression:

$$s_i^I = \sum_{j \in \forall i} w_{ij}^I \ , \ s_i^O = \sum_{j \in \forall i} w_{ij}^O \tag{2}$$

The weights of edges linked to the particular node can either be of the same magnitude or they can be heterogeneously distributed with some edges dominating the others. The measurement of this heterogeneity is sometimes called as the ***participation rate ratio*** or disparity measure, but in reality is nothing else as the widely used Herfindahl-Hirschmann index. Participation ratio close to unity indicates preferential relationships between nodes and is calculated as follows:

$$h_i^W = \sum_{j \in \forall i} \left(\frac{w_{ij}}{\sum_{j \in \forall i} w_{ij}} \right)^2 = \sum_{j \in \forall i} \left(\frac{w_{ij}^O}{s_i^O} \right)^2 \tag{3}$$

Symmetry of the Banking Network

As the existence of directed and weighted networks brings along a more complicated and convoluted analysis, researchers tend to symmetrize the network (i. e. making in undirected) and then apply standard procedures for undirected network analysis. We use the symmetry index proposed by Fagiolo (2006) in order to check for symmetry of a weighted matrix $\mathbf{W}^{O(I)}$ to reject or confirm the hypothesis, that the banking sectors of the chosen EU28 member states in terms of country risk exposure is highly skewed. In other words, symmetric matrix would imply that the net positions (assets-liabilities) are zeroed on average.

After testing for the symmetry of a network we compute the difference between out-and in-strength of a link ij to capture the net exposure of the country banking sector in terms of net foreign claims of foreign banks. For the measurement of the dependency between foreign banking sector and domestic banking sector in general we will calculate the ***dependency measure*** in the following way:

$$d_i = \sum_{j \in \forall i} \left(w_{ij}^O - w_{ji}^O \right)^2 = \sum_{j \in \forall i} \left(w_{ji}^I - w_{ij}^I \right)^2 = \sum_{j \in \forall i} l_{ij}^2 \qquad (4)$$

Dataset Description

The dataset used in our analysis spans from year 2007 to the end of 2012 and observations are collected on yearly basis. Data are taken from the Bank for International Settlements (BIS) database for consolidated banking statistics on bilateral basis for 13 member states of the European Union for which we have complete data on bilateral foreign claim linkages.[1,2]

According to the BIS guidelines for reporting the BIS international banking statistics (BIS, 2014, p. 54), the foreign claims are defined as: "financial claims on residents of countries other than the reporting country, i.e. claims on non-residents of the reporting country. In the consolidated banking statistic, foreign claims are calculated as the sum of cross-border claims and local claims (in all currencies) of reporting banks' foreign affiliates, or equivalently of international claims and local claims denominated in local currencies." In comparison, the international claims are defined as (BIS, 2014, p. 55): "sum of cross-border claims in any currency and local claims of foreign affiliates denominated in non-local currencies." As we focus on exposure of domestic (reporting) banking sector to total country risk we will take data on foreign claims that includes both domestic as well as foreign claims of foreign affiliates of domestic banking sector.

The total foreign claims of reporting country against the receiving country will be divided by the total financial assets of financial corporations[3] sector on consolidated basis as reported by the Eurostat in local currency converted to the US dollars by the end of period exchange rate. Basically, this is in line with procedure used in Allen et al. (2011) and Schoenmaker and Wagner (2011) for calculation of the outward and inward integration index.

3 Results and Discussion

In this section we discuss results of the network analysis based on the data for EU13 countries in terms of claims of their banks' foreign claims, i.e. country exposure and measurement of systemic risk. Before discussing the topological properties of the EU13 banking network let us briefly comment the role of foreign claims in total financial assets of the domestic financial corporations sector measured by inward integration index (in-strength degree). If in 2007 the index values varied from 11 percent (United Kingdom) to 31 percent (Greece), the financial and consequently the debt crisis has caused drop to minimum level 5 percent (United Kingdom) and maximum 22 percent (Belgium). Apparently, even after the crisis the level of foreign exposure in domestic banking sector

[1] Austria, Belgium, Denmark, France, Germany, Greece, Ireland, Italy, Netherlands, Portugal, Spain, Sweden, United Kingdom.

[2] The BIS statistics provides data on foreign claims provided by 25 reporting countries from which only 13 countries belong to the EU28 economic region. Even though the creation of the bilateral matrix for 28 EU member state would be in theory possible the matrix would be incomplete. The paper by Allen et al. (2011, p.63) replaces the missing values for the rest 15 countries by zeros stating that: "Finland and Luxembourg, (…), as well as the new member states do not have any large banks that do sizeable business abroad." We do not follow their approach for the sake of data consistency.

[3] By the definition provided by Eurostat the financial corporations sector comprises all private and public entities engaged in financial intermediation such as monetary financial institutions (broadly equivalent to banks), investment funds, insurance corporations and pension funds.

of some countries represents a significant factor for assessment of its stability and support the need for assessment of the systemic risk present in the entire EU13 banking network.[4]

Table 1 reports the standardized Fagiolo Index values for period 2007 to 2012. In all years the computed indices are way over the zero threshold suggested by Fagiolo (2006) indicating that the matrix is directed, thus highly asymmetric. In economic terms, the high level of foreign claims floating from country i toward country j is not being reciprocated by backward flows in form of foreign liabilities originating in country j.

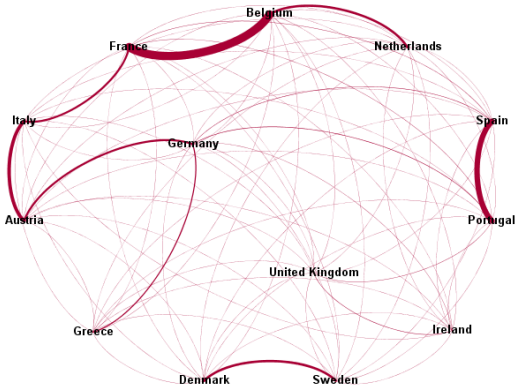
Table 1 Fagiolo Symmetry Measure of the EU13 Banking Network

	2007	2008	2009	2010	2011	2012
Fagiolo Index	18.479	20.316	22.083	20.524	20.864	20.181

Turning to the development over time, the highest level of asymmetry was achieved in year 2009 with a subsequent decrease. Yet, the changes in the Fagiolo index over this relatively short period cannot be considered significant and are barely able to cover the fact that the relationship between domestic banking sectors in EU13 is highly asymmetric in terms of creditor-debtor position.

Table 2 and Table 3 provide the summary of the in- and out-strength degree of the banking sectors in the EU13 banking network. The countries with the highest influence over the banking sector of their network partners are France and Germany followed by Netherland and UK (out-strength degree). On the other side stand countries such as Portugal, Belgium and Austria (in-strength degree) and plays role of the most exposed countries toward their foreign partners. Regarding the evolution over time, the significant drop in the in- as well out-strength degree signalizes substantial closing out of the foreign positions of network members. This tendency is the most visible in case of the PIIGS countries, such as Greece, Ireland or Italy (in-strength degree) where the debt crisis has led to fall in their dependency on foreign banking sector, on one hand, but resulted to higher dependency on the international institutions ("Troika") on the other hand. Belgium, as the representative country of the Western developed economies, proves to be a special case due to the problems of domestic banking sector caused by the financial crisis in 2008. While the dependency of domestic banking sector had increased to an unprecedented levels (in-strength degree, 2009), the foreign creditor position of domestic banking sector was hit severely and reached its bottom (out-strength degree, 2012).

Figure 1 EU13 Banking Network by Dependency Measure in Year 2012



[4] Dependency on foreign financing is even more visible in the case of new EU28 members, such as Slovak or Czech Republic. Initial calculations suggest that the value of inward integration index for those countries fluctuates around 60 percent.

Table 2 In-Strength Degree of the EU13 Banking Network Nodes

	Austria	Belgium	Denmark	France	Germany	Greece	Ireland	Italy	Netherland	Portugal	Spain	Sweden	UK
2007	24.729	19.396	14.068	9.224	9.608	31.712	18.993	22.264	11.140	27.394	20.653	10.295	10.846
2008	24.009	19.550	11.637	8.071	9.080	28.001	17.872	20.373	8.617	27.185	19.943	11.000	7.298
2009	21.263	27.151	13.375	6.887	8.403	25.649	15.195	18.526	7.457	27.346	18.148	9.927	7.268
2010	18.353	22.236	13.105	6.709	8.234	18.686	11.304	14.569	7.353	22.731	14.924	8.204	6.074
2011	17.654	21.965	13.114	6.850	7.271	16.876	9.967	12.152	7.170	21.872	12.390	7.670	5.129
2012	17.328	21.910	12.983	5.954	7.437	8.098	7.960	11.080	7.516	18.823	10.631	7.978	5.156

Source: author's computation

Table 3 Out-Strength Degree of the EU13 Banking Network Nodes

	Austria	Belgium	Denmark	France	Germany	Greece	Ireland	Italy	Netherland	Portugal	Spain	Sweden	UK
2007	3.660	16.019	5.754	46.257	54.746	0.158	8.716	18.347	26.961	2.578	15.726	8.758	22.641
2008	3.126	11.324	6.837	46.057	49.878	0.122	7.005	19.169	21.837	2.688	15.316	7.691	21.588
2009	3.222	5.102	5.127	56.777	45.961	0.296	6.155	15.352	19.166	3.154	15.540	9.126	21.615
2010	2.375	4.063	4.511	42.012	38.911	0.237	3.157	13.472	14.649	3.128	14.488	10.068	21.416
2011	1.955	2.993	4.176	38.314	34.424	0.222	0.928	13.032	14.089	2.651	14.659	11.426	21.212
2012	1.389	2.069	4.174	31.579	30.779	0.262	0.755	11.932	13.632	2.252	14.281	11.049	18.703

Source: author's computation

Table 4 HHI Index for the In-Strength Degree and Out-Strength Degree of the EU13 Banking Network Nodes (average, 2007-2012)

	Austria	Belgium	Denmark	France	Germany	Greece	Ireland	Italy	Netherland	Portugal	Spain	Sweden	UK
In-Strength	0.332	0.337	0.435	0.221	0.168	0.261	0.212	0.315	0.209	0.265	0.197	0.275	0.179
Out-Strength	0.126	0.139	0.625	0.163	0.105	0.156	0.172	0.383	0.200	0.294	0.475	0.689	0.115

Source: author's computation

Table 5 Dependency Measure of the EU13 Banking Network Nodes (average, 2007-2012)

	Austria	Belgium	Denmark	France	Germany	Greece	Ireland	Italy	Netherland	Portugal	Spain	Sweden	UK
Austria	0.00	0.16	0.02	2.49	**51.03**	0.40	0.16	**74.37**	0.31	0.04	0.05	0.00	0.38
Belgium	:	0.00	0.02	**107.53**	3.14	1.44	1.78	0.07	**34.40**	0.43	0.07	0.01	1.52
Denmark	:	:	0.00	0.79	4.80	0.00	0.11	0.02	0.22	0.01	0.01	*21.39*	0.26
France	:	:	:	0.00	0.08	**77.55**	1.99	**61.36**	0.85	*13.68*	*12.28*	0.78	1.72
Germany	:	:	:	:	0.00	**33.33**	*13.30*	2.06	0.88	*23.77*	*21.58*	3.33	1.02
Greece	:	:	:	:	:	0.00	0.92	0.84	3.19	1.61	0.02	0.01	3.66
Ireland	:	:	:	:	:	:	0.00	0.10	0.39	0.16	0.05	0.03	*12.73*
Italy	:	:	:	:	:	:	:	0.00	1.42	0.36	0.03	0.01	1.24
Netherlands	:	:	:	:	:	:	:	:	0.00	1.27	3.92	0.17	1.39
Portugal	:	:	:	:	:	:	:	:	:	0.00	**90.80**	0.00	6.80
Spain	:	:	:	:	:	:	:	:	:	:	0.00	0.00	1.27
Sweden	:	:	:	:	:	:	:	:	:	:	:	0.00	0.69
UK	:	:	:	:	:	:	:	:	:	:	:	:	0.00

Source: author's computation

Let us now focus our attention on the properties of the EU13 banking network in terms of its heterogeneity. Even though the absolute changes in the in- and out-strength degrees, thus the foreign exposure, are substantial the distribution of power remains relatively constant with slow upward trend towards more concentration in both in- and out-strength degree. From this reason we do not report the evolution of the HHI indices over time but only their 6-year averages.[1] As apparent from the results presented in the Table 4, to countries with highest concentration of their dependency (in-strength degree) or their power (out-strength degree) belong Sweden, Denmark, Spain and Italy followed by Austria and Belgium. Countries that are able to distribute their foreign exposure the most heterogeneously are Germany, UK, Ireland and France.

The last piece of the puzzle called EU13 banking network is provided by the Table 5 and visually presented in the Figure 1. The banking system is not only centralized but also highly asymmetric with some countries serving as leaders and some as the followers. This leads to the structure characterized by two almost separated clusters (Denmark -> Sweden, Spain -> Portugal); one chainlike hybrid (Netherlands -> Belgium <- France; France -> Italy -> Austria; Germany -> Greece <- France) and United Kingdom and Ireland loosely connected to each other. The geographical distances linked to other cultural and social factors clearly play a significant role in determining the strength of the linkages in the EU13 banking network.

The third criterion in the SSM mechanism is related to the cross-border activity of a banking entity that is subject to the international jurisdiction. As we show the cross-border in narrower and foreign banking in broader sense represent an integral part of the European banking network which is reflected by inclusion of the cross-border activity criterion into the assessment of systemically important banking institutions (groups).

From the perspective of the EU13 banking network the network can be characterized by high level of clustering on country level that may have a potential impact on the systemic risk of the banking sector on an international level. The one country from the EU13 group that is likely to stay outside of the SSM mechanism is the United Kingdom. This decision is understandable once we recall that the UK scores very low in in-strength degree which only reflects the low exposure of the UK banking system towards the other members of the EU13 in relative numbers. Additionally, the UK banking system is the one with the most heterogeneously distributed claims and liabilities against the EU13 banking network which is likely to positively affect its robustness. The costs related to the single supervisory mechanism imposed by the ECB are thus likely to be considered inappropriate from the perspective of the UK policy makers. Interestingly, as the UK banking system is marked by the relative high out-strength degree which, economically speaking, means that the UK banks own a relatively significant portion of the EU13 banking network, the establishment of the SSM mechanism might increase the safety of the UK exposure without bearing the costs associated with the regulatory change.

The highly asymmetric EU13 banking network supports the need for a common supervisory mechanism procedure as the domestic banking sectors of highly dependent countries are likely to be hit most severely once a liquidity shortage on international level occurs. In order to avoid the "cut and run" behavior of the owners of foreign capital (Allen et al., 2011) the Single Supervisory Mechanism can serve as a stabilizing component to prevent such a behavior.

Lastly, due to the uncertain times ruling over the last five years the foreign banking has been significantly reduced, as our numbers suggest. Allen et al. (2011) and Schoenmaker and Wagner (2013) argue that cross-border banking can yield significant gains from the international diversification. The SSM procedure can indirectly affect decisions of the banking institutions to reestablish channels of international capital flows that have been previously closed due to the financial crisis or to create the new ones which could lead to a more stable and less asymmetric banking network.

[1] One exception to this rule is Denmark where the concentration in the in-strength degree has almost doubled to 0.567 over the last six years.

4 Conclusions

This paper investigates the properties of the EU13 banking network in terms of foreign claims exposures in light of the currently established Single Supervisory Mechanism. The banking network of the EU13 economic space can be characterized as highly asymmetric with tendency to create clusters based on geographic distance and cultural and social similarities. The total exposure measured by the share of foreign claims on total domestic financial asset of financial corporations sector has decreased due to the financial and debt crisis in Europe. From this perspective the Single Supervisory Mechanism can serve as a stabilizing mechanism that ensures that the countries in dependent position will be less exposed to the "cut and run" behavior. On top of that the Single Supervisory Mechanism could encourage banking sector to restore foreign financing in order to earn possible benefits from international diversification.

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Relation of CSR and Market Measures of Financial Performance: International Evidence

Tomasz Słoński, Karolina Daszyńska-Żygadło, Bartosz Zawadzki

Wrocław University of Economics
Institute of Financial Management
118/120 Komandorska St., 53-345 Wroclaw, Poland
E-mail: tomasz.slonski@ue.wroc.pl, karolina.zygadlo@ue.wroc.pl, bartosz.zawadzki@ue.wroc.pl

Abstract: *This study assesses the relationship between corporate social performance and financial performance. We measure CSR practices through a reliable, complete and worldwide database, ASSET4 provided by Thomson Reuters. We use Tobin's q as a proxy of financial performance and introduce numerous control variables such as size, sales growth, year, industry and region. We find different levels of sensitivity among investors to different CSR dimensions. Using disaggregated measures of CSR, we find robust significant negative impact of the environmental dimension of the CSR scoring and measures of financial performance and positive when it comes to different CSR actions.*

Keywords: CSR, Tobin's q

JEL codes: G38, G32, Q

1 Introduction

In the mainstream theory of finance the only goal of the firm is to maximize shareholder wealth (Friedman, 1962). The purpose of a firm is not to act in the moral sphere or play the role of government, but mainly to do business (Levitt, 1958). In reference to neoclassical point of view, the firm shouldn't take into account any externalities since the money spent on social activities and "moral" stakes is lost for shareholders. It has been argued that CSR is expensive and demands significant portions of corporate financial resources, although benefits of CSR can be reaped only in the distant future if at all. Additional constraints result in additional costs and it makes the firm less efficient. In the long term it causes lower competitiveness in reference to less "responsible" competitors. Therefore acting towards stakeholders' satisfaction is considered counterproductive from purely financial standpoint (Shleifer, 2004). It is also argued that firms implementing CSR policies and activities can get distracted by adopting additional goals which can then lead to a negative impact on their profitability (Aupperle, Carroll, Hatfield, 1985).

On the other hand there are arguments for a positive effect of corporate sustainability performance on financial performance based on neoclassical microeconomics. One of the arguments suggests that governments do not fully resolve all problems with external effects and that competitive markets are not efficient. It can be dated back to one of the first works on defining market failures (Bator, 1958). It reflects the assertion according to which market fails when acting upon private interests leads to ineffective results, and it can be improved by actions including social interests. This is why CSR activities can substitute missing markets (and thus missing regulations) if external costs arise from them. These activities can also reduce conflicts between firms and stakeholder groups, such as the government, the general public, non-governmental organizations, competitors, employees, or clients. It can therefore be financially beneficial to engage in environmental and social activities because otherwise these stakeholders could withdraw the support for the firm. In succession a stakeholder theory comes up front. It's proponents (Freeman, 1984; Donaldson and Preston, 1995) believe that ethical behaviour and profit are not mutually exclusive. Although money spent on ethical issues is not paid to shareholders over the short term, it might enable the firm to be more profitable in the future. Among others, ethical behaviour can lead to reputational advantages, such as attraction of sensitive consumers (Guenster et al., 2010), it can also help to avoid social problems as well as environmental disasters. Investing in the moral area can be seen as an opportunity to protect the firm against future risks (Godfrey et

al., 2009) and play an important role in foreseeing environmental conflicts and distributional conflicts (Heal, 2005). It could protect the company from facing those conflicts and mitigate their escalation if they appear. Sustainable or socially responsible companies are claimed to have better financial performance since they represent well-managed firms and are less risky (Renneboog, at al. 2008a). These firms also connect better with their different stakeholders, which can translate into more revenues, lower expenses and less risk (Renneboog, et al.2008b).

The aim of this paper is to find the relation between different types of firm's actions present in the CSR universe. Next, we would like to differentiate specific types of CSR actions and measure their impact on the financial performance. We extend our analysis by checking the results with a wide range of control variables.

Our contribution to the literature on Corporate Social Performance (CSP) is threefold. First, our paper extends prior large scale American studies by utilizing data of 4000 firms from 60 countries. Second, we investigate financial performance of socially responsible companies, we investigate the relation of CSR actions undertaken by companies in three specific dimensions, namely: environmental, social and governance. Thirdly our proxy for CSP is the scoring of Thomson Reuters ASSET4 that hasn't been used for that type of research, yet (to the best knowledge of authors). Therefore this condition creates opportunity to confirm or reject hypotheses tested on different datasets being proxies for CSP.

The remainder of the paper is organized as follows. In the next section there is the literature review on CSR valuation. In the third section there is the description of data and research methodology. In the fifth section we present results and the discussion. The last section contains the conclusion.

2 Literature Review

Majority of the empirical research concentrates on finding relation between financial performance, including value creation and socially responsible activities of a company. Most of the empirical studies focus on the link between financial and CSR performance, while the relationship between value creation and CSR activities is less explored.

Waddock and Graves (1997) when conducting research on large sample of US companies found significant relationship between composite measure of CSR and financial performance, while Mahoney and Roberts (2007) obtained contradictory results. However their findings indicate significant relationship between individual measures of environmental and international activities and financial performance. Findings of Makni et al. (2008) stay in line with previous study, additionally they found a robust significant negative impact of environmental dimension of CSR and three financial performance measures (return on assets, return on equity and market returns). These results are consistent with trade-off hypothesis and in part with the negative synergy hypothesis which states that socially responsible firms experience lower profits and reduced shareholder wealth which as a consequence limits the capital expenditures for socially responsible investments.

It could be stated that results of different empirical studies are mixed and inconclusive and require further research.

In reference to research results on relationship between value and CSR it could be noticed that the scope and proxies for CSR activity vary throughout the time. It results from limited range of measures of sustainability prior year 2000, most of the CSR rankings and composite equity indices were launched in 2001 or 2002. Therefore researchers used environmental measures or toxic pollution. In early studies environmental data obtained from Investor Responsibility Research Center is used by research of Dowell et al. (2000) and Konar and Cohen (2001) or toxicity emissions and waste treatment (obtained from Toxic Release Inventory) (King and Lenox, 2002). While in newest studies KLD ratings and Innovest database is the source of CSR data (Bird et

al., 2007; Galema et al., 2008; Guenster et al., 2010).

Proxy for valuation is majorly the Tobin's q (Tobin 1969; Dowell et al. 2000; Konar and Cohen 2001; King and Lenox, 2002; Beiner et al., 2006; Guenster et al., 2010; Marsat and Williams, 2013) and on the second place market value - to - book value (MV/BV) (Bird et al., 2007; Galema et al., 2008; Marsat and Williams, 2013).

The study of Dowell et al. (2000) conducted on the sample of US multinational companies in years 1994-1997 shows that firms adopting a single stringent global environmental standard have much higher market values, as measured by Tobin's q, than firms defaulting to less stringent, or poorly enforced host country standards. On the basis of these results authors suggest that externalities are incorporated to a significant extent in firm's valuation. On the other hand Konar and Cohen (2001) provide results showing that poor environmental performance is negatively related to the difference between book value of assets and market value of assets represented by Tobin's q. It can be interpreted as indirect proof of positive relation of excellent environment performance and market value.

Main research conducted by Galema et al. (2008) finds that market valuation is positively related to corporate social responsibility supporting the stakeholder theory. Authors have constructed portfolios out of companies screened by KLD Research & Analytics, Inc., dividing them into positive CSR performance and negative CSR performance within six themes: community involvement, corporate governance, diversity, employee relations, environment, and product. They results suggest that strength portfolios (positive CSR performance) are more growth oriented that their concern counterpart (poor CSR performance), they also have lower book-to-market ratios which is consistent with overpricing. It indicates that strength portfolios should have lower performance than concern portfolios, but it is not the case with the community strength portfolio which significantly outperforms its accompanying concern portfolio.

As Marsat and Willams (2013) mention the results could be dependent on the choice of market (only US firms) and usage of KLD data which can be challenged. For Chatterji and Levine (2006) "KLD uses largely qualitative and subjective measures, which make it difficult to produce comparable and reliable metrics".

On the other hand conducting research on data from ratings of MSCI ESG (as Marsat and Williams, 2013) could also be biased by the significant influence of MSCI ESG analysts who assess the key issues of each industry. Therefore, the MSCI ESG measures can also be seen as subjective.

Marsat and Williams (2013) found, contrary to the mainstream of empirical related research, that high CSR involvement, and particularly eco-efficiency, is not rewarded by shareholders. They suggest that it results from high reliance of the process on the dataset or it might result from the change of perception of environmental involvement of investors throughout the time.

Our research provides evidence for the relation of CSP and financial performance, including market value creation, similar to Marsat and Williams (2013), but using different proxy for CSP, different time period and different sample of companies. In our study we would like to test following hypothesis:

H1. The firm's actions performed within CSR universe are cohesive.
H2. Social dimension of CSP enhances the financial performance.
H3. Environmental dimension of CSP enhances the financial performance.
H4. Corporate governance dimension of CSP enhances the financial performance.

In order to empirically test the challenges resulting from different dataset, we constructed the sample on the bases of ASSET4 database. It is said to provide transparent, objective, and auditable extra financial information and to offer a comprehensive platform for establishing benchmarks for the assessment of corporate performance.

3 Data Description and Methodology

The CSR data on firms is taken from Thomson Reuters Asset4 Database. To the three main proxy dimensions of corporate social responsibility: environment, social and corporate governance, Asset4 universe adds additional economic score as one of its pillars of the CSR performance assessment. Financial data comes from the Thomson Reuters and Bloomberg databases. Research is conducted for the period of 2009-2012.

ASSET4 gathers extensive, objective, quantitative and qualitative ESG data on almost 4000 global companies (as of Q1 2014) and scores them on four pillars: Environmental, Social, Corporate Governance, and Economic. Research analysts collect more than 600 data points per company since fiscal year 2002. According to Thomson Reuters all data must be objective and publically available, though analysts are permitted to contact company investor relations offices to learn the location of public data.

Financial data for our research is divided into valuation proxy (dependent variable) and control (independent) variables taken from Thomson Reuters Datastream and Bloomberg databases. Tobin's *q* is used as a proxy for asset valuation. For Tobin's *q* we have used the values provided by Thomson Reuters Datastream database.

Following (Barth et al., 1998), firm's value is influenced by firm profitability, firm size and sales growth. For the sake of the correctness of the model's specification we used a complete set of those variables. Return on Equity (RoE) is used a measurement of firm profitability; firm size is defined as a logarithm of the market enterprise value; sales growth as one-year revenue growth; Table 1 shows summary statistics for financial data.

Table 1 Summary statistics of financial data

	Mean	Median	Maximum	Minimum	Std. dev.	Skewness	Kurtosis
ROE	12.27	11.17	135.15	-83.07	17.64	0.43	11.17
Sales growth	6.61	4.49	183.94	-58.12	22.78	1.73	11.27
Tobins Q	1.60	1.26	20.30	0.00	1.05	4.50	41.95
Ln(Size)	16.59	16.09	24.37	8.30	2.45	0.55	2.91

Source: Own calculations

We control for years, industry and world regions (using dummy variables). The industries are coded according to Dow Jones industries level 1. Data breakdown is presented in Table 2.

Table 2 Observations by industry, year and region

Industry	Obs.	[%]	Year	Obs.	[%]	Region	Obs.	[%]
Consumer Discretionary	1177	15	Year 2009	2589	33	Asia	2052	26
Financials	1491	19	Year 2010	2753	35	Australia	632	8
Materials	863	11	Year 2011	2231	28	Europe	2095	27
Information Technology	733	9	Year 2012*	292	4	North America	2801	36
Industrials	1364	17				South America*	181	2
Utilities	413	5				Africa	104	1
Telecommunication Services*	204	3						
Consumer Staples	529	7						
Health Care	455	6						
Energy	636	8						
Total	7865	100	**Total**	7865	100	**Total**	7865	100

Note: Data marked with asterisk was not used as dummies in the regression
Source: Own calculations

To find relation between Based on OLS (ordinary least squares) regression, we estimated the specified model (model 1) with Tobin's *q* as the dependent variable. Following

Guenster *et al.* (2010), dependent variable is measured using three different approaches: in level, in logs and trimmed (the procedure ensures a limited effect of outliers). The trimming procedure allows dropping potential outliers in the extreme left and right 0.5 percent of the distribution.

Model 1:

$$Value_i = \beta_0 + \beta_1 CSR\ Rating_i + \beta_2 RoE_i + \beta_3 Size_i + \beta_4 Sales\ growth_i + \sum_{j=1}^{9} \text{Industry}_{i,j} + \sum_{j=1}^{3} \text{Year}_{i,j} + \sum_{j=1}^{5} \text{Region}_{i,j} + \varepsilon_i \quad (1)$$

Where: $Value_i$, valuation proxy for observation i; $CSR\ Rating_i$, proxy for CSR level; RoE_i, Return on Equity; $Size_i$, logarithm of enterprise value; $Sales\ growth_i$, one-year revenue growth; $Industry_{i,j}$, dummy variable for industry set j ; $Year_{i,j}$, dummy variable for year j; $Region_{i,j}$, dummy variable for region $_j$; ε_i, residual.

4 Results and Discussion

The correlation matrix (Table 3) shows that while CSR variables are correlated between one another, although to different extent. There is a strong co-movement between environment and social activities (the highest correlation) as well as economic and social activities (the second biggest correlation). Corporate governance actions are relatively less correlated. Since our first hypothesis is not confirmed, we find a strong motivation to check how each of dimensions influences financial performance. All five dimensions are negatively correlated with the valuation proxy (Tobins'q). On the other hand, financial factors (ROE and sales growth) are positively correlated with the ratio (there is no correlation with size). It also worth mentioning that sales growth is negatively correlated with all five CSR variables.

Table 4 shows the results of the estimation for years 2009 – 2012. For each of dependent variables: Tobin's q, ln (Tobin's q), Trimmed Tobin's q, Trimmed ln (Tobin's q) we run regressions which exhibit an adjusted R-squared between 27.32% and 36.56%. The proxies of CSR ranking are significant except for CSR Social actions. Only environmental actions have negative sign of coefficient which suggest value destruction. Nevertheless, all CSR activities have minor impact on financial performance. We accept second and fourth hypothesis and reject the third one.

Table 3 Correlation matrix

	Overall	Economic	Environment	Social	Corporate	Sales growth	ROE	Size	Tobins Q
Overall	1.00								
Economic	0.81	1.00							
Environment	0.87	0.57	1.00						
Social	0.91	0.67	0.83	1.00					
Corporate	0.62	0.38	0.36	0.39	1.00				
Sales growth	-0.12	-0.07	-0.12	-0.14	-0.07	1.00			
ROE	0.17	0.28	0.11	0.18	-0.02	0.11	1.00		
Size	0.00	0.05	0.05	0.05	-0.17	0.01	0.02	1.00	
Tobins Q	-0.19	-0.12	-0.19	-0.14	-0.17	0.17	0.25	0.01	1.00

Source: Own calculations

We decide to control results using a wide range of variables. Industry dummies provide many valuable information on CSR ranking. There is the biggest positive premium for Health Care industry, Consumer Staples being second, followed by Materials and Consumers discretionary. We find a discount for companies labeled as Financials and Utility. Concerning the continent of the firm's origin we find relatively lesser impact for North American firms comparing to European and Asian ones. We find the positive and

statistically significant impact of financial parameters like ROE and sales growth on dependent variables. Although, comparing to the impact of a sector and a region of the firm's origin, an introduction of financial variables enhance the model very little. Contrary to previous findings (Marsat and Williams, 2013) the firm's size is responsible for a discount in Tobin's q. Our results confirm that the change of Tobin's q depends on time specific events. Generally, events in 2009 enhanced the depended variable whereas in 2011 the market value in relation to book value was destroyed.

Table 4 OLS regression results for 2009-2012

	Ln (Tobins q)			**Tobins q**			**Trimmed ln(Tobins q)**			**Trimmed Tobins q**		
	Coeff.	Std. Error	P-val.	Coeff.	Std. Errorr	P-val	Coeff.	Std. Error	P-val.	Coeff.	Std. Error	P-val
Corporate	0.0005	0.0002	**	-0.0001	0.0006	-	0.0005	0.0002	**	0.0005	0.0005	-
Economic	0.0006	0.0002	*	-0.0002	0.0005	-	0.0007	0.0002	***	0.0006	0.0004	-
Environmental	-0.0023	0.0002	***	-0.0049	0.0006	***	-0.0023	0.0002	***	-0.0049	0.0005	***
Social	0.0004	0.0003	-	0.0010	0.0007	-	0.0004	0.0003	-	0.0010	0.0006	*
Europe	-0.1676	0.0298	***	-0.2278	0.0924	***	-0.1766	0.0288	***	-0.2836	0.0645	***
Asia	-0.1767	0.0285	***	-0.2482	0.0944	***	-0.1819	0.0275	***	-0.2882	0.0616	***
Australia	-0.2108	0.0332	***	-0.2580	0.0989	***	-0.2045	0.0321	***	-0.3056	0.0720	***
Africa	-0.0244	0.0449	-	0.0055	0.1127	-	-0.0268	0.0433	-	-0.0228	0.0971	-
North America	-0.0822	0.0307	***	-0.0950	0.0932	-	-0.0921	0.0297	***	-0.1617	0.0665	**
Consumer Discretionary	0.0700	0.0277	**	0.2222	0.0694	***	0.0629	0.0267	**	0.1924	0.0599	***
Consumer Staples	0.1753	0.0298	***	0.4418	0.0747	***	0.1691	0.0288	***	0.3956	0.0645	***
Energy	0.0435	0.0294	-	0.1137	0.0737	-	0.0501	0.0284	**	0.1074	0.0637	*
Financials	-0.2057	0.0272	***	-0.2641	0.0681	***	-0.2119	0.0262	***	-0.2940	0.0588	***
Health Care	0.2211	0.0306	***	0.4777	0.0767	***	0.2175	0.0295	***	0.4568	0.0662	***
Industrials	0.0275	0.0274	-	0.0988	0.0688	-	0.0273	0.0265	-	0.0847	0.0594	-
Information Technology	0.2371	0.0290	***	0.5852	0.0727	***	0.2234	0.0280	***	0.4897	0.0628	***
Materials	0.0929	0.0285	***	0.2740	0.0714	**	0.0851	0.0275	***	0.2216	0.0617	***
Utilities	-0.1172	0.0311	***	-0.1579	0.0780	**	-0.1203	0.0300	***	-0.1850	0.0673	***
ROE	0.0102	0.0003	***	0.0227	0.0006	***	0.0097	0.0003	***	0.0197	0.0006	***
Sales growth	0.0015	0.0002	***	0.0036	0.0005	***	0.0014	0.0002	***	0.0030	0.0004	***
Ln(size)	-0.0054	0.0027	*	-0.0133	0.0069	*	-0.0053	0.0027	**	-0.0099	0.0060	*
Year 2009	0.0887	0.0231	***	-0.1076	0.0581	*	0.0601	0.0225	***	0.0827	0.0505	*
Year 2010	0.0462	0.0229	**	-0.0834	0.0261	***	0.0211	0.0224	-	0.0165	0.0501	-
Year 2011	-0.0201	0.0231	-	-0.1871	0.0270	***	-0.0466	0.0225	**	-0.0958	0.0504	*
C	0.4100	0.0651	***	1.8621	0.1628	***	0.4434	0.0631	***	1.7494	0.1414	***
R-squared	36.75%			27.54%			36.61%			29.26%		
Adjusted R-squared	36.56%			27.32%			36.41%			29.04%		

Note: ***, **, * represent significance on 1%, 5% and 10% levels respectively
Source: Own calculations

We find that CSR actions, except for eco-efficiency activities, are positively perceived by investors. Negative financial implication of eco-efficient investments to. . In the literature we find three explanations: the first one, supported by (Friedman 1962), states

insolvable conflict in perception of investments leading exclusively to positive externalities. The second one is that acting towards stakeholders' satisfaction is considered counterproductive from purely financial standpoint (Shleifer, 2004). The third one is that firms implementing CSR activities can get distracted by adopting additional goals which can then lead to a negative impact on their profitability (Aupperle, et al. 1985)

The findings about positive impact of remaining CSR activities (i.e. social and governance) are similar to studies Mahoney and Roberts (2007), Makni et al. (2008) and Galema et al. (2008) but contrary to Marsat and Williams (2013). We find positive but negligible impact of social activities and stronger positive impact of governance actions. They could be explained by two factors. Firstly, we use the different dataset designed in a different manner. Secondly, the time-span of our analysis is different, enabling investors to appreciate this type of actions.

5 Conclusions

In this paper we investigate the relationship between different CSR activities and financial performance related to market value of assets. We use Thomson Reuters ASSET4 ratings in order to proxy CSR behaviour of worldwide sample of firms (7865 observations). Additionally we use several control variables like sector, years, financial ratios to test the robustness of the results. We found out that environmental activities have significant negative impact on market value of assets. Corporate Governance activities have minor, but statistically significant positive impact on market value of assets. Social performance has virtually no impact on the market value. One needs to keep in mind, that in the case of CSR investments the valuation is subject to imperfect and incomplete markets. The market for CSR actions is highly imperfect because the connection between the created value and cost can vary significantly. Alternatively stated, the expenditure on CSR is often a key value driver (or, indeed, value destructor). On the other hand, CSR actions tend to be either unique in nature, or inseparable from the company. CSR creates moral capital which is rarely traded and typically without market prices. For these reasons, the market incompleteness must be considered as the main valuation problem. Lastly, testing three dimensions of CSR actions using an entire sample of companies could be perceived as overall vague notion and might hide significant differences between CSR leaders and procrastinators. We think that further evidence is required based on portfolios of companies to confirm the reliability of the measures.

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Macroeconomic Factors and Commodity Price Volatility

Kamil Smolík[1], Oldřich Rejnuš[2]

[1] Brno University of Technology
Faculty of Business and Management, Department of Economics
Kolejní 4, 612 00 Brno, Czech Republic
E-mail: smolik@fbm.vutbr.cz

[2] Masaryk University
Faculty of Economics and Administration, Department of Finance
Lipová 41a, 601 00 Brno, Czech Republic
E-mail: rejnus@econ.muni.cz

Abstract: *In this paper, the relation between prices of individual sectors of commodity markets and values of selected macroeconomic determinants from January 2000 to September 2013 is analysed. This period is characteristic for its fast growth of investments into commodity assets by non-commercial market participants. To describe mutual dependence of development of individual classes of commodities assets and macroeconomic determinants, Spearman correlation coefficient is used. The results of the research refer to relatively high dependence between prices of commodity assets and Nominal Effective Exchange Rate of ISD or World Bank Inflation Rate. The paper draws attention to the fact that since 2008, the dependence between changes of macroeconomic determinants values and price volatility of commodity assets has been growing, with the exception of precious metals, which shows descending dependence. It was proved that most sectors of commodity assets respond to these changes in a similar way, but with different intensity.*

Keywords: commodity markets, macroeconomic determinants

JEL codes: G01, G11, G12, G15

1 Introduction

Macroeconomic determinants are commonly considered to be important indicators that directly influence the price of individual assets on financial markets. When speaking about shares, the validity of this opinion has been proved by study Flannery, Protopapadakis (2002) or Chen, Roll, Ross (1986). In this paper, we assume that there is a causal link between the development of values of macroeconomic determinants and individual sectors of commodity markets, among others agriculture, energies, industrial metals, livestock, and precious metals. This prerequisite can be explained by the fact that macroeconomic determinants directly influence both demand for respective commodities and their production and stock (Borensztein, Reinhart, 1994). The other explanation is growing number of non-commercial participants in the market, which means speculators, when the period after so called "tech share bubble" is typical for growing financialization of commodity markets (Tang, Xiong, 2010; Rejnuš, Smolík, 2013). Financialization of commodity markets is defined as „increasing role of financial motives, financial markets and financial sector entities in commodity markets" (UNCTAD, 2011). Taking into account investment strategies, speculators, as well as those who invest in conventional financial assets, (shares, obligations) can proceed from contemporary or anticipated values of individual macroeconomic determinants.

Based on previous studies, this paper is focused on several macroeconomic determinants, such as inflation, interest rate, Exchange rate of USD or economic growth.

Inflation: Commodities, especially precious metals, are from historical point of view considered to be assets suitable for securing oneself against inflation (Greer, 1978). Furthermore, it is an indicator which, in the framework of consumers' prices of price index of producers, directly reflects the change of prices of commodity assets (Gorton, 2004).

Interest rates: Among prices of commodity assets and short-term interest, inversion relationship is assumed by Frankel (Frankel, 2006). First, it can be explained by the fact that financialization of commodities market supports short-period speculation, for which business participants more and more often borrow money, especially in case of lower interest rates. It means lower costs and leads to increasing of demand for individual commodities. The second, we can say that lower interest rates support investors (as well as speculators) to await faster growth of economy and higher demand for commodities that are used in industry, and their price growth.

Exchange rate of USD: Worldwide, US dollar is the most important currency used in international business and investment transactions. This macroeconomic factor is partially connected with interest rates indicator. The strength of US dollar in connection with commodity market was analyzed by Akram (2007). The results of this study show that weak dollar results in high commodities prices.

Economic growth: The last analyzed macroeconomic determinant is economic growth; we can say that economic growth is an impulse for growth of commodities prices, especially industrial metals or energies (Bhardwaj, Dunsby, 2012).

The goal of this paper is to bring full analysis of relationship between macroeconomic determinants and prices of commodity activities from 2000 to 2013. Within the framework of this analysis, different reactions of price volatility of individual sectors of commodities market in reliance on change of values of macroeconomic determinants are indicated, where monitored time interval is divided into 3 parts: pre-crisis period, year 2008 and following years. Within the analysis, we work on the presumption of the theory of rational expectations, when individual participants who make business on commodity stock exchange quickly respond on newly published news.

2 Data and methodology

From the commodity market sector, commodity futures indexes Agriculture, Energy, Livestock, Industrial Metals and Precious Metals are analysed. The composition of these indexes can be seen in table 1. For all indexes, total revenue is evaluated, which includes spot revenue dependent on revenue of underlying assets as well as collateralized revenue and revenue that results from positions rolling. Mentioned indices are tradable in US dollars and the data were provided by S&P Dow Jones Indices.

Table 1 Structure of commodity indexes 2013

Index	Included Commodities
Energy	Crude Oil (and supporting contracts) and Natural Gas
Agriculture	Wheat, Corn, Soybeans, Coffee, Sugar, Cocoa, and Cotton
Livestock	Lean Hogs, Live Cattle and Feeder Cattle
Industrial metals	Aluminium, Copper, Lead, Nickel and Zinc
Precious Metals	Gold and Silver

Source: S&P Dow Jones Indices, 2013

Within these analyses, worldwide macroeconomic determinants are applied, including following variables:

- *Nominal Customer Price Index* of countries included in the World Bank as an indicator of worldwide inflation.
- Short-term interest rates – *US interest rates, Chinese interest rates a*nd *EURO countries short term interest rates*. The information on short term interest rates comes from OECD statistics.
- Long-term interest rate: *CBOE Interest Rate10-YearT-Note* which data are available at *Yahoo Finance*.

- *Nominal Effective exchange Rate of USD* is provided by World Bank. This variable is the weighted average value of the USD currency relative to pool of foreign currencies.
- The indicator of economic growth is *Global Purchasing Managers index on Manufacturing (Global PMI)*, where data provided by companies Markit and JPMorgan can be found. Another indicator of economic growth is *Global Industrial Production in US Dollar* provided by the World Bank.

To describe mutual dependence of development of individual classes of commodities assets and macroeconomic determinants, Spearman correlation coefficient is used. This coefficient has been chosen for its non-parametric properties. Statistic software Statistica 12 was used for data processing.

Proportional monthly changes of individual variables in the period from January 2000 to September 2013 were analyzed; commodity indices were based on arithmetic mean of prices on business days of given month.

3 Results

Due to high volatility of prices of commodity assets in 2008, compared with other years (see table 2), the monitored period was divided into three parts. Pre-crisis period 2000-2007, year 2008, with strong fluctuation of values of all monitored commodities indices, and period from 2009 to September 2013.

Table 2 Yearly standard deviations of revenues of individual commodities indices based on monthly data

Period	Agriculture	Energy	Industrial Metals	Livestock	Precious Metals
2000	2.572287214	7.601435014	3.479184900	3.164645190	2.840272989
2001	2.816840008	4.347105779	2.588001023	2.674268341	2.117827043
2002	4.467859394	7.774744940	2.616320388	5.380213903	2.139964250
2003	3.409757964	8.164376110	3.032058474	3.043236780	3.947877346
2004	4.374897822	7.898795904	3.529286551	4.371373146	2.994622215
2005	3.811984438	7.289029348	3.740800673	3.100894933	3.043513807
2006	4.648624501	6.039149024	7.350164718	3.510194061	6.985950514
2007	5.418558751	6.294772081	6.178908089	2.532345224	3.563270444
2008	8.770722192	14.16577956	10.24683325	4.107242837	6.696352331
2009	6.052967288	9.051201605	5.566448453	2.875693500	4.190050010
2010	6.337767898	4.916009162	6.797117135	2.476711194	3.032894629
2011	4.376387644	5.447667141	4.586651943	3.358367705	5.164485201
2012	7.589388606	5.818347747	4.705231277	2.147261521	3.853913739
2013*	2.358495236	3.313493241	2.918448080	1.981538799	3.974866650

* 1/2013 - 9/2013

Source: author´s calculation

Tables shown below contain values of correlation coefficients between revenues of individual commodity indices and proportional changes of values of chosen macroeconomic determinants. Table 3 shows correlation coefficients in the period from 2000 to 2007, table 4 contains correlation coefficients in 2008 and table nr 5 will contain the results from 2009 to September 2013. The correlation coefficients in bold indicate a statistically significant correlation with a p-value less than 0.05.

Values of correlation coefficients from 2000 to 2007 are not high. Stronger dependence can be seen only in case of couples - inflation rate and energy, inflation and Precious metals, China Interest Rate and Precious Metals. Furthermore, relatively high value of negative correlation between Exchange Rate of USD and Industrial and Precious Metals was detected. None of these correlations exceeds the value of +/- 0.5.

Table 3 Correlation matrix – commodities indices and macroeconomic determinant, 2000-2007

Variable	Agriculture	Energy	Industrial Metals	Livestock	Precious Metals
PMI on Manufacturing	0.128877	0.114096	0.161674	0.074426	**0.210316**
Industrial Production	0.137668	**0.265566**	0.141545	0.006201	0.182335
Inflation Rate	0.094667	**0.446011**	0.123922	0.010736	**0.371067**
US Interest Rate	0.083062	**0.218432**	0.154142	0.081795	0.060916
EURO countries Interest Rate	**0.203821**	0.028709	0.024874	0.026204	0.038788
China Interest Rate	0.125281	0.155394	0.089226	0.165999	0.358254
CBOE 10y Interest Rate	-0.073650	0.121998	0.089600	0.090307	0.095094
Exchange Rate of USD	0.016951	-0.140566	**-0.372536**	0.074076	**-0.464978**

Source: author´s calculation

Table 4 Correlation matrix – commodity indices and macroeconomic determinants, 2008

Variable	Agriculture	Energy	Industrial Metals	Livestock	Precious Metals
PMI on Manufacturing	0.419580	**0.727273**	**0.741259**	0.209790	0.503497
Industrial Production	0.405594	0.524476	**0.776224**	0.062937	0.398601
Inflation Rate	**0.643357**	**0.741259**	**0.759340**	0.503497	0.405594
US Interest Rate	**-0.496503**	0.048951	-0.125874	-0.055944	-0.321678
EURO countries Interest Rate	-0.258741	0.517483	0.202797	-0.097902	-0.223776
China Interest Rate	-0.167832	0.391608	0.461538	-0.237762	0.076923
CBOE 10y Interest Rate	0.125874	0.188811	0.167832	-0.069930	0.167832
Exchange Rate of USD	**-0.671329**	-0.398601	**-0.636364**	0.132867	**-0.804196**

Source: S&P Dow Jones Indices, 2013

In 2008, correlation coefficient was growing rapidly for almost all monitored macroeconomic determinants. High level of dependence between values of all commodity indices and inflation rate, PMI on Manufacturing, Industrial Production and USD Exchange is proved. The highest values of correlation coefficients can be found in couples with Industrial Metals; strong dependence on MPI on Manufacturing, Industrial Production, Inflation Rate and USD Exchange Rate were detected.

Table 5 Correlation matrix – commodities indices and macroeconomic determinant, 2009-2013

Variable	Agriculture	Energy	Industrial Metals	Livestock	Precious Metals
PMI on Manufacturing	0.091263	0.205471	**0.508750**	0.038890	-0.015426
Industrial Production	-0.054382	0.067280	**0.281047**	0.196267	0.019769
Inflation Rate	0.249028	**0.400506**	0.189914	0.032020	0.087503
US Interest Rate	**-0.433469**	-0.222840	**-0.397909**	0.096774	-0.049101
EURO countries Interest Rate	-0.022556	0.045826	-0.086077	0.178053	-0.018991
China Interest Rate	0.039572	-0.030918	0.082092	-0.040771	0.126266
CBOE 10y Interest Rate	0.132227	0.148107	0.128338	0.126005	-0.147135
Exchange Rate of USD	**-0.403163**	**-0.471092**	**-0.621143**	-0.191211	**-0.345800**

Source: S&P Dow Jones Indices, 2013

In the last monitored time interval, which means from 2009 to September 2013, high dependence of all sectors of commodities assets on USD Exchange Rate was proved. Negative correlation between US Interest Rate and most commodity indices started to prove, which is, according to Frankel (2006), valid from the long-term point of view. In

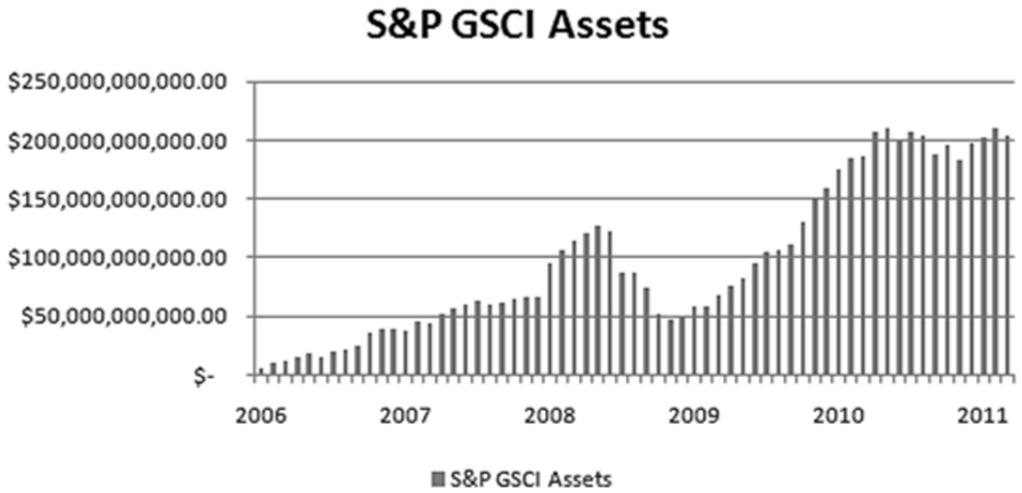
case of other analyzed world short-term interest rates and long-term interest rate, negative correlation with individual commodity indices did not prove in most cases and resulting values of relevant correlation coefficients are not on important values of 5%. Industrial metals index is, as well as in 2008, dependent on economic indicators, while Global PMI on Manufacturing seems to be better indicator, compared with Global Industrial Production. In case of Precious Metals index, steep decline of correlation with macroeconomic determinants appeared, compared with previous monitored periods.

In all monitored periods, most commodity indices show similar dependence on macroeconomic determinants. The most important dependence on macroeconomic determinants proves to be with Industrial Metals Index. The highest values of correlation coefficients were noticed in 2008. In case of Agriculture, Energy and Industrial metals, growth trends of correlation coefficient values is present, in case of Precious Metals, this trend is dropping, while for Livestock index, dependence on any macroeconomic determinant has not been proved.

4 Discussion

Individual sectors of commodities market show slight dependence on individual sectors of commodities market, that is price level of individual commodities increase and decrease together. This conclusion might be related to the process of financialization of commodities market, when the popularity of investment products grows, which enables the investors to participate on revenues of commodity assets with solely financial contracts settlement (Rejnuš, Smolík, 2013). From this point of view, composite commodity indices seem to be the most often discussed products; at the same time, the investors enter long positions of various contracts of commodity futures, while positions are rolled continuously in accordance with established methodology. The development of handled assets in composite index S&P GSCI is shown in figure 1. Another possible explanation of this result is relations among individual commodities, where there is dependence between price of energy and price of other commodities (Tang, Xiong, 2010).

Figure 1 The development of value of total assets in composite index S&P GSCI



Source: strubelim.com by bettermarkets.com data, 2011

Precious metals are, from historical point of view, considered to be suitable investment, taking into account assuring oneself against inflation influences (Greer, 1978). In the last monitored period, dependence between precious metals and inflation was not noticed. The same results were demonstrated in case of correlation of this sector of commodity assets with further macroeconomic determinants. Price volatility of precious metals in recent years cannot be suitably explained by macroeconomic determinants, analyzed in this paper.

5 Conclusions

In this paper, dependence between price volatility of individual sectors of commodity markets and macroeconomic determinants was analyzed. The period from the year 2000 to September 2003 is analysed; this period was divided into three time periods, 2000-2007, 2008 and 2009 – 9/2013. To describe the trends of dependence between individual variables more precisely, it seems that in future, it would be suitable to add graphics of gliding annual correlations in individual months, based on monthly data of analyzed couples.

Achieved results show the fact that in the monitored period from 2008, there is growing dependence between changes of values of macroeconomic determinants and price volatility of commodity assets, with the exception of precious metals, which shows descending dependence. It was proved that most sectors of commodity assets respond to these changes in a similar way, but different intensity. The only index that, within the whole monitored period, did not show any important values of correlation coefficient is index Livestock.

In this paper, relatively strong inversion relation between most commodity indices and Nominal Effective Exchange rate of USD was proved. The most distinctive dependence on macroeconomic factors can be seen on industrial metals index. In case of this index, strong correlation with economic growth index can be seen, where Global PMI on Manufacturing seems to be more suitable index, compared with Global Industrial Production.

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Lease Type B and Possible Duplicate Recognition of Assets

Alžběta Srnová[1], Hana Bohušová[2], Veronika Blašková[3]

[1, 2] Mendel University in Brno
Faculty of Business and Economics, Department of Accounting and Taxes
Zemědělská 1, 613 00 Brno, Czech Republic
E-mail: xsrnova1 @node.mendelu.cz, hana.bohusova @mendelu.cz
[3] Mendel University in Brno
Faculty of Business and Economics, Department of Statistics and Operation Analysis
Zemědělská 1, 613 00 Brno, Czech Republic
E-mail: veronika.blaskova@ mendelu.cz

***Abstract**: According to the revised draft of financial reporting standard Leases (Re-ED 2013), all lease agreements with duration of over 12 months are classified into two groups A and B. The basic criterion for classification is the consumption of significance of proportion of the economic benefits associated with the leased asset. The main problem of this methodology can be considered the possibility of duplicate reporting of assets in both statements of financial position, lessor and lessee. It could lead to an over statement of assets arising from the relevant lease agreement. Moreover, we cannot exclude other possible asymmetry, e.g. where the lessor classified lease as type B and lessee as type A (or vice versa)., or cases where the lessor and the lessee evaluate the economic benefits of contract termination or extension of the lease agreement in a different way and the balance sheet items on both sides will be calculated from a different lease terms. The aim of this paper is to identify the lease agreements that allow duplicate reporting. A model case is used to demonstrate and to quantify this duplicate reporting and to identify possible impacts.*

Keywords: lease reporting, lessee, right-of-use

JEL codes: M410

1 Introduction

The ongoing globalization of capital markets puts pressure on provision of comparable, high-quality and comprehensive information to external and internal users of the financial statements. The comparabilityand reliability ofdatain the companies´ financial statements create an important source of information about current and future expected financial situation of the company, not only for investors and banks, but also for the management of the company. Current differences between the accounting treatments for capital and operating lease do not provide necessary comparability and create the space for individual adjustments.

To distinguishcapital and operatingleases, SFAS 13 (Statement of Financial Accounting Standards No. 13) uses bright line test included four basic rules to classify the type of the lease. A lease can be classified as a capital lease only if one of the following criteria are met: ownership of the asset is transferred by the end of the lease term to the lessee, the lease has a bargain purchase option, lease term equals or exceeds 75% of economic life of the leased property, or present value of minimum lease payments exceeds 90% of fair value of the leased property. Dieter (1979) provided evidence that these rules are quite easy manipulated such that the lessee can avoid capitalizing the lease arrangement. Coughlan (1980) also pointed out that there is a way how to structure the terms of the lease arrangement that allows classify capital lease as operating lease and avoid recording lease liability and asset on the lessee's balance sheet. Generally, the capital lease is recorded on the balance sheet, whereas operating lease is disclosed only in footnotes. According to Fahnestock (1998) different attitude towards disclosing capital and operating leases make difficult, nearly impossible, to compare companies ` financial situation correctly. For this reason users of financial statements are forced to capitalize individually operating leases for their analytical evaluation. The effects of capitalization of operating leases were demonstrated on the example of American company FedEx. The

authors of this case study, Duke, Franz and Hsieh (2012), calculated that after capitalizing all FedEx's unrecorded lease liabilities, the balance sheet would significantly increase of more than $11 billion dollars.

Whereas the companies follow IAS 17 (International Accounting Standards) issued by International Accounting Standards Board, they do not have to use any specific tests to determine whether a lease should be capitalized or expensed. IAS 17 provides scope for subjective assessment about the lease classification. It is quite obvious that it is easier to adapt lease treatment to individual needs of lessor or lessee. Generally from lessee's point of view, the operating leases is preferable because the lease liability is not recorded on balance sheet and the management provides "better" financial picture of the company in front of investors. The lessors could be also more attractive by operating leases, which retain them the ownership of the asset, for multiple reasons including for example the tax benefit of depreciation.

According to Franzen et al. (2009) from 1980–2007 huge increase of 745% in off-balance-sheet lease financing calculated as a percentage of total debt was seen. In the similar research led by Franzen (2009) was found out that if leased assets were brought into the balance sheet over 27 year sample period, average debt-to-capital ratios would increase by 50-75%. High debt ratios are understood as a signal of higher financial risk for investors and creditors. Krishnan and Moyer (1994) empirically investigated positive relationship between capital (on-balance-sheet) leases and the costs of bankruptcy. Four years later, Graham, Lemmon and Schallheim (1998) confirmed that the positive relationship extends to operating (off-balance - sheet) leases.

The models of the off-balance sheet lease commitments capitalization reconstruct a financial profile of a company and improve company's financial statements comparability. The models show what would have resulted if operating leases would have been accounted for as capital leases. The consequences of the adjustment models could be seen not only on balance sheet, but also on income statement, cash flow statement and in recalculated financial indicators. The starting point for all models is the disclosure of future minimum lease obligations. Bostwick, Fahnestock, O'Keefe (2013) identified several key characteristics which distinguish the capitalization models: the timing and amount of lease payments, the rate used to discount these future lease payments, the past and future depreciation related to the leased asset, and the tax rate faced by the company.

Imhoff, Lipe, and Wright published in 1991 one of the key methods of the capitalization which became the basisfor future modified models. In this method, the future lease payments were expected to continue at the level as the fifth year's payment, leased asset was computed as 70% of the present value of the lease payments using strictly defined discount rate 10% and depreciation of leased asset was expected to keep on next 15 years. This model did not focus on effects on income statements and tax rate 40% was assumed. The authors revised themselves the model several times. In their model from 1997 the discount rate was not determined same for all capitalized leases anymore and started to be depended on each firm's capital lease rate or average interest rate company paid for its debt. Asset deprecation was matched to the length of the future lease payments and effects of deferred taxes were taken into account. Another capitalization model by Fahnestock and King (2001), which comes from the previous one, brought new specific parameters. Firstly, the model uses company's unique marginal tax rates for the calculation of deferred income tax and leased asset is 100% equal to the present value of the future lease payments defined at the beginning of the fiscal year. Another contribution of the methods is splitting of the liability adjustment into current and noncurrent portions.

The rating agencies, which are important players in global capital market, should provide independent, quality and comparable ratings, although each of them uses a different adjustment model. For example, since March 2005 Standard & Poor's has capitalized operating leases using present value method. Simply in the method, the future lease payments are discounted by the chosen rate and the portion of asset related to the lease

is recorded. The Standard & Poor's discount lease payments by the rate based on an estimate of an issuer's actual borrowing costs. In 2006 Moody's reconstructed its capitalization model and started to use factor method developing present value method. Under the new methodology, Moody's uses a multiple of current rent expense to capitalize operating lease obligations. Unlike the previous method, factor method captures the full economic life of the asset. Rent expense is reallocated in one-third to interest expense and two-thirds to depreciation expense. The last example is Fitch, it applies hybrid method – mixture of two previous methods. (Berman, LaSalle, 2007) The subsequent recorded firm's financial picture and calculated financial ratios are not identical under each of the methods.

2 Methodology and Data

The paper is concerned with the situation of duplicate reporting of leased assets in the case of lease classified as the lease Type B. The model case is corresponding with conditions of the lease Type B issued. The main aim is to quantify the value of the assets reported twice (at the side of lessee and leasoor) in course of the lease term.

The value of assets which is reported twice is formulated as theofright-of-use (ROU) recognized by a lessee, it is a part of the value ofasset recognized by a lessor.ROU recognized by alessee is equal to thelease liability, it is equal to the present value of the total lease payments and it formulated

$$j = \sum_{t=1}^{n} \frac{c}{(1+i)^t}, \quad (1)$$

Where: t is the number of lease payments, c is nominal value of payment, and i is the discount rate.

It is supposed that the ROU is amortized during the lease on the straight-line basis. Lessor recognizes assets at the book value of leased assets and depreciates on the straight-line basis in themost cases.The schemes and the tables areused for presentation of the value of the leased asset reported twice.

3 Results and Discussion

The current form of lease reporting is characterized by a number of ambiguous adjustments. Some of them were already mentioned. The existence of two different accounting models for capital (financial) and operational leases can be considered as the biggest problem of present leasing arrangements. Investors and the others users of financial statements are forced to capture off-balance-leases to receive comparable and actual view on company's financial position. Several possible capitalization models and their characteristics were introduced. Since 2006the International Accounting standards Board as the body responsible for the IFRS development (IASB) and (Financial Accounting Standards Board (FASB) responsible for development of US GAAP have been cooperating on the common project Lease whose objective is the improvement of current models (IAS 17 and SFAS 13) and the introduction of a single lease accounting model removing different attitudes to capital and operating leases.

The first achievement responding to the criticism in the lease reporting was published by IASB and FASB in March 2009.The Discussion Paper Preliminary Views on Leases included the IABS´s preliminary opinions on unification of majority of lease arrangements reporting. The paper focused only on the lessee's part of the lease arrangement. The lessor's reporting principles which would have been set symmetrical to the lessee's principles were not cover by this material. The Exposure draft – Lease development (August 2010) was issued built on feedback received from number of institutions and professionals(over three hundred comment letters) where the new concept based on the rightof – use was supported.The main ideas of comment letters were used in the Exposure draft. The Exposure draft already specified the possible methodology for the lessee's reporting principles and proposed accounting models for lessors - Performance obligation approach and Derecognition approach. These two approaches should have

distinguished the different nature of lease agreements. Under the derecognition approach the lessor recognizes an asset for the right to receive lease payments with a corresponding recognition of lease income. Furthermore, the lessor derecognizes a portion of the carrying amount of the leased asset with a corresponding charge to lease expense. The remaining carrying value of the leased asset is reclassified as a "residual asset". Under the performance obligation approach, the lessor also recognizes an asset for the right to receive lease payments. However, under this approach the asset is offset by the establishment of a performance obligation liability. This liability represents the obligation of the lessor to permit the lessee to use the lease asset. Under the performance obligation approach, a portion of the carrying value of the leased asset is not derecognized in any manner. (Stafford,2012) However, the performance obligation approach appeared to be very problematicand in revised Exposure draft (2013) is no mentioned anymore.

Revised Exposure draft (2013) proposes the "dual-recognition approach" to the recognition, measurement, reporting and disclosure of costs and cash flows arising from lease contracts. Dual approach distinguishes lease type A (leases of assets other than property) and type B (leases of the property). The classification relates to the leases with a possible lease term of more than twelve months and it is dependent on whether the lessee consumes the significant portion of the leased asset or not. If so, this is the lease of type A, in the other case it is the lease of type B. Under both types of leases, a lessee records a right-of-use asset and a lease liability, both initially measured at the present value of the future lease payments. After that the lessee reports a lease cost consisting of the unwinding of the discount on the lease liability with the amortization of the right-of-use-asset on a straight-line basis in the income statement. It means that the right-of-amortization costs increase over the course of the lease term due to decrease in interest costs. Under the lease type B, lessors continue in recognition of the underlying asset in their balance sheet and recognize rental income over the lease term on a straight-line basis. (Baker, 2013)

The proposed methodology of lease type B seems to be very problematic. This method allows recognising the same underlying asset twice in the balance sheets of both parties of the lease arrangement. The lessee has a right-of-use the leased asset and on the other hand the lessor records underlying asset in its balance sheet. See the example below. There is a clear overestimation of the property comes from the lease contract itself, but also the overestimation of the volume of assets in the national economy.

Example: The lease company ABC offers offices for rent. XYZ ltd. decided to lease the offices for 4 years. The lease agreement is classified as the lease Type B. The lessee XYZ agrees to pay 25,000 currency units as the annual payments at the end of each year. There are no other elements to the lease payments or payments to the lessor before the commencement of the lease. The initial measurement of the right-of-use asset and lease liability is 81,242.51 currency units using an implicit discount rate of 8,86%.

Table 1 Key characteristics of lease agreement - lessee (in currency units)

Item	Initial	Year 1	Year 2	Year 3	Year4
Cash lease payments		25,000	25,000	25,000	25,000
Lease liability	81,242.51	63,440.60	44,063.44	22,965.28	0.00
Decrease of lease liability		17,801.91	19,379.16	21,096.16	22,965.28
Interest		7,198.09	5,620.84	3,903.84	2,034.72
Right-of-use asset at the end of year	81,242.51	63,440.60	44,063.44	22,965.28	0.00
Amortization of Right - of-use asset		17,801.91	19,379.16	21,096.16	22,965.28

Source: Own work

Figure1 Recording of lease contract by lessee during the lease period

Right -of- use (ROU)	
1) 81,242.51	

Lease liability	
	1)81,242.51
2a)17,801,91	

Cash	
	2)25,000

Expenses- interests	
2b) 7,198. 09	

Accumulated depreciation (ROU)	
	3) 1,7801.91

Expenses - deprecation(ROU)	
3) 17,801.91	

Source: Own work

1) Right- of-use and lease liability at the commencement of the lease
2) Annual paid lease payments
3) Annual deprecation of the right-of-use.

Table 2 Key characteristics of lease agreement - lessor (in currency units)

Item	Initial	Year 1	Year 2	Year 3	Year4
Cash lease payments		25,000	25,000	25,000	25,000
Balance sheet					
Underlying asset	200,000				
Amortization of underlying asset		20,000	20,000	20,000	20,000
Underlying asset at the end of year		180,000	160,000	140,000	120,000

Calculation of amortization costs: 200,000/10years = 20,000 annual depreciation costs

Source: Own work

Figure2 Recording of lease contract by lessor during the lease period

Leased asset	
250,000	

Cash	
1) 25,000	

Income	
	1) 25,000

Accumulateddepreciation	
	2) 20,000

Expenses - deprecation	
2) 20,000	

1) Annual paid lease payments
2) Annual deprecation of the leases asset

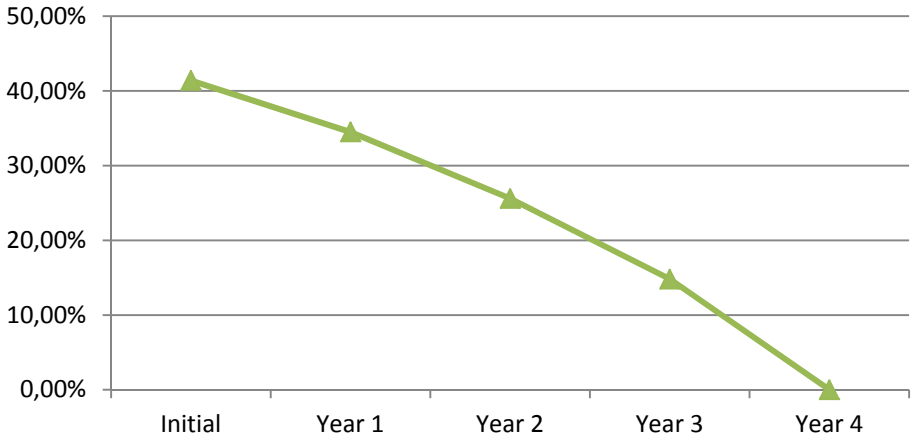
Source: Own work

Table 3 Duplicate recognition

Item	Initial	Year 1	Year 2	Year 3	Year 4
Asset recognised at lessor	200,000	180,000	160,000	140,000	120,000
ROU recognised at lessee	81242,51	63440,60	44063,44	22965,28	0,00
Duplicate recognition	40,62%	35,52%	27,53%	16,40%	0

Source: Own work

Figure 3 Changes in the duplicate recognized assets



Source: Own work

In comparison to the current approach to lease reporting, there are significant changes for lessee's accounting in the case ofcurrent operating lease classified a lease of type B according to the Re-ED. Under the new methodology the lessee is obliged to recognisean long term asset in the form ofthe right-of-use and the long term liability to pay lease instalments. Right-of-use is amortized during the lease term and concurrently the lease liability is decreased due to lease payments in its balance sheet. At the same time the lessor continues to recognise leased asset in its balance sheet as its property (See Figure 1 and 2). The Figures 1 and 2 and Table 3 show that the portion of leased asset equals to the right-of-use is recorded twice – once in the lessor's balance sheet as a part of the leased asset and the second time in the lessee's balance sheet as the right–of-use. It is evident that the methodology allows the overestimation of asset from the lease contract. The overvaluation decreases during the lease according to the amortization of the right-of-use (See Table 3) and at the end of the lease agreement it is zero.

The figures also point out that duplicate deprecation costs are recorded. The lessor continues in amortization of leased asset and concurrently the lessee amortizes the right –of-use on straight line method. Both of them are able to decrease tax base. Tax revenues would be lower than in case that only one part of the lease agreement records deprecation costs. Duplicate record of the deprecation costs and leased asset will also influence the financial ratios and judgement of the company's financial position. The total of lessee´s financial position statement will increase due to presentation of the right-of-use as long term asset and the lease liability. The increase of long term assets will result in decrease of ratios connected to assets. The Return on Assets (ROA) will decrease.The structure of the cost will be changedin the lessee´s income statement due to amortization of the right-of-use instead of rent cost in the current approach.

4 Conclusions

The current lease accounting principles do not provide comparable, high-quality and comprehensiveinformation to externalandinternal usersof the financialstatements. The most important standards IAS 17 and Topic 840 Leases ASC have different attitude towards disclosing capital and operating leases. So, the users of the financial statements are forced to use individually adjustment model to compare the company's financial position. Each of the adjustment models has its own characteristics that bring different results. The IASB and the FASB decided to cooperate on Lease project and solved the problems. Under the Lease project, the Discussion Paper, Exposure draft (2010) and Revised Exposure draft (2013) have been issued so far.

The paper focuses on the lease type B which is quite problematic. The new methodology allows recognising apart of the same underlying asset twice - in the balance sheets of both parties of the lease arrangement. The lessee has a right-of-use the leased asset and on the other hand the lessor continues to record the underlying asset in its balance sheet. The overestimation of a leased asset is equal only to the right-of-use. The calculation showed that the overestimation decreases during the lease contract as the right-of-use is amortized. The calculation and schemes confirmed that under proposed methodology a clear overestimation of the property which arises from the lease contract itself.It is also possible to expect the overestimation of the volume of assets in the national economy.This mentioned problem influences the key financial ratios which are bases for decision making of external users.

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The Analysis of the Threshold of Obligatory Offer Based on the Theory of Games for Companies from Index WIG30 in Poland

Anna Sroczyńska - Baron

University of Economics in Katowice
Department of Applied Mathematics
Ul. Pułaskiego 25, 40 – 276 Katowice, Poland
E-mail: kozak@caprisoft.com.pl

Abstract: *Nowadays, taking over companies are becoming increasingly common in Europe. Of course, one cannot buy every number of shares without any limitations. There are legal regulations relating to takeover bids and securities sale in each Member State. They should be according to European Parliament and Council Directive 2004/25/EC of 21 April on takeover bids. The Directive establishes a framework of general requirements which Member States are to implement through more detailed rules in accordance with their national systems and cultural contexts. In Poland, the public offering act from 2005 met with many negative opinions. The threshold of mandatory bid has been changed in a project of amendment of a low to accommodate it to the low generally accepted in Europe. However, the proposed changes met also with great criticism because of the nature of Polish market. In this work the structure of shareholders of chosen sectors in Poland is examined with the use of cooperative games and a project of amendment of public offering act from 2005 in Poland is discussed. The main aim of this work is to check if the threshold of mandatory bids at the level of 33% according to the amendment of the Act in Poland is proper considering the shareholders structure of Polish companies. The solution based on the theory of games is proposed to solve the problem of the limit of obligatory offer.*

Keywords: takeover, obligatory bid, cooperative games, Banzhaf index, shareholders

JEL codes: G1, G18, C71

1 Introduction

The history of taking over is connected mostly with American market. European markets used to be characterized by many factors which did not favor taking over processes. But changes proceeding in this part of the world – mainly European Union forming and globalization – made the takeover processes necessary to keep for existence and development of companies. The bigger activity connected with hostile takeovers is also visible on Polish market. There are a lot of attempts observed on stock exchange in Warsaw for example Emparia by Eurocash in 2011, coalmine Bogdanka by concern NWR in 2010 or Signity by Asseco and Polfa Kutno by Concern Recordati. Of course, one cannot buy every number of shares without any limitations. Each Member State has got legalities which should conform with directive of the European Parliament 2004/25/WE. The Directive only establishes a framework of general requirements which Member States are to implement through more detailed rules in accordance with national systems and cultural contexts. European companies have got better legal protections toward takeover bids and concurrently there are protected the interests of small shareholders. The directive started a great discussion in Europe (Clarke, 2009). In Poland, the public offering act from 2005 is in force. It also met with great discussions. The rules are criticized inter alia in view of a fixed threshold of mandatory bid at the level of 66%. Ministry of Finance has been working on the amendment of the Act on a public offer. The draft amendment of the Act in Poland is similar to the law of many Member States. However, there are many negative opinions of it in Poland as well (Olbrycka, 2012). One should consider that there are usually widely dispersed shareholders in countries with the threshold at proposed level. It seems to be not so obvious in Poland.

The theory of games is a useful tool for proper decisions making in the world of economics especially when we are not certain of how the other subjects are going to act. It seems to be a suitable tool to use on the stock exchange (Sroczyńska – Baron,

2013a). One of its practical applications connected with the stock exchange is using cooperative games for the analysis of hostile takeovers. It seems to be a better tool than percentages (Leech, 2013). The main aim of this work is the analysis of the shareholders structure of chosen companies traded on the Stock Exchange in Warsaw based on the theory of games and the discussion of proposed level of threshold of mandatory bid in the draft amendment.

2 Legal Regulations for Takeover Bids in Poland

In Poland an offeror is obliged to keep the following legal rules applicable to the conduct of bids according to the Act of 29 July 2005 on a public offer:

- the offeror is required to make a bid of the purchase of shares representing not less than 66% of all in the offeree company when the offeror is going to hold shares representing at least 33% of them in that company,
- the offeror is required to make a bid of the purchase of all other shares of the offeree company when the offeror is going to hold shares representing at least 66% of them in that company.

The rules were criticized inter alia in view of two fixed thresholds of mandatory bids: 33% and 66%. The limit 33% often confers control in a company and concurrently it allows to launch a bid only till 66% of shares. There are fears for protection of minority shareholders – not all of holders of remaining securities are able to require the offeror to buy their securities at a fair price and to withdraw from the investment in such a situation. On the other hand, the obligation to launch a bid for all other holdings after the threshold of 66% of securities applies when the takeover is in principle conducted. The majority shareholder can stop the acquiring at the level of 65% of securities which gives him the control of the offeree company without the obligation of a bid for the rest of securities. It seems that defensive action for minority shareholders is too weak and do not satisfy the assumptions of the Directive in Poland. Although the Directive does provide for arrangements in the area of the protection of minority shareholders, it leaves it up to Member States themselves to establish the threshold of mandatory bid. Ministry of Finance has been working on the amendment of the Act on a public offer. There are proposed two thresholds for all other shares:

- the offeror is required to make a bid of the purchase of all other shares of the offeree company when the offeror is going to hold shares representing at least 33% or 66% of them in that company,

The draft amendment of the Act in Poland with the threshold of 33% is similar to the law of many Member States. However, there are many negative opinions of it in Poland. One should consider that there are usually widely dispersed shareholders in countries with the threshold at the level of one – third, what is not so obvious in Poland.

3 Methodology

In this work the n – person cooperative game is used. The theory is completely different from the theory of two - person game because of possibilities of coalition forming. It often makes it possible to increase the expected payoff for the player. Let S be a subset of players who made decision to form a coalition. It means that they will decide about individual actions so that the sum of payoff for all members of coalition would be possibly the best. It is assumed that the rest of players form the coalition S'. Then the game comes down to two – person game: coalition S contra coalition S'. In this work the Shapley's method is used to solve it. He formulated the idea of the value. It is defined as the weighted sum of profit growths, which one player gives to all coalitions he belongs to. Power index is a particular value of games for simple games (characteristic function of this kind of games takes only two values: 0 or 1 – it means, that the coalition is a wining one or not). One of the most popular indices is Banzhaf index.

$$\beta_i(\upsilon) = \frac{c_i}{\sum_{j \in I_n} c_j} \tag{1}$$

where c_i is a number of coalitions with the player i as a decisive player (it means the coalition with this player is a winning one, without him is a loosing one). Banzhaf index assigns a part of whole winnings to each player. The part is proportional to number of coalitions for which the player is a decisive one. It is said that Banzhaf index measures power as an influence. The value which is gained by the coalition is the possibility of control. This kind of index also ignores the order of players attachment to coalitions. That is why Banzhaf index is more often taken to examine the shareholders structure (Leech 2002). There are many popular tools to evaluate the companies, for example TMAI (Węgrzyn, 2013a) and others (Węgrzyn, 2013b), but to evaluate shareholders structure of those companies Banzhaf index seems to be proper one (Sroczyńska – Baron 2013b).

In this work the power index was used to check the situation of a company – offeror and the threshold of 33% for obligatory offer. The model of large games with an outcome majority (half of shares, which are possessed only by main players) was used to analyze it (Gambarelli, 1994). It was assumed that there were *m* main players and infinitive number of small players who did not have any influence individually. The tools of the theory of games, as for example grey systems (Barczak 2013a,b) could be effective alternatives for traditional methods of market analysis.

3 The researches

3.1 Data

Data used for researches come from Polish Stock Exchange in Warsaw. There were examined 30 companies from index WIG30. This is a new index published for the first time in September of 2013. This index consists of the biggest and the most fluid companies from the Main Market of the stock exchange in Warsaw. The index belongs to price indices – it means that only prices of conducted deals are taken into consideration during calculation of its value. There are no more than 7 companies from one sector and the participation of one company in capitalization of the index is limited to 10%. The shareholders structure of companies from the index WIG30 is presented in Table 1.

Table 1 The structure of shareholders for companies from WIG30 02.05.2014 in [%]

	shareholder A	shareholder B	shareholder C	shareholder D	shareholder E	shareholder F	Free float
Alior	33	8	-	-	-	-	59
AssecoPol	11	10	6	-	-	-	73
Bogdanka	15	10	10	5	-	-	60
Boryszew	59	7	-	-	-	-	34
BZWBK	70	-	-	-	-	-	30
CCC	35	8	6	6	-	-	45
CFPLSAT	51	7	-	-	-	-	42
ENEA	52	-	-	-	-	-	48
Eurocash	44	-	-	-	-	-	56
GrAzoty	33	15	10	9	6	6	21
GTC	30	11	9	6	-	-	44
Handlowy	75	-	-	-	-	-	25
INGBSK	75	5	-	-	-	-	20
JSW	55	-	-	-	-	-	45
Kernel	38	-	-	-	-	-	62
KGHM	32	-	-	-	-	-	68
Lotos	53	5	-	-	-	-	42
LPP	19	11	10	10	-	-	50
MBank	70	5	5	-	-	-	20
Netia	17	14	13	6	6	-	44

	shareholder A	shareholder B	shareholder C	shareholder D	shareholder E	shareholder F	Free float
Orange	51	-	-	-	-	-	49
Pekao	51	-	-	-	-	-	49
PGE	62	-	-	-	-	-	38
PGNIG	72	-	-	-	-	-	28
PKNOrlen	28	5	5	-	-	-	62
PKOBP	31	7	5	-	-	-	57
PZU	35	-	-	-	-	-	65
Synthos	62	-	-	-	-	-	38
TauronPE	30	10	5	-	-	-	55
TVN	53	5	5	-	-	-	37

Source: own computation based on www.stockwatch.pl

3.2 Run of the Researches

The structure of shareholders for companies from WIG30 were examined. There are averagely 2 main shareholders and the free float is at the level of 45,57%. There is a shareholder with more than 50% of shares in a half of all companies. There is a phenomena of minority controlling in the rest of companies. These companies face a high risk of hostile takeover because potential "invader" can take control without an agreement with the company. The average participation of free float in these companies is higher and equal 54,73%. It makes the risk of hostile takeover bigger.

During the researches the Banzhaf Index was used to check the situation of main shareholders of companies presented in Table 1. The outcome majority (majority of shares owned only by main players) was used during the calculations. The obtained results are presented in Table 2.

Table 2 Banhaf Index for companies from WIG30 02.05.2014

	β_A	β_B	β_C	β_D	β_E	B_F	Outcome majority
Alior	1	0	-	-	-	-	21
AssecoPol	0.33	0.33	0.33	-	-	-	14
Bogdanka	0.42	0.25	0.25	0.08	-	-	21
CCC	1	0	0	0	-	-	28
Eurocash	1	-	-	-	-	-	23
GrAzoty	0.54	0.13	0.13	0.13	0.04	0.04	40
GTC	1	0	0	0	-	-	29
Kernel	1	-	-	-	-	-	20
KGHM	1	-	-	-	-	-	17
LPP	0.5	0.17	0.17	0.17	-	-	26
Netia	0.38	0.23	0.23	0.08	0.08	-	29
PKNOrlen	1	0	0	-	-	-	20
PKOBP	1	0	0	-	-	-	22
PZU	1	-	-	-	-	-	18
TauronPE	1	0	0	-	-	-	23

Source: own computation

A good situation is observed in 10 companies. The main shareholders ensured the dominant position among all other shareholders. The situation seems to be stabile in the absence of external aggressors (the value of index is equal 1). There is not really bad situation in two more companies: GrAzoty and LPP because of great ascendancy of the biggest shareholder in comparison with other shareholders (the value of index is at least 0,5). Particularly difficult situation is observed in the rest of companies: AssecoPol, Bogdanka and Netia (the values of index are equal or similar). Non of the main shareholders ensured enough vantage. What is more, the researches show how important is the size of participation of main shareholders in the case of minority control. Let us analyse the structure of shareholders of company GrAzoty. There are two players

with different participations: 15 and 10% but the same position in the company (the value of index was the same against the percentages). However, it is worth saying once again that all presented companies are potentially threatened by hostile takeover because of minority controlling in these companies.

There is proposed the threshold of mandatory bids at the level of 33% according to the amendment of the Act on a public offer in Poland. So the analysis of the situation of examined companies was also conducted during hypothetical attempt of purchase 33% of shares by the aggressor. Will the free float be protected in this situation and concurrently won't the threshold become a barrier and will cause phasing out by companies and loosing the fluid? The results are showed in Table 3 (it is assumed that the aggressor is a player B).

Table 3 Banhaf Index for companies from WIG30 02.05.2014 with minority control during hypothetical attempt of purchase 33% of shares by the player B

	β_A	β_B	β_C	β_D	β_E	B_F	Outcome majority
Alior	0.5	0.5	-	-	-	-	34
AssecoPol	0	1	0	-	-	-	26
Bogdanka	0	1	0	0	-	-	31
CCC	0.5	0.17	0.17	0.17	-	-	41
Eurocash	1	0	-	-	-	-	39
GrAzoty	0.29	0.29	0.21	0.07	0.07	0.07	49
GTC	0.25	0.42	0.25	0.08	-	-	40
Kernel	1	0	-	-	-	-	36
KGHM	0	1	-	-	-	-	33
LPP	0.17	0.5	0.17	0.17	-	-	37
Netia	0.09	0.64	0.09	0.09	0.09	-	38
PKNOrlen	0.2	0.6	0.2	-	-	-	34
PKOBP	0.33	0.33	0.33	-	-	-	35
PZU	1	0	-	-	-	-	35
TauronPE	0.33	0.33	0.33	-	-	-	35

Source: own computation

It is showed that the threshold of 33% of shares would allow to gain the control in the company only in 3 cases: AssecoPol, Bogdanka and KGHM. These companies are characterized by the biggest free float (more than 60%). In each other company the shareholder *B* would have to buy all other shares despite the lack of control. What is more, in one of these three cases the threshold also seems to be wrong. It would be enough to buy only 18% instead of 33% of shares of AssecoPol to gain the control in the company. So the aggressor could gain the control and would not have to buy all other shares. There are only two companies where the level of threshold seems to be proper: 31% of shares of Bogdanka and 33% of shares of KGHM would be necessary to gain the control in these two companies in the situation of minority control.

4 Conclusions

In Poland the problem of the threshold fixed by the Act of 29 July 2005 on a public offer has been discussing for a few years. Legislations were conducted according to the Directive of the European Parliament 2004/25/WE. Unfortunately, it seems that it did not meet with assumptions of the Directive. The new draft amendment of the Act in Poland is similar to the law of many Member States but it met also with great criticism because of the nature of Polish market. In this work the companies from index WIG30 ware examined. The researches showed that the threshold of 33% for obligatory offer do not work properly for these companies. The participation of small shareholders is not enough for such a level of threshold. The offerors are too often required to make an obligatory offer without the position of dominator and concurrently there are not protected the interests of small investors in many situations (the company – offeror is not obliged to make bid for other shares after acquiring the control). It worked in a

proper way only in 6% of companies. It seems to be worth the discussion to increase the threshold of obligatory bid. The other solution is to use just the power index to fix the threshold. The limit in percentages is neither universal nor effective limit in many situations. The more dispersion of shareholders, the lower limit of real control in the company – it could be much lower than 30% in many cases. Concurrently, if there are not many small shareholders, the limit could be much higher. So there are not protected the interests of small investors in many situations. On the other hand, the offerors are sometimes required to make an obligatory offer without controlling the situation in a company.

To conclude the discussion, the threshold of 30% seems to be proper in countries, where the companies with dispersion of shareholder structure are predominate. However, in countries with opposed tendency (for example Poland), the solution should be different. It is proposed to use just Banzhaf index instead of percentages. It is universal tool analyzing the structure of the power, insensitive to shareholder structure, especially with the model of large games presented in this work. Fixing one level of this index as the threshold of obligatory bid would allow to standardize the situations of companies – offerors at the moment of excess of it and would better protect the interests of small shareholders.

The problem of the measurement of influences seems to be always actual and very important. Good solutions of this problem in one area could help to solve similar problems in other, which the European Union meets, for example the rotation voting system recently adopted by the European Central Bank (Di Giannatale & Passarelli, 2013).

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External Imbalances in the European Union Before and After the Financial Crisis

Daniel Stavárek

Silesian University in Opava
School of Business Administration in Karviná, Department of Finance
Univerzitní nám. 1934/3, 733 40 Karviná, Czechia
E-mail: stavarek@opf.slu.cz

Abstract: *Economic development in the EU during the pre-crisis period was typical of substantial macroeconomic and financial imbalances. Since the start of the crisis the size of imbalances has reduced rapidly, creating severe adjustment pressures. The aim of the paper is to quantify the effect of the crisis on the size of external imbalances and to demonstrate the adjustment process in the EU. An emphasis is put on imbalances in the current account savings and investment, and divergence in international competitiveness. Stylized facts on evolution of the imbalances are supplemented with regression analysis covering pre-crisis and post-crisis periods to document the effect of the financial crisis. The results suggest that the crisis contributed significantly to reduction of the imbalances mainly due to a sudden stop in private capital flows that financed and stimulated domestic demand in deficit countries.*

Keywords: current account, savings-investment, international competitiveness, demand, government bonds

JEL codes: E21, E65, F32, H63

1 Introduction

Several years after the financial crisis it is evident that the crisis was the most immense shock to the European economy since 1930s. It has caused substantial losses in output, increased level of unemployment, undermined stability of financial system and brought about serious problems in fiscal policy and sustainability of public finances as it is illustrated in Table 1. It is almost certain that the crisis will leave a permanent scar on the economy of the European Union (EU). However, we have also learnt from the recent development that the crisis did not affect the EU uniformly. The impact on individual EU member countries as well as the adjustment and recovery of national economies differ remarkably across the EU.

Table 1 Selected principal indicators for the EU27

	2005	2006	2007	2008	2009	2010	2011	2012	2013
Real GDP growth (%)	2.2	3.4	3.2	0.4	-4.5	2.0	1.7	-0.4	0.1
Unemployment (%)	9.0	8.2	7.2	7.0	9.0	9.6	9.6	10.4	10.8
General gov. gross debt (% GDP)	62.7	61.5	58.9	62.2	74.5	80.0	82.4	85.2	87.1
General gov. deficit (% GDP)	-2.5	-1.5	-0.9	-2.4	-6.9	-6.5	-4.4	-3.9	-3.6
3-month Euribor (%)	2.19	3.08	4.28	4.63	1.22	0.81	1.39	0.57	0.22

Source: Eurostat Economy and Finance database

Explanation of the intra-EU differences can be found in several factors. Buti (2011) argues that one of the most prominent ones was the accumulation of increasingly large macroeconomic imbalances and expansion in competitiveness divergences in the pre-crisis period. Gros (2012) points out that the imbalances are critical mainly in the euro area where they were built up over the last decade as massive capital flows moved from

the North part to the South part of the euro area and Ireland. Since the start of the crisis and even more intensively after the crisis culmination the abundant private capital flows have abruptly stopped. Such a crunch in financing contributed to the seriousness and deepening of the crisis in number of countries and caused severe pressures on domestic demand and public finances.

As it is evident from the existing literature (e.g. Blanchard and Giavazzi, 2002; Honohan and Walsh, 2002; De Grauwe and Yuemei, 2012; Berger and Nitsch, 2010; Merler and Pisani-Ferry, 2012; Bertola et al., 2013) the financial crisis represented a milestone in recognition and understanding of the imbalances. However, the effect of the crisis on development of the imbalances, their magnitude and significance deserve more attention. Therefore, the aim of the present study is to quantify the effect of the crisis on external imbalances in the EU and to demonstrate the adjustment process that occurred after the crisis. This paper contributes to the existing literature in two ways. First, we include into later, and we employ the most up-to-date data available (up to 2013 in most cases). Second, we relate the imbalances to other fundamental macroeconomic variables and compare how different was the relationship before and after the crisis.

2 Stylized Facts on Imbalances

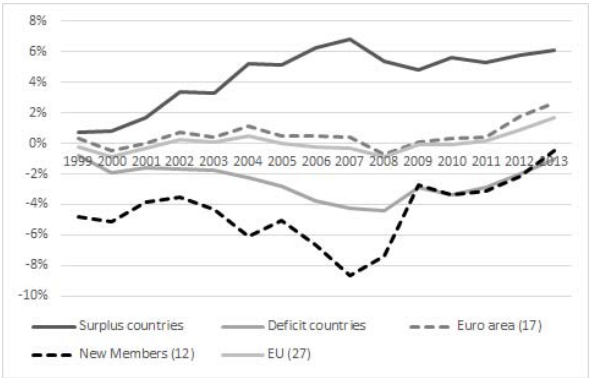
In this part of the paper, we examine evolution of selected imbalances in the EU. We describe the facts behind current account imbalances, divergence in international competitiveness measured by the real effective exchange rate, and imbalance between savings and investment. We provide evidence on the actual developments over the period 1999-2013. For the empirical analysis, we rely on data from AMECO database of the European Commission.

Current Account Imbalance

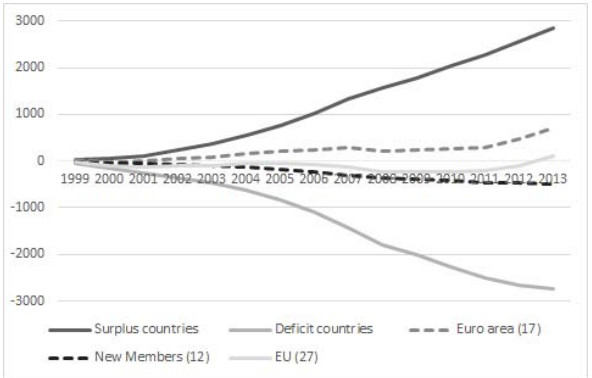
One of the major and most influential disproportions that have evolved in the EU is the current account imbalance. It refers to existence of disequilibria in the external position of the EU member states. The current account imbalance can be examined from two perspectives. First, the flow perspective, which looks at the ratio of annual current account balance on GDP. Second, the stock perspective, which measures the cumulated current account imbalance over the examined period. The imbalances considered from both perspectives are depicted in Figure 1.

Figure 1 Current account imbalances in the EU (1999-2013)

Flow perspective (in % of GDP)



Stock perspective (in billion EUR)



Source: Author's calculations based on data from AMECO database

One can observe that the current account of the EU as a whole has remained almost balanced over the most of the analyzed period. Very similar development can be seen also for the entire euro area although the euro area's current account balance has been constantly slightly outperforming the EU's balance. However, under the first sight overall balance in external position one can reveal considerable imbalances within the EU and the euro area.

Some counties have substantial and persistent current account surpluses and other have extensive and persistent current account deficits. We do not analyze separately each country but rather we sort the EU members out to several groups and show the groups' current account development. The group of surplus countries consist of Austria, Belgium, Denmark, Finland, Germany, Luxembourg, Nederland and Sweden. The group of deficit countries includes Bulgaria, Cyprus, Czechia, Estonia, France, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Malta, Poland, Portugal, Romania, Slovenia, Slovakia, Spain and United Kingdom. One of the two groups was selected for each country according to the general behavior of the current account since 1999. Holinski et al. (2012) used the cluster analysis for the same purpose within the euro area and obtained groups of identical composition. Furthermore, we report data for the group of member countries that joined the EU in 2004 or later. Hence, each country contributes to development of more than one group presented in Figure 1.

It is apparent that since 1999 the current account balances in surplus and deficit countries have been evolving like mirror images of each other with movements of similar size but opposite sign. The extend of the current account imbalance culminated in 2007-2008 when the annual balance reached almost +7% of GDP in the surplus group (in 2007) and almost -5% of GDP in the group of deficit countries (in 2008). The development came to reversion in 2008 and particularly in 2009. While the surplus countries maintained the current account indicator above 5% of GDP over the last four years, the size of the current account deficit in the respective group diminished substantially getting the current account/GDP ratio to roughly -1%. Therefore, we can conclude that the flow form of the current account imbalance in the EU became less urgent in the last two or three years.

Nevertheless, many preceding years of building up the imbalances remain to be reflected in enormous stock form of the current account imbalance. The right graph in Figure 2 shows how the imbalances accumulated over the period 1999-2013. It is clear that the financial crisis did not have any significant effect on multiplication of the imbalances, and the surplus and deficit countries have accumulated huge stocks of opposite sign. Whereas the total surplus volume was 2864 billion euro the total volume of deficit was 2747 billion euro in 2013. The stock dimension of the imbalance indicate seriousness of the problem. Even if annual deficits in deficit countries vanished completely the large existing stocks would have to be revolved unceasingly.

Savings-Investment Imbalance

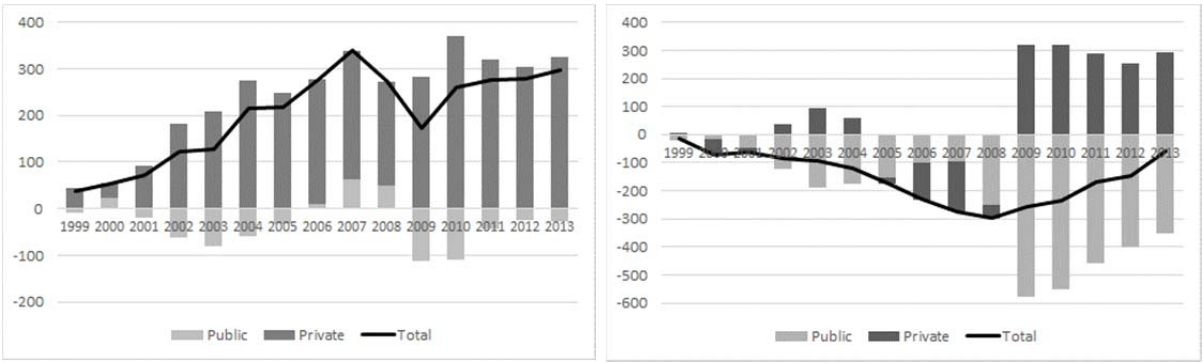
It is also instructive to look at the sectoral composition of the imbalances. Figure 2 depicts differentials between savings and investment in surplus and deficit countries. Apparently, these differentials were important driving forces of the external imbalances. One can observe that the savings-investment balance developments differ substantially between the groups of countries. In the group of surplus countries, the financial balance of the private sector has been continuously positive and even improving over time. By contrast, the private sector in the deficit countries has been reporting progressively deteriorating financial balance up to 2007. The rebalancing in the deficit countries took place in 2009-2013 and, as argued by Buti (2011), it came through sharp balance sheet adjustments in the private sector.

Although the public sector financial balance was generally negative in both groups of countries, one can distinguish differences in size and recent development. While the negative balance exceeded 100 billion euro only exceptionally in the surplus group, the same result in the group of deficit countries can be considered as the best achievement. The effect of the financial crisis is evident in the public sector balance in both groups. The savings-investment balance turned negative in the surplus countries in 2009-2010 and already negative government sector balance in the deficit countries deteriorated even further due to massive government spending and counter-cyclical fiscal measures implemented after the crisis.

In summary, the financial crisis halted accumulation of the savings overhang in the surplus countries and pushed ahead the tendency of lowering the savings shortage in the deficit countries in the EU. While the total savings overhang in the surplus countries maintained between 200 and 300 billion euro, the total savings shortage in the deficit countries decreased from 300 to less than 100 billion euro.

Figure 2 Savings-Investment imbalances in the EU (1999-2013)

Surplus countries (in billion EUR) Deficit countries (in billion EUR)



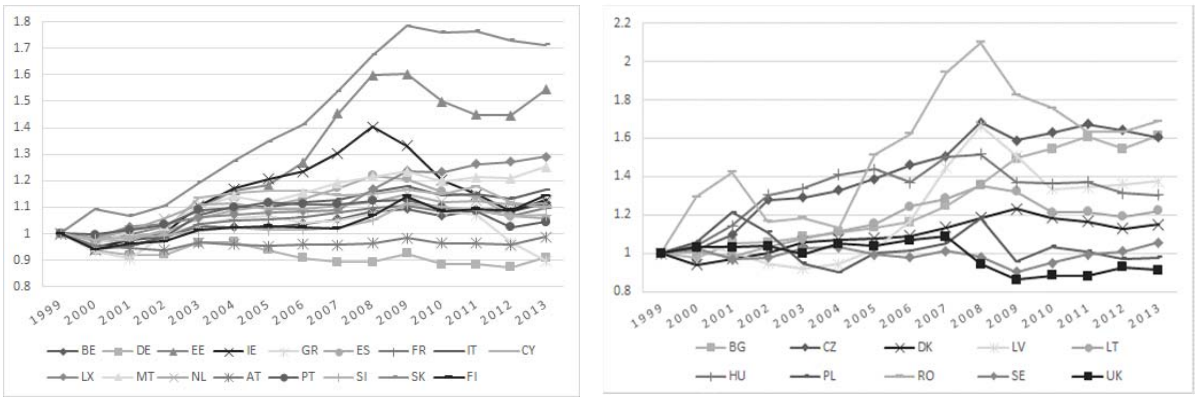
Source: Author's calculations based on data from AMECO database

Divergence in International Competitiveness

The external imbalances are tightly connected with international competitiveness of a country. Figure 3 demonstrates development of the real effective exchange rate of all EU member states in separate graphs for the euro area countries and for the non-euro EU member states. We use the real effective exchange rate based on unit labor costs. We can realize from the graphical illustration that most of the euro area countries went through process of real appreciation of around 10% during the period 1999-2013. However, Slovakia and Estonia that entered the euro area in 2009 and 2011 respectively lost much of their price competitiveness before joining the euro area and outbreak of the financial crisis. Among the traditional members of the euro area, the most significant loss in competitiveness was experienced in Ireland, Spain and Italy during the pre-crisis period. Not surprisingly, it is about the countries where consumption and construction bubbles evolved in the same time. Germany and Austria have constantly had real effective exchange rate lower than unity and improved their competitiveness markedly. The path of real depreciation was followed also by other countries in the post-crisis period. Namely Spain, Greece, Portugal and Ireland underwent an economic adjustment associated with reduction of labor costs and resulting, among others, into real depreciation.

Figure 3 Real effective exchange rate (1999-2013)

Euro area countries Non-euro countries



Source: Author's calculations based on data from AMECO database

A substantial level of divergence is manifested also within the group of EU members outside the euro area. One can even remark that the divergence level has been increasing over time. While the competitiveness of some countries like the United Kingdom, Poland or Sweden improved or remained relatively stable the others became less competitive in international markets. The non-euro countries with the largest loss in competitiveness are Romania, Czechia and Bulgaria.

3 Relations between imbalances and selected macro fundamentals

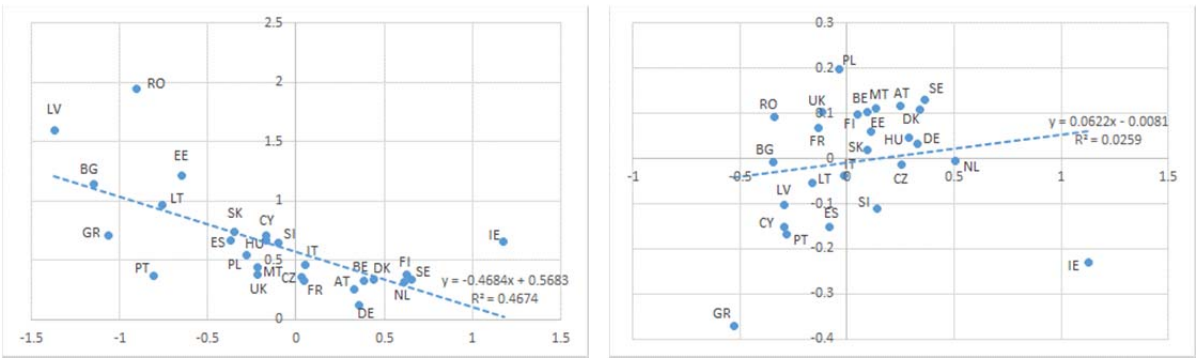
When the financial crisis hit the European economy and fully demonstrated its power, the existence of large imbalances proved to be devastating for many EU member states. As we demonstrated in the previous section the financial crisis induced some rebalancing of the disequilibria. However, this macroeconomic adjustment was often too distressing and painful, principally for the countries sunk into large external deficits. In this part of the paper, we relate external imbalances to selected macroeconomic variables that can stand behind the evolution of the imbalances. In order to emphasize the effect of the financial crisis we distinctly present relations in the pre-crisis and post-crisis period. We use simple regressions depicted in scatter plots for all 27 countries that were members of the EU at the end of the observation period.

Trade Balance and Demand

As mentioned above the domestic demand can be one of the most influential factors determining external imbalances. Since the current account consists of variety of transactions and not all of them are closely related to demand we estimate and present relationship between trade balance and domestic demand. In addition, the trade balance is tied with competitiveness more firmly than the whole current account. We particularly examine how the accumulated change in domestic demand as a percentage of GDP (axis y) can be attributed to the accumulated change in trade balance as a percentage of GDP (axis x). Totally different relationship patterns are revealed in Figure 4 if we compare the two subperiods. While the pre-crisis graph unequivocally indicates that the countries with largest increase in domestic demand generally run huge trade balance deficits and vice versa, the post-crisis picture shows insignificant linkage between the trade balance and demand. In the post-crisis period, we can observe considerably lower and even negative changes in domestic demand. Likewise, the dispersion of the trade balances across the EU decreased after the crisis. In this context, Buti (2011) points out that corrections in domestic demand were accompanied by corrections in external imbalances particularly in 2008-2010. This rebalancing process was also associated with a massive rise in unemployment which may indicate insufficient price/wage adjustment. The financial crisis partially eliminated the trend of increasing differences in international competitiveness and interrupted flows of cheap capital from surplus to deficit countries where it financed excessive spending. Hence, the two channels through which domestic demand and trade balance are usually connected lost strength and the mutual relationship weakened.

Figure 4 Trade balance and total demand in the EU

Pre-crisis (1999-2007) Post-crisis (2008-2013)



Source: Author's calculations based on data from AMECO database

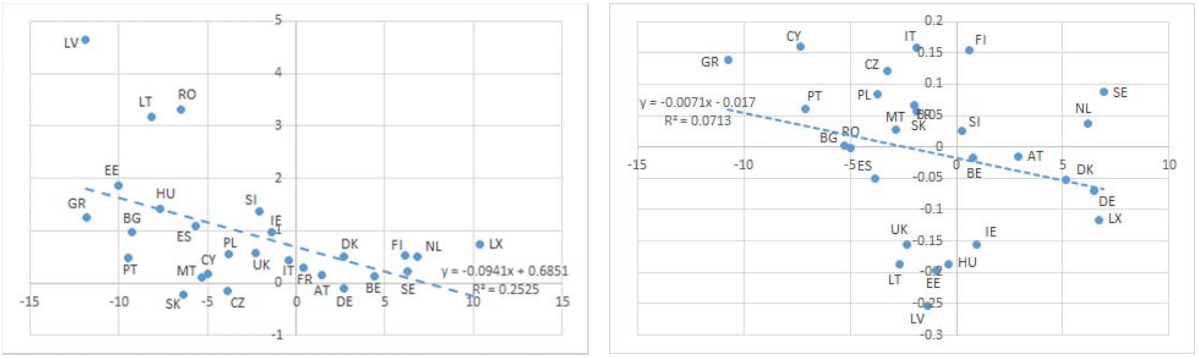
Current Account and Credit to Private Sector

Since we assume that the uncontrolled demand expansion was based on credit inflows to deficit countries we should obviously relate current account imbalances to volume of credits disbursed to private sector. Scatter graphs in Figure 5 depict the relation between the average current account balance as a percentage of GDP (axis x) and change in volume of credits to private sector as a percentage of GDP (axis y). It is well known that companies in the EU have had a tendency to fund themselves much more from banks than from markets, suggesting substantial 'bank dependency'. According to data from the European Central Bank the non-financial corporations residing in the euro area had around 75% of consolidated debt in their balance sheets in form of bank credits before the crisis (De Rougemont and Winkler, 2014).

The graph from the pre-crisis period clearly shows positive relationship between credit expansion and current account deficit. There are several factors that have encouraged cross-border credit flows in the EU. The increased level of financial integration within the EU and the euro area in particular have definitely stimulated European banks to lend to other EU member states. Next important factor is the fast convergence in nominal interest rates and their decrease to historical lows across the EU. The simple regression documents that the countries which gained most of the profit from reduction in funding costs also accumulated the largest current account imbalances.

Figure 5 Current account and credit to private sector in the EU

Pre-crisis (1999-2007) Post-crisis (2008-2013)



Source: Author's calculations based on data from AMECO and World Bank databases

In reaction to the new market conditions after the crisis banks substantially tightened credit standards and non-financial companies were able to obtain less resources from banking sector and other financial intermediaries. This is apparent in the post-crisis graph as many countries report negative growth rates in credit volume during the period 2008-2013. Therefore, it is not surprising that the pre-crisis relation between the credit volumes and current account imbalances faded away during the post-crisis period.

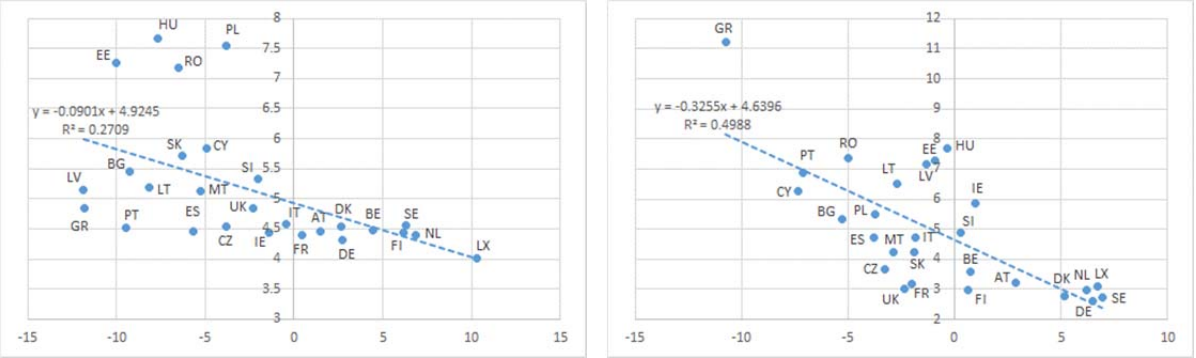
Current Account and Long-Term Interest Rates

The financial balance of the public sector is the element that can be hardly isolated from the issue of imbalances in the EU as we already documented in discussion on the savings-investment imbalance. For that reason we examine the relation between the current account balance and yields on 10-year government bonds. We consider sovereign bond returns as a good common proxy for financial balance of the public sector and sustainability of public finances. In Figure 6 we report usual scatter plots with average current account balance as a percentage of GDP (axis x) and long-term nominal interest rates represented by average yields on 10-year government bonds in % p.a (axis y). Until the financial crisis sovereign bonds of all EU and particularly euro area member countries were considered as a safe investment and the spreads between them were marginal and insignificant. The positive relation between bond yields and current account deficit in the pre-crisis period is caused by four non-euro countries (Estonia, Hungary,

Poland, Romania). Without those 'outlier' countries, there was just a moderate relation between the examined variables. In fact, average bond yields of all traditional members of the euro area are situated around the level of 4.5%. On the other hand, the average current account balance of those countries varies between -12% for Greece and +7% for Netherlands (or even +10% for Luxembourg).

Figure 6 Current account and long-term interest rates in the EU

Pre-crisis (1999-2007) Post-crisis (2008-2013)



Source: Author's calculations based on data from AMECO database

Once the crisis hit aggregate demand and structural differences among the EU and euro area member states were perceived more intensively the long-term interest rates on government bonds started to reflect financial balance of the public sector more accurately. According to Canale and Marani (2014) the current account became the proxy for financial markets to evaluate a country's ability to repay its debts. The direction of capital flows reversed as compared with the pre-crisis period. Deficit countries experienced capital outflows and increases in government bond yields. Hence, the post-crisis graph in Figure 6 reports very different situation from the pre-crisis times. The range of current account balances now varies from -11% to +7% and the long-term interest rates are between 2.6% and 11%. Therefore, we can sum up that there is a solid and definite relationship between current account balances and ability of the public sector to finance additional deficit and debt.

4 Conclusions

The current account imbalances existed right from the start of the monetary union in 1999. However, they have been gradually enlarging and aggravated considerably in 2007-2008. While the group of surplus countries maintained the surplus around 6% of GDP the deficit countries reduced the imbalance substantially in the post-crisis period. Specifically, the current account deficit was -4.4% of GDP in 2008 and improved up to -1% in 2013. Nevertheless, this promising trend does not solve the problem of large stocks of current account surpluses and deficits accumulated in previous years. Although the pace of accumulation (principally on the deficit side) has been slowing down significantly the total volumes of current account surpluses and deficits have been continuously rising.

Evolution of the savings-investment imbalance considerably resembles development of the current account imbalance. Whereas the net savings ratio was increasing in surplus countries before the crisis the group of deficit countries experienced a fall in the net savings ratio. After the crisis, the surplus countries kept the ratio at stable and positive levels. Contrary to this, the savings-investment imbalance in deficit countries started adjustment towards equilibrium. It is clear that the divergence in national savings behavior between the two groups mainly originated in the private sector and the post-crisis turn in development of the net savings ratio in deficit countries was also caused by dramatic change of the private sector saving manners. While there had been only little divergence in government savings between the two groups before the crisis, government

saving fell faster and more steeply in the deficit group during the crisis and following recession.

We used the real effective exchange rate based on unit labor costs to investigate development of international competitiveness of the EU member states. It is apparent that countries with largest current account deficits usually experienced substantial real appreciation and subsequent worsening of the competitiveness. Likewise, the effect of the financial crisis is mostly recognizable in countries with large current account deficits where the crisis led to a reversal in development, activated real depreciation and, hence, lowered dispersion of the real effective exchange rates across the EU.

In order to illustrate how the imbalances adjusted after the crisis we related trade balance to domestic demand and current account balance to credit to private sector and yields on long-term government bonds. According to regression estimations and comparison of results obtained for the pre-crisis and post-crisis periods we can conclude that before the crisis the external imbalances were tightly linked with changes in demand and volume of bank credits disbursed to private sector. By contrast, we found only negligible relationship with government bonds yields. The financial crisis changed the picture completely. Whereas the relationship with demand and credit almost disappeared, which confirms that contraction in these two aggregates is a part of rebalancing process, differences in the current account balance are now more reflected in bond yields.

Acknowledgments

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Capital Structure and Capital Disparity across the Economic Subjects in the Agricultural Sector in the Czech Republic Before and After the Financial Crisis

Jana Steklá, Marta Gryčová

Czech University of Life Sciences in Prague
Faculty of Economics and Management, Department of Economics
Kamýcká 129, 165 21 Praha 6 - Suchdol, Czech Republic
E-mail: stekla@pef.czu.cz, grycova@pef.czu.cz

Abstract: *The financial crisis of 2008 had an impact on the entire economy of the Czech Republic, and especially for the Czech agriculture. The problem of the Czech agrarian sector lies mainly in its under-capitalization, which was amplified by the financial crisis. For this reason, the paper will focus on the capital structure. The aim of this paper will evaluate the development of the capital structure of agricultural subjects in the Czech Republic with respect to the legal form before and after the financial crisis. For this analysis will be used the debt leverage indicators and method of comparative statics. Data will be obtained and processed from the database of companies of Albertina for time series 2006 - 2011.*

Keywords: capital structure, agricultural sector, financial crisis, capital disparity

JEL codes: G32, Q14

1 Introduction

The agricultural sector is an important part of the national economy and has its own specifics. Its specificities are mainly seasonal nature of production and dependence on natural conditions. These specifics are reflected in the economic results of farm enterprises, thereby affecting their capital structure.

The capital constitutes one of the major factors of enterprises. In case of correct adjustment of capital structure, i.e. the ratio of equity capital and foreign capital, it is necessary take into account a number of factors which operate on the structure of capital. The capital structure is affected not only the specifics of the agricultural sector, but also a variety of funding sources or other factors such as the legal form of business.

An important is to find out an optimal capital structure. Businesses that are situated too far from the optimum faced greater risk of failure. Companies make efforts to increase leverage when they face growth opportunities or when poor performances reduce equity value. Businesses can gain advantage when rapid growth reduces financial slack.

There are two main theories of corporate capital which are the hypothesis of the optimal tradeoff and the hypothesis of the pecking order. The optimal tradeoff hypothesis was mentioned by Kraus and Litzenberger (1973), Jensen and Meckling (1976) and Morellec (2004). The pecking order hypothesis was mentioned by Donaldson (1961) and Myers and Majluf (1984) in their study.

According to the tradeoff hypothesis, taxes and costs combine to yield, thereby is acquired an optimal capital structure. And businesses are punished for deviating from that optimum in form of lower risk-adjusted returns, and potentially failure. On the basis the pecking order hypothesis, capital structure is a result of investment opportunities in the presence of asymmetric information. Businesses are faced to the new investment opportunities and they strive to moderate unfavorable selection costs and so they seek use the least risky forms of financing. Leverage is increased when there are a lot of investment opportunities and the demand for investment capital is greatly high. Leverage is decreased when there are not much investment opportunities and cash flow is extensive. Businesses are punished that they have not enough financial slack on investments or they do not maintain more slack than is optimal.

Leverage was mentioned, in different studies, by Lemmon et al. (2008), DeAngelo and DeAngelo (2007), Baker and Wurgler (2002), Fama and French (2005) and Welch (2011). Lemmon et al. (2008) and DeAngelo and DeAngelo (2007) defined leverage and they emphasized the potential tax advantage of debt financing. They measured leverage as the ratio of debt to total assets. Baker and Wurgler (2002) defined leverage and they emphasized information asymmetry. They included, to their study, equity in leverage and convertible debt. Fama and French (2005) defined leverage as total liabilities to total assets. Welch (2011) defined leverage as Fama and French (2005) and extra he added that there is an advantage for both financial and nonfinancial liabilities as claims to equity.

Under the capital structure, Minton and Wruck (2002) defined that the businesses with the low-leverage have high market-to-book value ratios. This phenomenon is not specific to particular industries. In addition the businesses do not have low tax rates, high non-debt tax shelters or information asymmetries. Shivdasani and Stefanescu (2010) mentioned that businesses are less conservative in their choices of leverage than in previous years, and they defined that businesses incorporate the magnitudes of pension liabilities in their capital structure decisions. Baker and Wurgler (2002) mentioned that the market timing has an influence on capital structure. Miller (1977) defined adaptive or imitative behavior of managers and their connection with an optimal capital structure. Lemmon, Roberts, and Zender (2008) mentioned that leverage ratios are characterized by a transitory and a permanent component. They found out that known determinants of capital structure do not exactly explain heterogeneity in leverage ratios. Another who was concerned with structure of capital was Graham and Leary (2011). They found out that standard variables used to explain observed capital structures have little ability to explain variation.

2 Methodology and Data

Data were obtained from the database Albertina for time series 2006 – 2011. After cleaning the data file (because of duplicates or incomplete information accounts) were analyzed 393 cooperatives, 706 limited liability companies and 473 joint-stock companies. They were selected businesses focusing their activities on crop and agriculture production.

In this article is used the following formulas:

- Debt to equity ratio (D/E ratio)
- Debt to assets ratio (D/A ratio)
- Interest coverage ratio (IntCov ratio)
- Gross profit ratio (GP ratio)
- Net profit ratio (NP ratio)
- Return on capital employed (ROCE)

The debt-to-equity ratio (Leavy, 2004) is a financial ratio indicating the relative proportion of shareholders' equity and debt used to finance a company's assets. Closely related to leveraging, the ratio is also known as Risk, Gearing or Leverage. The two components are often taken from the firm's balance sheet or statement of financial position (so-called book value), but the ratio may also be calculated using market values for both, if the company's debt and equity are publicly traded, or using a combination of book value for debt and market value for equity financially.

Debt to assets ratio (Welch, 2011), on a balance sheet, it is the debt (liabilities) plus equity equals assets. The debt to asset ratio shows the proportion of a company's assets which are financed through debt. If the ratio is less than one, most of the company's assets are financed through equity. If the ratio is greater than one, most of the company's assets are financed through debt. Companies with high debt/asset ratios could be in danger if creditors start to demand repayment of debt.

The formula for the interest coverage ratio (Faulkender, Wang, 2006) used to measure a company's earnings relative to the amount of interest that it pays. The interest

coverage ratio is considered to be a financial leverage ratio in that it analyzes one aspect of a company's financial viability regarding its debt.

Gross profit (Peterson, Fabozzi, 1999) is very important for any business. It should be sufficient to cover all expenses and provide for profit. When gross profit ratio is expressed in percentage form, it is known as gross profit margin or gross profit percentage.

According to net profit ratio (Guthmann, Dougall, 1955), net profit is equal to gross profit minus operating expenses and income tax. All non-operating revenues and expenses are not taken into account because the purpose of this ratio is to evaluate the profitability of the business from its primary operations. Examples of non-operating revenues include interest on investments and income from sale of fixed assets. Examples of non-operating expenses include interest on loan and loss on sale of assets. Net profit ratio is a useful tool to measure the overall profitability of the business. A high ratio indicates the efficient management of the affairs of business.

Return on capital employed (Gill et al., 2011) is a financial ratio that measures a company's profitability and the efficiency with which its capital is employed. "Capital Employed" is the sum of shareholders' equity and debt liabilities; it can be simplified as (Total Assets – Current Liabilities). Instead of using capital employed at an arbitrary point in time, analysts and investors often calculate ROCE based on "Average Capital Employed," which takes the average of opening and closing capital employed for the time period.

Depending on the selected formulas the following hypotheses were constructed:

- H1: There is a negative relationship between Debt to equity and Net profit/Gross profit.
- H2: There is a negative relationship between Debt to equity and Return on Capital Employed.
- H3: There is a negative association between Debt to equity and Interest coverage ratio.
- H4: There is a negative relationship between Debt to Total Assets and Net profit/Gross Profit.
- H5: There is a negative relationship between Debt to Total Funds and Return on Capital Employed.
- H6: There is a negative association between Debt to Total Funds and Interest coverage ratio.

In this article is used the Pearson Correlation coefficient (King, Rosopa, Minium, 2011) which is a statistical measure of the strength of a linear correlation between two variables X and Y, giving a value between +1 and -1 inclusive, where 1 is total positive correlation, 0 is no correlation, and -1 is total negative correlation. Pearson's Correlation coefficient between two variables is defined as the covariance of the two variables divided by the product of their standard deviations.

Pearson's correlation coefficient (Sharma, 2005) when applied to a sample is commonly represented by the letter r. It is possible to obtain a formula for r by substituting estimates of the covariances and variances. That formula for r is:

$$r = \frac{\sum_{i=1}^{n}\left(X_i - \overline{X}\right)\cdot\left(Y_i - \overline{Y}\right)}{\sqrt{\sum_{i=1}^{n}\left(X_i - \overline{X}\right)^2}\sqrt{\sum_{i=1}^{n}\left(Y_i - \overline{Y}\right)^2}} \tag{1}$$

$$r = \frac{1}{n-1}\sum_{i=1}^{n}\left(\frac{X_i - \overline{X}}{s_X}\right)\cdot\left(\frac{Y_i - \overline{Y}}{s_Y}\right) \tag{2}$$

For the first and the second formula, the sample mean is:

$$\overline{X} = \frac{1}{n}\sum_{i=1}^{n} X_i \tag{3}$$

For the second formula, the sample standard deviation is:

$$s_X = \sqrt{\frac{1}{n-1}\sum_{i=1}^{n}\left(X_i - \overline{X}\right)^2} \tag{4}$$

3 Results and Discussion

The table 1 shows calculated values for the debt to equity ratios (D/E) of farmers' cooperatives, limited liability companies (LLC) and joint-stock companies (JSC) during the period of 2006-2011. The limited liability companies has the highest values of this ratio and the standard deviation during this period, esp. more than 2x higher than the ratio for cooperatives and more than 4x higher than joint-stock companies before the crisis. The optimal value is just around 1 (when debt equals equity) and the average acceptable value is between 1.5–2 (Brigham, Ehrhardt, 2013). Before the crisis this ratio was over this limit, but nowadays is close to the optimal value for the LLC. This ratio is quite low for the joint-stock companies, which might indicate that the firms are not able to reap profits from their debts. The capital disparity in the sense of the amount of debt in relation to equity was quite high before the crisis. Afterwards, the gap mainly between LLC and cooperatives is narrowing.

Table 11 Debt to equity ratio [Figures in times]

	2006	2007	2008	2009	2010	2011	Mean	St. Dev.
Farmers' cooperatives	0.86	0.82	0.82	0.79	0.71	0.70	0.783	0.0647
Limited companies	2.11	1.68	1.50	1.33	1.16	1.01	1.465	0.3954
Joint-stock companies	0.50	0.49	0.54	0.47	0.48	0.48	0.493	0.0250

Source: own processing

Table 2 with similar ratio indicates that the indebtedness in the sense of debt to assets ratio of the LLC is in the range of an optimal level. Before the crisis the value for LLC was reaching the borders of the maximum but still normal values.

Table 12 Debt to assets ratio [Figures in times]

	2006	2007	2008	2009	2010	2011	Mean	St. Dev.
Farmers' cooperatives	0.46	0.45	0.45	0.44	0.42	0.41	0.438	0.0194
Limited companies	0.68	0.63	0.60	0.57	0.54	0.50	0.587	0.0644
Joint-stock companies	0.33	0.33	0.35	0.32	0.32	0.32	0.328	0.0117

Source: own processing

According to the Table 3 the cooperatives in the Czech agricultural sector are now the ones with the highest value of interest coverage ratio and the highest standard deviation, but according to the mean value the long-term highest value belongs again to the LLC. When compared to other sectors of the economy those values are quite low that might indicate that those companies are not very attractive for debt financing institutions. Also the standard deviation, the highest for cooperatives, is lower than in other sectors that could mean that the interest rate of their debt is quite stable.

The most efficient companies in the Czech agricultural sector are the LLCs when considering the highest gross profit ratio (Table 4), the highest net profit ratio (Table 5) and the highest value of ROCE (Table 6) during the whole monitored period before and just after the financial and economic crisis in the absolute values of the ratios as well as in the values of mean.

Table 13 Interest coverage ratio [Figures in times]

	2006	2007	2008	2009	2010	2011	Mean	St. Dev.
Farmers' cooperatives	4.31	8.74	5.58	0.16	4.46	8.85	5,35	3,2436
Limited companies	6.15	10.69	6.91	4.64	6.15	8.31	7,142	2,1088
Joint-stock companies	3.65	5.92	3.00	1.49	4.33	8.27	4,443	2,3779

Source: own processing

The highest standard deviations of those ratios were performed by the cooperatives as the ones which were hurt by the crisis the most. The high standard deviations are typical for the agricultural sector because of the special characteristics of agricultural business dependent mainly on weather and other agro-environmental conditions. When compared to the other sectors the profit ratios and mainly ROCE are lower that might make the reason for subventions.

Table 14 Gross profit ratio [Figures in percent]

	2006	2007	2008	2009	2010	2011	Mean	St. Dev.
Farmers' cooperatives	2.07	5.19	3.47	-1.28	2.57	5.47	2,915	2,4675
Limited companies	3.28	6.21	4.11	3.06	3.97	5.21	4,307	1,1999
Joint-stock companies	1.33	2.71	1.18	0.14	1.85	3.81	1,837	1,2825

Source: own processing

Table 15 Net profit ratio [Figures in percent]

	2006	2007	2008	2009	2010	2011	Mean	St. Dev.
Farmers' cooperatives	2.06	4.79	3.12	-0.89	2.43	4.63	2,69	2,0804
Limited companies	2.87	5.31	3.43	2.56	3.46	4.39	3,67	1,0180
Joint-stock companies	1.20	2.52	1.06	0.18	1.56	3.15	1,612	1,0694

Source: own processing

Table 16 Return on capital employed [Figures in percent]

	2006	2007	2008	2009	2010	2011	Mean	St. Dev.
Farmers' cooperatives	3.32	7.38	5.20	0.15	3.69	7.24	4,497	2,7299
Limited companies	9.00	14.50	10.23	7.09	8.25	10.64	9,952	2,5779
Joint-stock companies	3.01	5.39	3.06	1.40	3.49	6.81	3,86	1,9284

Source: own processing

Table 7 summarizes the results of correlation analysis between all mentioned ratios. As supposed the debt-to-equity and debt-to-assets ratios are highly positively correlated (by definition). The same is true for the positive correlation coefficients between GP and NP ratios and ROCE by definition and also between those profit ratios and interest coverage ratio. According to the hypotheses of this paper also there is also negative relationship between the debt ratios and profit ratios, except for the LLCs contrary to the hypotheses.

Table 7 Correlation matrices for capital structure and profitability (Pearson Correlation)

	D/E	D/A	IntCov	GPr	NPr	ROCE
			Farmers' cooperatives			
			5% critical value (two-tailed) = 0.8114			
D/E	1.000	**0.993**	-0.198	-0.221	-0.181	-0.178
D/A	0.993	1.000	-0.228	-0.244	-0.200	-0.203
IntCov	-0.198	-0.228	1.000	**0.993**	**0.992**	**0.995**
GPr	-0.221	-0.244	0.993	1.000	**0.998**	**0.994**
NPr	-0.181	-0.200	0.992	0.998	1.000	**0.993**
ROCE	-0.178	-0.203	0.995	0.994	0.993	1.000

		Limited liability companies				
		5% critical value (two-tailed) = 0.8114				
D/E	1.000	**0.989**	0.054	-0.169	-0.142	0.190
D/A	0.989	1.000	0.066	-0.150	-0.125	0.216
IntCov	0.054	0.066	1.000	**0.974**	**0.978**	**0.981**
GPr	-0.169	-0.150	0.974	1.000	**0.998**	**0.927**
NPr	-0.142	-0.125	0.978	0.998	1.000	**0.928**
ROCE	0.190	0.216	0.981	0.927	0.928	1.000
		Joint-stock companies				
		5% critical value (two-tailed) = 0.8114				
D/E	1.000	**0.980**	-0.195	-0.148	-0.134	-0.104
D/A	0.980	1.000	-0.262	-0.214	-0.185	-0.153
IntCov	-0.195	-0.262	1.000	**0.997**	**0.990**	**0.989**
GPr	-0.148	-0.214	0.997	1.000	**0.996**	**0.993**
NPr	-0.134	-0.185	0.990	0.996	1.000	**0.995**
ROCE	-0.104	-0.153	0.989	0.993	0.995	1.000
		All three economic subjects together				
		5% critical value (two-tailed) = 0.4683				
D/E	1.000	**0.976**	0.374	0.431	0.423	**0.702**
D/A	0.976	1.000	0.388	**0.472**	**0.470**	**0.707**
IntCov	0.374	0.388	1.000	**0.974**	**0.969**	**0.877**
GPr	0.431	0.472	0.974	1.000	**0.997**	**0.890**
NPr	0.423	0.470	0.969	0.997	1.000	**0.873**
ROCE	0.702	0.707	0.877	0.890	0.873	1.000

Source: own processing

The table no. 8 summarizes the statistics of the data for all economic subjects together during the period of 2006-2011.

Table 8 Summary Statistics (All economic subjects together), using the observations 2006-2011

Variable	Mean	Median	Minimum	Maximum
D/E	0.91389	0.80500	0.47000	2.11000
D/A	0.45111	0.44500	0.32000	0.68000
IntCov	5.64500	5.75000	0.16000	10.69000
GPr	3.01944	3.17000	-1.28000	6.21000
NPr	2.65722	2.71500	-0.89000	5.31000
ROCE	6.10278	6.10000	0.15000	14.50000
Variable	**St. Dev.**	**C.V.**	**Skewness**	**Ex. kurtosis**
D/E	0.47227	0.51677	1.13662	0.42833
D/A	0.11504	0.25501	0.47980	-0.88286
IntCov	2.71961	0.48177	-0.12107	-0.46926
GPr	1.94431	0.64393	-0.38112	-0.29637
NPr	1.63165	0.61404	-0.36364	-0.33003
ROCE	3.62693	0.59431	0.46647	-0.17571

Source: own processing

4 Conclusions

The results of the calculation of the financial indicators of the firms' health confirm the hypotheses of this paper for the economic subjects in the agricultural sector in the Czech Republic for the period of 2006-2011.

The financial and economic crisis of 2008 and 2009 lowers the debt to equity ratio, debt to assets ratio mainly for the limited liability companies, because during the crisis new

investments were closed and liquidity was lowered. The similar but in the opposite direction is true for the gross/net profit ratios and return on capital employed ratios.

The capital disparity gap between the LLCs, cooperatives and JSCs was quite lowered during and after the financial and economic crisis, not thanks to the similar profitability and a better usage of capital, but mainly thanks to crises and lower investment possibilities for LLCs.

The paper tried to evaluate the capital structure and its disparity in the agricultural sector just before, during and after the economic and financial crisis. However, deeper analysis should be processed to fully describe and foresee the capital conditions, structure and health of the Czech agricultural firms.

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The Effect of Ownership Structure on the Performance of Manufacturing Companies

Michala Strnadová, Michal Karas

Brno University of Technology
Faculty of Business and Management, Department of Finance
Kolejni 2906/4, 612 00 Brno, Czech Republic
E-mail: strnadova@fbm.vutbr.cz, karas@fbm.vutbr.cz

Abstract: *The article deals with the analysis of the influence of the distribution of property on company´s productivity. The distribution of property is understood here in the sense of company´s control by the domestic, respectively external, subject. The aim of this article is to identify the areas of financial productivity that are statistically significantly different in the companies which are controlled by the domestic or external proprietor. In the scope of here presented pre-research, the following areas of financial productivity were tested: profitability, liquidity, activity, indebtedness and productivity on the sample of twenty-seven engineering companies in the period between the years 2009 and 2012. The identification of the different factors was based on the Wilcoxon test for two independent sets. No statistically significant difference in the area of profitability, liquidity, activity (at the beginning of the researched area) and indebtedness was detected in the research sample. Statistically significant differences were detected especially at the end of the researched period in the areas of activity, wages productivity, assets productivity and costs.*

Keywords: ownership structure, firm performance, value drivers

JEL codes: G32

1 Introduction

Measurement and regulation of the performance of companies is one of the approaches to the improvement of effectiveness and competitiveness. Performance can be understood as a *rate of results achieved by individuals, groups, organisation and its processes*, see Nenadál (2004). According to Lesáková (2004), the firm performance refers to its ability to achieve desired effects and products in measurable units.

From the point of view of Performance management is a crucial issue, which factors affect it, or whether these factors are different depending on the size and ownership structure of enterprises. In opinion of the relationship between ownership structure[1] and business performance literature is not unanimous.

On the one hand, there are many writings that claim to ownership structure does not represent a significant factor affecting the performance of companies, see Claesens and Djankov (1999), Pivovarsky (2003), Šiška (2006), Brown et al. (2006), Blažek et al. (2007, 2009), Kadeřábková et al. (2007), Hanousek a kol. (2007) a Estrin et al. (2009). Demsetz and Villalonga (2001) examined the impact of indebtedness and ownership structure on the firm performance, and found out that the ownership structure is not a significant factor.

However, there are many papers, which arrived at an opposite conclusion that the ownership structure is an important factor in the performance of companies (see Hill and Snell, 1989; Blomström et al., 2001, Estrin et al., 2009), i.e. that the ownership structure is a significant factor. Estrin et. al. (2009) and Brown et al. (2006) add that companies controlled by an external investor are more successful than those controlled by a domestic proprietor. Estrin et. al. (2009) and Brown et al. (2006) add that companies controlled by an external investor are more successful than those controlled

[1] The term ownership structure is understood as absolute share of domestic, or rather foreign ownership in the share capital of the company

by a domestic proprietor. Šiška (2006) in his study states that enterprises with foreign ownership reached in his study higher levels of profitability. The profitability of enterprises researched yet been assessed on the basis of indicators return on assets and return on equity. The reason it states that the type of ownership affects the degree of autonomy enjoyed by corporate management for its decision making. Study conducted by Deloitte (2010) for the agency CzechInvest states that companies owned by foreign owners have higher productivity than the domestic firms.

According to the study, the Czech Statistical Office (2004) firms owned by foreign owners stand out in particular in the areas of productivity, return on sales, costs, equity or total equity capital. In contrast, companies owned by domestic owners excel in the areas of inventory turnover, the share of personal costs in relation to the added value and debt.

The purpose of the submitted article is to identify the areas of financial performance, which are statistically significantly different in companies controlled by a domestic or foreign proprietor.

2 Methodology and Data

Research Sample

Within the pre-research, 27 companies were analyzed from 2009 to 2012, which is a selection set. The companies are legal entities operating in the Czech Republic in the field of Manufacture of structural metal products (see CZ-NACE 28.1).

The basic set was selected from a group of organizations included in the HBI database (A Bisnode Solution). The basic set contains 1,556 companies. The selection set consists of those companies from the basic set, which participated in the questionnaire inquiry, containing 27 companies (as stated above). For the purposes of the questionnaire inquiry, companies from the basic set were addressed by e-mail. The questionnaire was filled in by means of a web form by 30 companies; however three of them did not publish their accounting statements. For this reason, they were not included in the selection set.

The structure of the sample of researched companies by their size is shown in Table 1:

Table 1 Basic characteristic of the research sample

Company size	**Number**	**%**	***Number of employees***	**Number**	**%**
Petty	7	25.93%	**Less than 10**	4	14.81%
Small	6	22.22%	**11 - 50**	13	48.15%
Medium	12	44.44%	**51 - 250**	8	29.63%
Big	2	7.41%	**More than 251**	2	7.41%
Total	27	100.00%		27	100.00%

Source: own research

As for the ownership structure, the structure of researched companies is as follows:

Table 2 Structure of the research sample by the ownership structure

Ownership structure	**Number**	**%**
Domestic proprietor	18	66.67%
External proprietor	9	33.33%
Total	27	100.00%

Source: own research

The performance of the analysed companies was analysed by means of the following 27 indicators, which were defined for each researched period. The total number of observation thus amounts to 108.

Table 3 List of analysed financial ratios

Indicator	Name	Calculation
EAT	Earnings after tax	EAT
EBIT	Earnings before interest and tax	Equity before taxes + interest
EBITDA	Earnings before interest and tax, amortization and depreciation	EBIT + amortization
ROA I.	Return on assets I.	EBIT/total asset
ROA II.	Return on assets II.	EAT/total asset
ROA III.	Return on assets III.	EBT/total asset
ROI	Return on Investment	EBIT/total capital
ROE	Return on Equity	EAT/equity
ROS I.	Return on Sales I.	EBIT/sales
ROS II.	Return on Sales II.	EAT/sales
ROCE	Return on Capital Employed	(EAT+interest)/(equity+long-term liabilities)
CR	Current ratio	Current assets/short-term liabilities
QR	Quick ratio	(Short-term financial assets+short-term receivables)/short-term liabilities
IR	Cash ratio	Short-term financial assets/short-term liabilities
TAT	Total asset turnover	Sales/total asset
FAT	Fixed asset turnover	Sales/fixed asset
IT	Inventory turnover	Inventories/average daily sales
DDR	Debtor days ratio	Short-term receivables/average daily sales
PTR	Payables turnover ratio	Short-term liabilities/average daily costs
TD	Total debt	Liabilities/total asset
ER	Equity ratio	Equity/total asset
TIER	Times Interest Earned Ratio	EBIT/interest
MD	Maturity of debt	Liabilities/cash flow
WP	Wage productivity	Revenues/personal costs
PFA	Productivity of fixed asset	Revenues/fixed asset
C	Cost	Cost/revenues
PC/VA		Personal costs/value added

Source: Beaver (1966); Gibson (1987); Sedláček (2007); Tajnikar et al. (2008); Richard et al. (2009); Zeytinoglu, Akarm (2013)

Methods Used

The companies in the selected sample were divided into two groups by their ownership structure. The first group consists of companies with a domestic proprietor as a majority holder (interest in the registered capital exceeding 51%). The second group includes companies owned by foreign entities (interest exceeding 51%). For these groups, the aforesaid performance indicators were defined. The Wilcoxon test was used for the analysis of the difference between these two samples. An F-test was also considered for the analysis of the impact of the ownership structure on the performance of a company, but, regarding the low number of observations and abnormal distribution of data, the results would not have been evidential and reliable. The Wilcoxon test was selected because it is suitable especially if a set is smaller and an analysed random quantity shows abnormal distribution (see Procházka, 1999).

Wilcoxon Test for Independent Selections

It is a non-parametric test. A null hypothesis requires identical distribution of the examined quantity in both groups.

The test can be based on an asymptotically valid testing *z*-statistics, which is calculated by standardising the T_1 quantity by its theoretical medium value $E(T_1)$ and standard deviation σ_T, provided that a null hypothesis is valid

$$Z = \frac{T_1 - E(T_1)}{\sigma_T} \quad (2)$$

where

$$E(T_1) = \frac{n_1(n_1+n_2+1)}{2} \quad (3)$$

$$\sigma_T = \sqrt{\frac{n_1 n_2 (n_1+n_2+1)}{12}} \quad (4)$$

n_1, n_2 = number of companies within the first and second observation

(Hendl, 2012).

3 Results

The following table contains results of calculations made for the period from 2009 to 2012:

Table 4 Results of calculations for the period from 2009 to 2012

Indicators	T	Z	p-value	Indicators	T	Z	p-value
Earnings indicators				***Return indicators***			
EAT 09	4	1.363	0.173	ROA I. 09	10	0.105	0.917
EAT 10	13	0.169	0.866	ROA I. 10	13	0.169	0.866
EAT 11	9	0.845	0.398	ROA I. 11	9	0.845	0.398
EBIT 09	4	1.363	0.173	ROA I. 12	6	0.405	0.686
EBIT 10	13	0.169	0.866	ROA II. 09	10	0.105	0.917
EBITDA 09	4	1.363	0.173	ROA II. 10	12	0.338	0.735
EBITDA 10	13	0.169	0.866	ROA II. 11	10	0.676	0.499
EBITDA 11	10	0.676	0.499	ROA II. 12	6	0.405	0.686
EBITDA 12	3	1.214	0.225	ROA III. 09	10	0.105	0.917
Operating indicators				ROA III. 10	12	0.338	0.735
WP 09	6	0.943	0.345	ROA III. 11	11	0.507	0.612
WP 10	5	1.153	0.249	ROA III. 12	6	0.405	0.686
WP 11*	1	1.753	0.080	ROI 09	9	0.314	0.753
WP 12	1	1.461	0.144	ROI 10	14	0.000	1.000
PFA 09	6	0.943	0.345	ROI 11	9	0.845	0.398
PFA 10	9	0.845	0.398	ROI 12	6	0.405	0.686
PFA 11	8	1.014	0.310	ROE 09	8	0.524	0.600
PFA 12*	1	1.753	0.080	ROE 10	6	1.352	0.176
C 09	5	1.153	0.249	ROE 11	6	1.352	0.176
C 10**	0	2.201	0.028	ROE 12	7	0.135	0.893
C 11	13	0.169	0.866	ROS I. 09	5	1.153	0.249
C 12	6	0.405	0.686	ROS I. 10	9	0.845	0.398
PC/VA 09**	0	2.201	0.028	ROS I. 11	11	0.507	0.612
PC/VA 10	6	0.405	0.686	ROS I. 12	5	0.674	0.500
PC/VA 11	13	0.169	0.866	ROS II. 09	5	1.153	0.249
PC/VA 12	13	0.169	0.866	ROS II. 10	10	0.676	0.499
Liquidity indicators				ROS II. 11	10	0.676	0.499
CR 09	10	0.105	0.917	ROS II. 12	5	0.674	0.500
CR 10	11	0.507	0.612	ROCE 09	6	0.943	0.345

CR 11	9	0.845	0.398	ROCE 10	6	1.352	0.176
CR 12	7	0.135	0.893	ROCE 11	7	1.183	0.237
QR 09	9	0.314	0.753	ROCE 12	7	0.135	0.893
QR 10	12	0.338	0.735	***Activity indicators***			
QR 11	12	0.338	0.735	TAT 09	10	0.105	0.917
QR 12	5	0.674	0.500	TAT 10	14	0.000	1.000
IR 09	7	0.734	0.463	TAT 11	12	0.338	0.735
IR 10	10	0.676	0.499	TAT 12**	0	2.023	0.043
IR 11	13	0.169	0.866	FAT 09	6	0.943	0.345
IR 12	5	0.674	0.500	FAT 10	9	0.845	0.398
Debt indicators				FAT 11	8	1.014	0.310
TD 10	10	0.676	0.499	FAT 12*	1	1.753	0.080
TD 11	12	0.338	0.735	IT 09	3	1.214	0.225
TD 12	7	0.135	0.893	IT 10	8	1.014	0.310
ER 09	7	0.734	0.463	IT 11	8	1.014	0.310
ER 10	9	0.845	0.398	IT 12	2	1.095	0.273
ER 11	11	0.507	0.612	DDR 09	9	0.314	0.753
ER 12	7	0.135	0.893	DDR 10	10	0.676	0.499
TIER 09	1	0.447	0.655	DDR 11	8	1.014	0.310
TIER 10	2	0.535	0.593	DDR 12	6	0.405	0.686
TIER 11	2	0.535	0.593	PTR 09	10	0.105	0.917
TIER 12	1	0.447	0.655	PTR 10	10	0.676	0.499
MD 09	9	0.314	0.753	PTR 11	12	0.338	0.735
MD 10	6	1.352	0.176	PTR 12	10	0.105	0.917
MD 11	13	0.169	0.866				
MD 12	7	0.135	0.893				

Note: * - significance level 10%, ** - significance level 5%, *** - significance level 1%
Source: own research

According to the conclusion Wilcoxon test for independent selections does not exist in the analysis period a statistically significant difference in any of the standard level of significance in the area of earnings among the companies, which are dominated by domestic or foreign owner. Profit was examined on different levels (EAT, EBT, EBIT, EBITDA).

Similarly, a statistically significant difference was not identified not in the area of profitability. Profitability was examined both in terms of the profitability of the assets, and that as the ratio of EBIT, EBT or EAT and total assets (see ROA I, II, III). Furthermore as the profitability of sales (ROS), i. e. as the ratio of EBIT and sales. And also as a Return on Capital Employed (ROCE), calculated as the ratio of the sum of the EAT and the interest and total equity and long-term liabilities.

Also in the area of liquidity was not found statistically significant difference between groups of examinees enterprises. Liquidity was evaluated as Current ratio (CR), or the ratio between current assets and short-term liabilities, Quick ratio (QR) (sum of short-term financial assets and short-term receivables divided by short-term liabilities) and Cash ratio (IR), or the ratio of short-term financial assets and short-term liabilities.

The results also showed that a statistically significant difference between the groups of enterprises, nor is there the examinees in the area of debt. Both when assessing the overall level of indebtedness of an indicator of the Total debt (TD), i.e. the ratio of liabilities and total asset or Equity ratio (ER), i.e. the ratio of Equity and total asset, nor between the values of interest coverage (TIER), i.e. the ratio of EBIT and interest or debt repayment period (MD), i.e. the ratio of liabilities and cash flow.

In the area of operational indicators exists according to Wilcoxon test statistically significant difference at the 10% level of significance it between enterprises with domestic and foreign ownership only for Wage productivity indicators (WP), i.e. the ratio between the personal costs and revenues in 2011 and the Productivity of fixed asset (the ratio between the revenues and fixed asset) in the year 2012. In 2010, the statistics has been identified a significant difference on a 5% level of significance for Cost (C), i.e. the ratio of cost and revenues, and in 2009 the ratio PC/VA (personal cost/value added).

Another statistically significant difference between the groups of enterprises were identified in the area of activity. And especially for the parameters Fixed asset turnover (FAT), i.e. the ratio of sales and fixed asset, respectively. Total asset turnover (TAT), i.e. the ratio of sales and total asset. In the year 2012 was proved the difference for the FAT indicator at the 10% level of significance and her pointer TAT (in the same year) at the 5% level of significance.

For other survey indicators of activity, which were Inventory turnover (IT), i.e. the ratio of inventories and average daily sales, Debtor days ratio (DDR), i.e. the ratio of short-term receivables and average daily sales and Payables turnover ratio (PTR), i.e. the ratio of short-term liabilities and average daily costs have not been identified statistically significant differences on any of the standard level of significance.

4 Discussion

In the area of debt relief were not found statistically significant differences between companies owned by domestic and foreign owners. This conclusion is consistent with the findings of the authors Demsetz and Villalonga (2001). However, contrary to the conclusions of the study, the Czech Statistical Office (2004).

The conclusions of the Šiška (2006), or the study of the Czech Statistical Office (2004) about the different degree of profitability were not within the framework of the study presented here confirmed. The profitability of the companies investigated were assessed on the basis of indicators of profitability of the total capital and profitability of equity, i.e. as well as in those works.

The conclusions of the study, the Czech Statistical Office (2004), however, can be confirmed in the field of operational indicators, in particular the ratio of personnel costs and value added (see pointer PC/VA). In the area of asset management, however, the conclusions of the studies mentioned further up, in particular in the area of inventory turnover.

5 Conclusions

The aim of this article was to identify the areas of financial productivity that are statistically significantly different in the companies which are controlled by the domestic or external proprietor. The research was based on data collected from 2009 to 2012; 27 indicators were tested. The analysis of the difference between two samples was based on the Wilcoxon test due to the smaller scale of the set and abnormal structure of the analysed random quantity. Using the aforesaid method, a significant influence of the activity indicators and operating indicators was identified.

According to calculations carried out has not been identified statistically significant difference between groups of enterprises in the areas of examinees result, profitability, liquidity and indebtedness. In contrast, in the area of operational indicators and actions have been demonstrated statistically significant differences, especially in Wage productivity indicators (WP), the Productivity of fixed asset (PFA), the ratio of personal cost/value added (PC/VA), Fixed asset turnover (FAT) and Total asset turnover (TAT).

The results prove that the effectiveness in using the total assets (and/or fixed assets) in companies controlled by the external and domestic proprietor differs. The operating indicators indicate that indicators differ by the type of an owner also in the area of the labour productivity.

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Corporate Non-life Insurance Claims: Empirical Evidence from the Polish Market

Grzegorz Strupczewski

Cracow University of Economics
Faculty of Finance, Department of Risk Management and Insurance
Rakowicka Street 27, 31-510 Cracow, Poland
E-mail: strupczg@uek.krakow.pl

Abstract: *The aim of the article is to analyze non-life insurance claims reported by corporations. Most publication in the field of insurance losses concentrates on aggregate loss data for the whole industry presented by a domestic insurance supervision authority. Sometimes there are papers presenting claims statistics given by one particular insurance company or focusing on one particular type of losses (e.g. motor insurance losses). The paper is based on unique database of a leading insurance broker, containing ca. 5.000 loss records reported by a portfolio of 480 Polish companies during a 7-year period. The loss statistics cover a wide range of industries and lines of insurance business. The paper presents valuable insight into a structure of insurance losses divided into particular industries and lines of insurance business. There also will be shed some light on level of deductibles built into insurance policies. Moreover, the level of risk retention in particular industries will be compared.*

Keywords: insurance, loss experience analysis, deductible, risk retention

JEL codes: G22, G30, L60, L80

1 Introduction

Insurance activity is reasoned by the presence of risk, the implementation of which leads to unfavorable effects (Thlon 2013, p. 17). Insurance protection provided by the insurance company is an intangible service, difficult to capture, based mainly on mutual trust of the parties to the agreement, which is an insurance contract.

If the insurance contract is the guarantee of getting financial compensation for the random loss, the moment of its verification which enables evaluation of established protection terms is reporting a compensation claim to the insurance company, which, after completion of the loss adjustment procedure is obliged to pay due benefit without further delay and in adequate amount (Strupczewski, 2011).

The purpose of insurance is to provide financial compensation against random events, which the insured is exposed for. The classical theory of risk management lists five factors that determine the choice of risk financing methods: frequency of losses, extent of damage, financial resources of an organization, the size of a company, cost of insurance (Baranoff, 2000). Insurance risk transfer is not the only solution. In some cases, it is worth considering the decision to retain all or part of a risk. The larger the organization, the better the absorption capacity of negative consequences of a risk (Denning, 1978). Retention is a risk financing method, according to which an individual experiencing losses covers their direct financial consequences (Williams et al., 2002).

Insurance perceived as a method of risk management is a complex instrument, that connects elements of transfer and risk diversification, risk control (prevention), and specifically - retention, by retaining some of the risk of the insured's deductible (Strupczewski, 2013). Rejda (2008) distinguishes active (conscious) and passive retention. Retention should be used in relation to high-frequency and low potential losses risks. Definitely it is not recommended to retain risks of low frequency and potentially catastrophic consequences. Taking into account the time factor, retention can be divided into prospective (*ex ante*), retrospective (*ex post*) and simultaneous (losses charged to current income) (Williams et al., 2002).

Full insurance coverage is not always economically reasonable, hence - somewhat in opposition to the basic principle of full-coverage insurance – the subjects of the insurance relation decide on covering financially random loss including their individual needs. One of the anomalies on the insurance demand is purchase of insurance policies with too low deductibles, despite the fact that it would be more profitable to raise the deductible in exchange for a reduction in premiums (Kunreuther et al., 2013).

The measure of enforcing the full-coverage principle is the relation of insurance compensation to the value of the random loss (Sangowski, 1996). Gaining the assumed ratio between retention (representing particular risk exposure) and transfer of risk to the insurer is possible by the use of deductible in insurance contracts. Its level should on the one hand correspond to the loss profile of the insured subject, so that the total loss volume of the deductible does not exceed the assumed risk appetite, whereas on the other hand – the underwriting policy of the insurer, who basing on own data on the loss distribution tends to compose the optimal portfolio of insurance contracts. From the point of view of the client, this may mean the use of mandatory deductibles, which are non-negotiable (Strupczewski, 2010).

Risk retention is a "default" risk management technique in the sense that not applying other method, such as risk avoidance, risk control or risk transfer, means de facto retention. It means that retention is the most common method of handling risk (Vaughan, 2014). In some cases, retention is the only (or most effective) method of risks financing (due to unavailability of insurance coverage, high deductibles imposed by the insurer, lack of effective risk control) (Williams et al., 2002).

Taking into account the above concerns, the aim of the article is to study the economic viability of the insurance coverage by the insurers (in this case a group of Polish enterprises) in the context of random loss compensation covered by insurance. The following hypotheses will be verified:

- H1: structure of corporate losses (quantity, value, type) depends on type of business activity (PKD),
- H2: level of retention differs across type of business activity (PKD),
- H3: level of retention depends on type of insurance line.

2 Methodology and data

In the present study the data set was used on reported losses provided by one of the leading international brokerage firms operating in Poland (the similarity of Polish economy to the EU average is proved, among others by Stanczyk and Wyrobek (2012), 2013). The research sample includes 480 enterprises from different sectors of the economy divided by PKD sections (see table 1). The major area of business activity specified in the documentation decided upon the assignment of an entity to a specific PKD section.

Polish Classification of Activities (PKD) it is the systematics of economic activities commonly used in Poland, principally used in the business activity register and public statistics. It is composed of 21 sections marked with successive letters of the alphabet, and within them 88 divisions of PKD classification indicated with double-digit numbers. The full number of the PKD comprises of a letter signifying the section, subsequently two double-digit numbers separated by a dot. The analyzed group includes the enterprises whose main business areas cover 68 out of 88 departments. Therefore it is possible to state an adequate degree of a sample variation.

Enterprises from almost all sections of PKD are represented in the research sample. Merely three sections were missed: A - agriculture and forestry, T - household production for own use, U - extraterritorial organizations. Subjects belonging to these have minimal influence on shaping the analyzed phenomena among the whole population of enterprises in Poland.

Apparent dominance of two sections - C (manufacturing) and G (wholesale and retail trade) is seen when analyzing the subjective structure of the research sample. In these two areas 54.17% of analyzed subjects were centered. The above-mentioned sections including section K (financial services, banking, and insurance) are prevailing in terms of the number of occurred losses. Participation of section C, G and K in the overall loss ratio amounts to 57.62%.

Table 1 Structure of the research sample

PKD section	Description	Number of entities	Structure of entities	Number of claims	Structure of claims
B	Mining and quarrying	3	0.63%	5	0.10%
C	Manufacturing	163	33.96%	753	14.57%
D	Energy supply	14	2.92%	122	2.36%
E	Water supply. sewerage. waste management	21	4.38%	254	4.91%
F	Construction	29	6.04%	373	7.21%
G	Wholesale and retail trade	97	20.21%	1225	23.67%
H	Transportation and storage	32	6.67%	415	8.02%
I	Accommodation and catering	9	1.88%	318	6.14%
J	Information and communication	11	2.29%	184	3.56%
K	Banking. insurance and other financial services	13	2.71%	1003	19.38%
L	Real estate activities	41	8.54%	101	1.95%
M	Professional. scientific and technical activities	23	4.79%	130	2.51%
N	Administrative and support service activities	6	1.25%	12	0.23%
O	Public administration	8	1.67%	257	4.97%
P	Education	2	0.42%	2	0.04%
Q	Healthcare and welfare	1	0.21%	2	0.04%
R	Culture and entertainment	5	1.04%	15	0.29%
S	Other service activities	2	0.42%	3	0.06%
	Total	**480**	**100%**	**5174**	**100%**

Source: Author's own calculations

The research period encloses 7 full calendar years - from 2007 to 2013. The loss is assigned in the register to the calendar year, in which the insurance event occurred. As a result of the possible discrepancy in the years between the year of the loss occurrence, year of reporting it to the insurance company and the year of payment of the compensation, the decision was made on combined analysis of the whole period without splitting the data for each year.

The data do not include transportation losses reported from liability insurance policies of the motor vehicles owner, Auto- Casco, Assistance, etc. The losses are subject to records in other databases due to their large number and different procedure of consideration. Life insurance and other personal insurance were not included, except the claims concerning personal injury reported within the liability policies.

At first (in the version passed by the broker) compensation claims database included 9.740 submitted losses. Afterwards it was subjected to the clearance procedure, in which the following tasks were carried out:

- incomplete items were removed,
- claims rejected by the insurance companies were removed,

- claims withdrawn from the process of loss settlement before its closure were removed,
- due to the lack of final data on the amount of compensation granted, so called "open losses" were also removed, that is where the settlement procedure has not been finally closed yet.

In the analyzed period, the enterprises reported compensation claims to the insurance companies due to 5.175 insurance accidents. The total value of reported losses amounts to 300.264.497,21 PLN. In the course of detailed verification of particular database records it was established that in the database there is one loss evaluated at 103.054.369 PLN, and therefore forming 34% of all submitted claims within seven years. The outlier of such particular importance could deform the results, thus it was decided to omit it. Finally therefore, the research sample comprises of 5.174 losses with a total value of 197.210.128 PLN.

In the concerned insurance portfolio the systematics of losses was applied according to the following groups of risks:

- construction and erection risks (CAR/EAR)
- goods-in-transport risks (Cargo)
- elementary risks: fire, explosion, fall, lightning (Flexa)
- inundation risks (Inundation)
- machinery breakdown risks (MB)
- natural risks (Natural Perils)
- other property risks, such as financial risks, loss of profit risks (Other property)
- theft risks (Theft)
- third party liability risks (TPL)
- vandalism risks (Vandalism).

3 Results and Discussion

Characteristics according to the Types of Losses

During the seven-year history of the loss ratio of the analyzed insurance portfolio the largest number of losses were reported due to third party liability insurance (30.67%). The insurance claims of other property risks (16.04%) and vandalism risks (15.83%) were also significant. One in ten notifications concerned theft or inundation loss.

Civil liability claims, apart from the highest frequency, were also significant due to the second most valuable volume of losses (approximately 34.7 million PLN). The insurance accidents from the Flexa category were almost twice as costly (approximately 76.4 million PLN). This greatest loss potential had its origin in the relatively high average value of one loss (approximately 270.000 PLN) with the low incidence of events. The record level of the average loss was noted in the category "natural perils" (mainly floods and hurricanes), which revealed a specifically high susceptibility of the insured property to natural disasters. The risks causing the smallest average single loss contain vandalism (about 8.000 PLN) and theft (about 12.500 PLN).

Another area of loss profile analysis is the relation between the value of reported loss and the amount of compensation paid, expressed in the form of so-called full indemnification ratio. If its value is closer to 100%, the degree of fulfillment of one of the three basic principles of insurance, i.e. the principles of full coverage, is better. In the analyzed portfolio the cargo policies proved to be the most efficient, where the degree of claims coverage reached nearly 77%. High index values, of above 70% were additionally achieved in the areas of machinery breakdown, theft, and Flex risks. The lowest coverage was for the insurance claims of construction and erection risks (56.6%) and inundation risk (less than 60%).

Table 2 Structure of loss types (in PLN)

Type of loss	Number of claims	Structure of claims	Total value of claims	Average value of claim	Total value of indemnities	Average deductible	Average indemni-fication ratio	Claims below deductible to total claims value	Value of retained losses to total claims value
CAR/EAR	132	2.55%	9 580 891	72 582	7 975 015	12 171	56.6%	0.53%	15.97%
Cargo	122	2.36%	4 001 548	32 799	3 697 172	2 352	76.8%	0.11%	7.12%
Flexa	284	5.51%	76 432 722	269 129	74 113 778	10 734	70.2%	0.63%	1.20%
Inundation	490	9.47%	10 049 611	20 509	7 026 204	8 475	59.7%	18.67% (4.74%)*	29.52% (15.59%)*
MB	199	3.85%	15 292 921	153 122	13 714 597	8 747	72.0%	3.70%	10.01%
Natural perils	155	3.00%	13 178 186	418 765	11 261 476	17 969	68.0%	4.49%	14.52%
Other property	830	16.04%	23 451 493	198 820	15 766 659	16 428	66.1%	5.99%	31.66%
Theft	556	10.74%	6 969 514	12 535	5 694 321	2 110	71.8%	0.51%	15.57%
TPL	1587	30.67%	34 681 715	151 195	28 623 606	6 610	63.3%	3.81%	17.11%
Vandalism	819	15.83%	3 571 527	8 020	2 274 115	1 883	68.1%	3.11%	34.91%

(*) The ratio in brackets has been calculated after removing a 1.400.000 PLN loss from dataset as an outlier
Source: Author's own calculations

The deductible contained in the insurance contract have determinant influence on the degree of insurance coverage. Their average values are highly correlated with the level of indemnification ratio. Therefore, the average deductible in cargo policies was 2.352 PLN, which - apart from vandalism (deductible 1.883 PLN) and theft (deductible 2.110 PLN) - constituted the lowest amount in the analyzed portfolio. The substantial volume of a single loss, found in insurance of natural perils, construction and assembly and Flexa risks - seem to explain the use of high deductibles in these policies. Nevertheless, it is worth noting that despite the relatively large amounts of agreed deductibles exceeding 10.000 PLN per one event, their relative level in relation to the average claim remained at an insignificant level (4% or 8%). From this perspective, the average deductible of "inundation" policies seems rather radical (8.475 PLN), which constitutes 41% of a single loss value.

Another factor that influences the rate of full indemnification index is the number of claims that have been rejected by the insurance companies due to the loss value below the deductible. The greater part of such insurance accidents the lower the level of full protection. This expected direction of the relation is confirmed by the empirical data, apart from the CAR/EAR insurance, where the low percentage of claims rejected because of the deductible (0.53%) is associated with the lowest indemnification index in the portfolio.

Finally, the retained loss index was analyzed, which expresses the share of losses not covered by insurance compensation in the total volume of claims. Uncovered losses constitute not considered losses below the deductible and - in case of events which are subject to a loss settlement process – a part of compensation claims not covered by the insurer as a result of the application of the deductible. The retained loss index therefore shows the real burden of the insured with the loss compensation costs. Firstly the considerable variation of this index among different types of risk should be noted (coefficient of variation V=62%). The holders of the insurance against the vandalism risk (35%), and other property risks (32%) cover with their own funds the largest part of incurred losses. Whereas, the Flexa and cargo policies provided their holders with the loss compensation (respectively 1.20% and 7.12%) in the greatest amount. The average level of loss retention is 16,4%, which means - on average, that in the event of loss with the value of 100 PLN, the insured obtains 83.60 PLN from the insurer in the form of compensation.

Characteristics of Losses by Economic Activities

The analysis of the losses types divided into separate PKD sections shows interesting insights on the loss profile of different economy sectors (table 3). Taking into account internal diversity of types of losses within the section, the following scheme can be proposed:

1) economic sectors characterized by the dominance of one type of loss:

- construction and assembly losses- construction sector,
- Flexa losses - manufacturing, trade, hotels and restaurants,
- inundation losses - health care and social assistance,
- machinery breakdown - mining, extraction, energy sector,
- other property risks - culture, entertainment and recreation,
- commercial liability - transport and storage industry,
- vandalism - education and other service activities.

2) sectors of the economy with a more balanced structure of loss types without the distinct dominant: sections E, J, K, L, M, N, O.

Table 3 Structure of loss types by PKD sections

PKD section	CAR/ EAR	Cargo	Flexa	Inun-dation	MB	Natural perils	Other property	Theft	TPL	Vanda-lism
B	0%	0%	0.00%	0%	69.07%	0.00%	0.00%	0%	30.93%	0.00%
C	1.07%	2.54%	64.58%	3.97%	2.10%	6.80%	9.77%	1.34%	7.78%	0.05%
D	0%	0%	0.48%	1.48%	93.63%	0.62%	0.62%	1.00%	2.06%	0.11%
E	0.76%	0%	43.28%	0.35%	2.54%	0.82%	10.71%	3.33%	37.30%	0.91%
F	56.47%	0.51%	0.84%	2.23%	7.33%	3.18%	14.74%	4.51%	9.32%	0.87%
G	0.01%	4.52%	45.02%	4.11%	3.63%	13.56%	10.52%	3.44%	14.52%	0.68%
H	0%	0.13%	6.11%	0.59%	0.08%	0.86%	19.42%	0.25%	71.65%	0.90%
I	0%	0%	59.94%	9.03%	0.95%	0.40%	10.46%	1.29%	14.75%	3.18%
J	0%	0%	34.17%	2.82%	1.80%	11.08%	32.72%	14.67%	2.64%	0.10%
K	0%	0%	4.52%	22.61%	0.95%	1.00%	13.78%	26.99%	4.42%	25.72%
L	0%	0%	4.24%	44.22%	1.72%	2.49%	29.80%	0.62%	11.86%	5.05%
M	18.76%	0%	4.33%	19.43%	6.83%	13.53%	2.18%	2.56%	32.06%	0.33%
N	0%	0%	0.00%	39.45%	7.67%	21.24%	14.14%	8.41%	9.09%	0.00%
O	0%	0%	25.00%	13.65%	3.63%	2.56%	23.12%	5.65%	18.30%	8.11%
P	0%	0%	0.00%	0%	0.00%	0.00%	0.00%	0%	0.00%	100.00%
Q	0%	0%	0.00%	95.57%	0.00%	0.00%	0.00%	0%	0.00%	4.43%
R	0%	0%	0.00%	2.58%	0.00%	19.11%	70.73%	0%	5.14%	2.43%
S	0%	0%	0.00%	0%	0.00%	0.00%	0.00%	0%	32.21%	67.79%

Source: Author's own calculations

In the cross-section of the analyzed seven years, the highest total volume of claims was reported in the following sectors: industry, trade, transport and storage, which accounted for 73.3% of all losses (table 4). Such a high concentration of loss distribution is explained by the prevailing representation of the enterprises profile in the analyzed sample (60.8% of all companies).

The diversification of the average deductible level in particular PKD sections can be explained by the nature, frequency and scale of potential threats. The highest deductibles are applied in industrial sector (about 25.6 thousand PLN), and the lowest - in the areas of education, culture and entertainment sector (less than 1.000 PLN). Strong correlation is noticed between the average loss value and the agreed deductible (correlation coefficient = 0.725).

Table 4 Structure of loss values by PKD sections

PKD section	Total value of claims	Average value of claim	Total value of indemnities	Average indemni-fication ratio	Average deductible	Claims below deductible to total claims value	Value of retained losses to total claims value
B	255 592	51 118	227 325	77.1%	6 985	1.16%	11.06%
C	78 395 138	104 110	67 565 001	68.8%	25 588	4.67%	13.45%
D	10 850 961	88 942	10 708 987	69.9%	2 112	0.06%	1.41%
E	2 121 811	8 354	1 999 872	78.1%	1 441	0.63%	6.01%
F	13 934 229	37 357	12 213 908	65.2%	5 988	1.26%	11.73%
G	42 166 188	34 421	35 275 829	61.3%	6 833	3.44%	15.66%
H	23 941 254	57 690	20 782 709	73.3%	12 655	2.33%	12.63%
I	2 673 710	8 408	2 396 573	57.4%	1 237	3.86%	10.40%
J	4 680 989	25 440	4 225 078	81.2%	3 432	3.85%	9.05%
K	9 889 157	9 860	7 560 867	67.6%	2 258	0.75%	22.17%
L	1 924 197	19 051	1 542 479	53.1%	6 112	6.15%	20.80%
M	4 541 911	34 938	4 192 706	74.6%	3 137	0.30%	7.71%
N	88 012	7 334	71 962	72.4%	7 452	9.09%	18.24%
O	1 363 168	5 304	1 043 509	50.6%	1 476	5.80%	20.32%
P	2 150	1 075	1 650	86.7%	250	0.00%	23.26%
Q	18 053	9 026	16 253	47.1%	1 000	4.43%	9.97%
R	257 077	17 138	234 576	81.9%	567	0.00%	3.31%
S	17 981	5 994	7 181	34.2%	1 203	0.00%	20.08%

Source: Author's own calculations

Full insurance coverage index indicates a small variation in cross- section of PKD. Compared to an average of 66.7%, the highest values - exceeding 80% - occurred in the sectors of: education, culture and entertainment, and telecommunications. The insurance policies held by public sector entities, some service and real estate services companies showed the lowest level of coverage.

In turn, loss retention index is characterized by a large range of variation. Starting from the values not exceeding 5% (energy, culture and entertainment), and ending with more than 20% of retention in the financial sector, real estate services, education, public administration and other services.

The degree of the deductibles level adjustment to risk exposure and the related scale of possible losses illustrates in a proper way the index of the losses value share below the deductible to the overall volume of losses in a given sector of the economy. On the basis of the data in the table it can be concluded that too high limit of the deductibles, resulting in a higher than average percentage of rejected losses due to the deductible, was adopted in insurance sections N (administration services and support service activities), L (real estate market) and O (public administration). It is worth noting that, despite a substantial amount of losses in the financial and banking sector (1.003 losses, which constitutes 19.4% of all claims), a remarkably low level of participation of losses below the deductible was reached which amounted to 0.75%.

In order to verify hypotheses H2 and H3, one-way analysis of variance ANOVA has been conducted. ANOVA provides a statistical test of whether or not the means of several groups are equal. It is useful in comparing (testing) three or more means (groups or variables) for statistical significance.

The dependent variable (quantitative) was the retention level indicator which represents share of a loss not covered by indemnity. In turn, independent (grouping) variables were a type of business activity (PKD) in case of hypothesis H2 or a type of loss in case of hypothesis H3, both of these variables expressed on a nominal scale. Before starting

ANOVA, the assumptions of homogeneity of variance, normality and lack of correlation between means in groups and standard deviations were verified. Regarding the first assumption, Levene's test and Brown-Forsyth test showed lack of homogeneity (*p-value* <0.05). This problem can be solved by application of the F Welch correction. The last two assumptions were checked by visual assessment of categorical normality chart and categorical chart of means relative to standard deviations. Then ANOVA with F Welch amendment was performed (see Table 5). It showed that both PKD section and the type of property damage are factors determining the level of retention in companies. Thus, the hypotheses H2 and H3 have been confirmed.

Table 5 Results of ANOVA with F Welch correction

Grouping variable	Levene's test of homogeneity	Brown-Forsythe's test of homogeneity	df	F Welch test	p-value
PKD	F=26.2700 (p<0.001)	F=18.4819 (p<0.001)	17	11.7812	p<0.0001
Type of loss	F=55.6066 (p<0.001)	F=34.5015 (p<0.001)	9	10.7761	p<0.0001

Source: Author's own calculations using the Statistica 10 software

4 Conclusions

The conducted analysis showed a significant variety of the loss process in the business cross-section of the economy and the kinds of risks insured. The assessment of the adopted deductible solely on the basis of data from the insurance contracts is difficult without reference to the value of real losses, particularly when the deductibles are expressed as a loss or compensation percentage. By means of tracking the shaping of the actual deductible deductibles values against the particular compensation claims it was possible to diagnose the quality of insurance coverage and adequacy of the agreed terms of protection to the loss profile of different PKD sections. In addition, a broader look at the insurance issues from the perspective of the level of risk retained of the deductible in business and generic cross-section is the advantage of this study.

All three hypotheses posed at the beginning of the paper have been proved. The structure of corporate losses (quantity, value, type) depends on type of business activity (H1). Moreover, it was showed that level of retention is significantly different across various types of losses (insurance lines) and types of business activity (hypotheses H2 and H3).

The author distinguishes the need for further research in this area, mainly aiming to formulate conclusions that would be relevant to the whole population of enterprises. Nevertheless, this requires obtaining a representative research sample. Additionally, the profound statistical analysis of the data, including using the agglomeration techniques and cluster analysis could lead to remarkable conclusions. Nevertheless, limited capacity of this study did not allow to carry out extensive statistical analysis. It will be the subject of future work of the author.

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Product Quality and Performance of the Enterprise

Petr Suchánek[1], Maria Králová[2]

[1] Masaryk University
Faculty of Economics and Administration, Department of Corporate Economy
Lipová 41a, 602 00 Brno, Czech Republic
E-mail: suchy@econ.muni.cz

[2] Masaryk University
Faculty of Economics and Administration
Department of Applied Mathematics and Computer Science
Lipová 41a, 602 00 Brno, Czech Republic
E-mail: kralova@econ.muni.cz

Abstract: *The subject of this paper is the relationship between product quality and the performance of an enterprise. The aim of this paper is to analyze the affect of product quality on the performance of the enterprise. The paper is based on research into product quality (which includes six parameters) and the performance of enterprises in the food industry in the CR. The research was conducted by questionnaire and ascertained both qualitative and quantitative data. The evaluation was performed using standard statistical methods. In the research into the relationship between product quality (according to several parameters) and enterprise performance, the impact of quality parameters (individually and combined) on enterprise performance has been proven (statistically).*

Keywords: performance, product quality, ratios

JEL codes: L15, L25, L66, O31

1 Introduction

This paper is published as a part of ongoing specific research entitled Quality Management and Enterprise Competitiveness, and whose authors are the researcher concerned. One aspect of the research (and the subject of this paper) is an analysis of product quality and the performance of an enterprise. It is our thesis that the quality of a product affects an enterprise's performance. At the same time, product quality can be identified according to a variety of factors. In this paper the authors examine six of these basic factors. The aim of the paper is therefore to analyze the relationship between product quality with its various factors and the performance of an enterprise. This analysis will be conducted on a sample of food enterprises in the Czech Republic.

Our research draws on the assumption that the performance of an enterprise is influenced (among other things) by the quality of the product. From this starting point we formulated the hypothesis that an improvement in product quality will lead to the improved performance of the enterprise. It will be interesting in this respect to ascertain what factors in terms of quality have an influence on enterprise performance and how (or how much) such factors of quality influence enterprise performance.

The performance of a company is by definition linked with productivity, i.e. with the output achieved by a particular company. This necessarily means performance can be calculated and further analyzed. Enterprise performance can be evaluated in a variety of ways; nonetheless, for the purpose of our research were used quantitative methods based on performance ratios.

With respect to the fact that the performance of a company is given in relation to the quality of its product, this quantity must be defined too. Quality can be defined as the degree to which requirements are fulfilled through a set of inherent characteristics (Nenadál et al., 2002). The quality of a product is thus conceived not simply in terms of its technical advancement, but in particular its ability to satisfy customer requirements. At the same time it applies that the more the product accords with the requirements of the customer, the greater the product quality. In this regard, various components (factors) of quality can be examined (see the subchapter: Model Specification).

2 Methodology and Data

Research was conducted in the form of a questionnaire (in which qualitative data was ascertained). The questionnaire was divided into several areas, where for the purposes of this paper the area devoted to product quality, i.e. the individual factors affecting product quality, was used. This section contained seven rating scale questions (the rating scale ranged from 1 – 10).

The questionnaire was additionally supplemented with selected quantitative data from the balance sheet and profit and loss account (for 2012), so as to determine the basic ratios of profitability (namely ROE and ROA), assets (namely asset turnover), liquidity (including long-liquidity L3) and indebtedness (namely own-funds ratio). The design of these indicators also emanates from methods used by the authors in previous research, and which are furthermore in accordance with the design used by the Ministry of Industry and Trade of the Czech Republic (Suchánek, Špalek, 2007).

The sample of enterprises examined comprised 86 companies in the food industry sector, which were questioned during the autumn of 2013. Economic data were gathered for the year 2012. In relevant sector are total 23,443 companies by the Albertina database. Our research has primarily focused on limited liability companies and joint stock companies. These companies, which formed the basic set was the 4255. Information, including financial data (which was crucial for our study) were obtained from 86 companies (unfortunately not all companies - especially companies with limited liability - provided by us financial data or have them publicly available).

First, on the basis of economic indicators, companies were divided into 'performing' and 'non-performing' ones. Enterprises with two out of the three indicators (ROA, ROE, ATO) above the median, after discarding a priori poor enterprises (Equity < 0), are those the study regarded as performing. The remaining enterprises were regarded by the study as non-performing.

The qualitative factors of the enterprises' quality characteristics were then ascertained for both samples of enterprises, and differences were looked for between both of the samples. The results were evaluated by Mann-Whitney tests.

Apart from considering the effect of individual variables on financial performance separately when assessing product quality, the effect was also considered from a complex perspective. For this purpose, Discriminant Analysis was used. The goal was to categorise the companies into two groups based on six variables evaluating customer satisfaction. These two groups were subsequently compared with groups of performing and non-performing companies as classified according to ROA, ROE and ATO. Discrimination analysis (DA) enables a plentiful interpretation of results. Among others, it enables to establish which of the variables evaluating satisfaction bear information substantial for discrimination.

Model Specification

As part of researching the relationship between product quality and enterprise performance, a model was formulated for product quality in general which contains six variables. The first variable was product quality – the variable QUALITY – (in the sense of the utility conveyed by the product to the user). The next variable was customer requirements, i.e. to what extent are customer requirements reflected in the product – the variable CREQUEST. The third variable was – VALUE – (value which customers attributed to the product). The next variable was – DEFECT – (this examines the number of defects in percentages per year per 100% production). The fifth variable was – RECLAMATION – (similarly as in the case of defects, this examines the number of complaints in percentages per year per 100% production). The final variable was - INNOVATION SCORE – (this variable expresses the number of innovations during one year).

3 Results and Discussion

In the first section are set out the results of the evaluation of the performance of the examined enterprises with respect to individual performance indicators. The characteristics of the performing enterprises are given in Table 1, while the characteristics of the non-performing enterprises are given in Table 2. The results clearly show that there were 38 performing enterprises and 48 non-performing one.

Table 1 Economic characteristics of performing enterprises

	GOOD=1 Descriptive Statistics (enterpprise_quality.sta)						
Variable	**Valid N**	**Mean**	**Median**	**Minimum**	**Maximum**	**Lower Quartile**	**Upper Quartile**
ROE	38	0.2208	0.1436	-0.1099	1.3424	0.0839	0.2591
ROA	38	0.1590	0.1126	0.0235	0.9092	0.0630	0.1488
ACTIVITY	38	2.2329	1.7938	0.6448	6.6413	1.2838	2.7526
LIQUIDITY	38	2.7709	1.4631	0.6133	18.7491	1.0603	2.3904
EQUITY	38	0.5043	0.5237	0.0548	0.9407	0.2993	0.7225

Source: authors' calculations

In light of the classification method, it was no surprise that the performing enterprises in the selection have on average much higher ROE indicators, whereas the indictor for ROA and L3 liquidity is only slightly higher. The ATO indicator (assets) is on average for performing enterprises even a little lower. Also, the indebtedness indicator is considerably lower for performing enterprises than it is for non-performing ones. It is clear that the essential difference between the performing and non-performing enterprises in the investigated sample were the indicators for ROE and indebtedness, whilst at the same time it is clear that non-performing businesses are unable to adequately makes use of (sufficiently increase the value of) external resources or generate sufficient net profit. This obviously does not depend on the turnover speed of the invested resources, which is comparable (and compared with the sector – the average asset turnover is 2.07 – even above average), but rather on the ability to make effective use of resources. Added value in this sector is after all relatively low, so less effective economic management pushes enterprises into the non-performing category. It will be interesting to observe whether the quality of the product (or its innovation) will have an effect on this status.

Table 2 Economic characteristics of non-performing enterprises

	GOOD=0 Descriptive Statistics (enterpprise_quality.sta)						
Variable	**Valid N**	**Mean**	**Median**	**Minimum**	**Maximum**	**Lower Quartile**	**Upper Quartile**
ROE	48	-0.1318	0.0033	-3.9323	1.2060	-0.1586	0.0373
ROA	48	0.1271	0.0132	-1.3207	6.7551	-0.0320	0.0339
ACTIVITY	48	2.3242	1.6153	0.0000	16.9497	0.9043	2.8515
LIQUIDITY	48	2.8610	1.1747	0.0225	26.3785	0.9383	1.7672
EQUITY	48	0.2338	0.3060	-3.8082	0.9554	0.1208	0.4884

Source: authors' calculations

In the second section are set out the results of the comparison of the individual factors of product quality in connection with enterprise performance. The results are given in Table 3. It is clear from the results that, with the exception of the characteristic DEFECT, all other quality statistics are not statistically significant.

At a significance level of 5 %, it was shown using the Mann-Whitney test that performing enterprises have significantly less defective products than non-performing ones. The P-value of this test is 0.0149 (0.0299/2).

Table 4 clearly demonstrates the difference in the average number of defects between the two groups of enterprises. At first glance this difference is not especially pronounced. Nevertheless, viewed using the six-sigma methodology, the average number of defects of performing enterprises is 511; while the average number of defects of non-performing enterprises is 4692 (the six-sigma methodology measures the number of defects per million products).

Table 3 Comparison of quality factors in performing (group 2) and non-performing (group 1) enterprises

	Mann-Whitney U Test (w/ continuity correction) (enterprise_quality.sta) By variable GOOD Marked tests are significant at p<0.05000									
Variable	Rank Sum Group 1	Rank Sum Group 2	U	Z	p-value	Z adjusted	p-value	Valid N Group 1	Valid N Group 2	2*1sided exact p
QUALITY	1715	1687	680	-1.4	0.1580	-1.4546	0.1458	45	37	0.1574
CREQUEST	1972	1687	638	1.45	0.1484	1.4795	0.1390	45	35	0.1492
VALUE	1653	1687	720	0.15	0.8821	0.1502	0.8806	42	35	0.8828
DEFECT	1362	1687	340	**2.16**	**0.0307**	**2.2917**	**0.0220**	37	27	**0.0299**
RECLAMATIO	1409	1687	433	1.48	0.1388	1.6433	0.1003	38	29	0.1378
INNOV_SCO	1414	1511	635	-0.9	0.3687	x	x	39	37	0.3680

Source: authors' calculations

The result cannot be taken literally since, unlike the six-sigma methodology, the defects were not ascertained in reality (measured), but just estimated by the enterprise (by management representatives). Nonetheless, it is possible to give some idea as to the level of the quantity of defects and thus of the quality management level in both groups of enterprises. Performing businesses can, according to Barone and Franco (Barone, Franco 2012), be categorized (with respect to the six-sigma methodology) at level three (more than 63.4 and less than 2700 defects per million products) and non-performing businesses at level two (more than 2700 defects and less than 45500 defects per million products). Thus it appears that performing enterprises manage quality one level better than non-performing enterprises (and achieve an order lower number of defects).

Table 4 Quantity of defects per 1000 products for performing (GOOD=1) and non-performing (GOOD=0) enterprises

	GOOD=1 Descriptive Statistics (enterprise_quality.sta)				
Variable	**Valid N**	**Mean**	**Minimum**	**Maximum**	**Std. Dev.**
DEFECT	27	0.5110	0.0030	6.0000	1.5941
	GOOD=0 Descriptive Statistics (enterprise_quality.sta)				
Variable	**Valid N**	**Mean**	**Minimum**	**Maximum**	**Std. Dev.**
DEFECT	37	4.6917	0.0030	67.0000	12.3025

Source: authors' calculations

In the third section a comprehensive evaluation was made using discriminant analysis of all the examined quality factors (expressing the variables set out above) on the performance of an enterprise. The results are given in Table 5.

Table 5 The influence of quality factors on enterprise performance

N=59	Discriminant Function Analysis Summary (enterprise_quality.sta) No. of vars in model: 6; Grouping: GOOD (2grps) Wilks's Lambda: 0.80826 approx. F (6,52)=2.0559 p<0.0746 Wilks's Lambda	Partial Lambda	F-remove (1.52)	p-value	Toler	1-Toler. (R-Sqr.)
QUALITY	0.8218	0.9835	0.8736	0.3543	0.7785	0.2215
CREQUEST	**0.9022**	**0.8958**	**6.0459**	**0.0173**	**0.6511**	**0.3490**
INNOVATION_SCORE	**0.8791**	**0.9194**	**4.5591**	**0.0375**	**0.7871**	**0.2129**
VALUE	0.8135	0.9935	0.3392	0.5628	0.9556	0.0444
DEFECT	0.8417	0.9602	2.1539	0.1482	0.8863	0.1137
RECLAMATION	0.8440	0.9577	2.2988	0.1355	0.8293	0.1707

Source: authors' calculations

In order to evaluate the overall influence of quality variables on economic performance the "canonical discriminant score" was derived (based on the Fisher discriminant criterion), which with P-value=0.074 showed statistical significance at a significance level of 10 %. It therefore has a good capacity to differentiate economically performing and non-performing enterprises (68 % of enterprises were correctly classified using the given score).

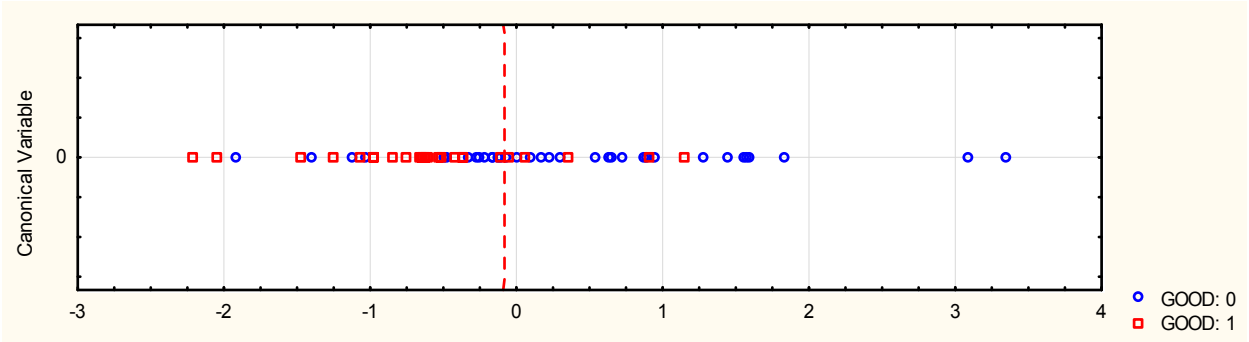
This discriminant score (Y) took the form:

Y= -0,33*Q + 0,9*CR - 0,73*I + 0,188*V + 0,48*D + 0,52*R

Where: Q = QUALITY
CR = CREQUEST
I = INNOVATION SCORE
V = VALUE
D = DEFECT
R = RECLAMATION

A company that obtains a value for the score (Y) less than -0.0908 is classified as a performing enterprise, whereas a score (Y) above this value means it is classified as non-performing. A summary of the results is given in Figure 1. Figure 1 shows the intermingling of red and blue symbols close to the value boundary; otherwise, good enterprises are on the left and bad ones on the right.

Figure 1 Classification of enterprises into performing (red squares) and non-performing (blue circles) based on a comprehensive evaluation of product quality



Source: authors' processing

The variables that best contribute to discrimination are CR and I. Their coefficients are the largest in terms of absolute value. A high value for the variable I (i.e. frequent innovation) leads to low values for the discriminant score (see the negative coefficient 0.73) and thus to the classification of the enterprise among the economically performing. It is also shown that a high value for the variable Q leads to a low value for the discriminant score and thus classification of the enterprise among the performing. These

statistical findings support the claim that enterprises which frequently innovate and which regard their products as high quality are also enterprises with better economic performance. High values for the variables V, D, R a CR on the other hand mean high values for the discriminant score and thus the classification of the business as a non-performing enterprise. In the case of variables D and R, the claim that enterprises producing poor quality (or lesser quality) products are also economically non-performing is supported. Naturally, the fact that a high value for CR leads to the classification of an enterprise as non-performing is surprising. In the evaluation of the comprehensive influence of all six quality variables on economic performance, it is the only controversial result.

The higher projection of customer requirements onto a product should increase product quality and as a consequence the performance of the enterprise. Why has the research shown the exact opposite to be the case? It would seem that how particular customer requirements are projected onto the product is important. The projection of customer requirements onto a product represents product innovation. Such innovation requires a certain amount of time to be implemented, as well as time for presenting the new product to the customer. Innovation must also be meaningful for the customer; it must significantly improve customer satisfaction. Only when this occurs will the customer be willing to pay the set price for the innovation (the enterprise's costs plus profit). It is thus no simple matter to balance out the frequency and significance of innovation (for the customer).

A further serious problem is also that an enterprise may fail to correctly ascertain (or estimate) what requirements customers may have, especially where enterprises seek to ascertain such requirements randomly, irregularly or unsystematically. If in fact the innovation does not reflect the actual requirements of the customer, they will not be willing to pay for such innovation and the performance of the enterprise will be reduced accordingly. In the light of previous research results, poor knowledge of customer requirements may be the main obstacle to a company's better performance (for more detail see Suchánek et al., 2013).

In addition, the fact that high values for the variable V (the value which the enterprises supposed the customer attributed to the product) lead to low enterprise performance, was also a somewhat odd result. It may be deduced that the level of product value depends on its price level, which then influences the company's performance. If the price is low, then the company will realize a smaller profit on the same volume of sales, and its performance will also be low. On the other hand, a low product price means high value (and high quality) for the customer. If therefore the product price is high, the value of the product is also high for the manufacturer, but the value of the product for the customer is low. Thanks to the fact that the quality of the product is primarily evaluated by the customer, the quality of the product is therefore also low and thus performance too is driven down.

If a business wants to maintain high performance at low prices, it must attain high levels of production (and sales), which means exerting pressure on existing customers (to buy more) as well as acquiring new ones. Conversely, with higher prices the business must convince the customer that the quality of the product (and value for the customer) is high and so that it makes sense for the customer to purchase the product. It may follow from the research that such communication, or customer pressure, is not overly successful for the time being (within the chosen sample of enterprises).

In total, all six of the stated variables participated in explaining 20 % of economic performance. This figure was achieved as 1- Wilks' Lambda, which in previous tables Wilks' Lambda=0.80826. It is therefore clear that besides quality (and its individual components), a series of other factors are influencing performance. These factors will form the subject of other analyses, since the research from which this paper is derived is voluminous and wide-ranging (and includes both internal and external factors affecting enterprises and their performance).

4 Conclusions

As a part of the research it was possible to divide enterprises into two groups (performing and non-performing) based on a series of ratios for ROA, ROE and ATO. While examining the influence of quality factors on enterprise performance, it was demonstrated that of the various factors, only product defects affected enterprise performance significantly when examined separately.

It was found that performing and non-performing enterprises differ by one level according to the six-sigma methodology. While performing businesses achieved a level three, non-performing ones only achieved level two. In view of the fact that the maximum level achievable is six (at least 1), it is clear that even performing enterprises still have some considerable slack in their management of quality (and defects). On the other hand, it must be emphasized that these results are only approximate, since no precise measurement was made (as is required by the six-sigma methodology), only an estimate.

It was further demonstrated (using discriminant analysis) that the six examined quality factors (combined) significantly influenced the performance of an enterprise. These factors also consider the quality factors (factors that affect the quality). Nevertheless variable Q represents technical quality (of product) which is understood as part of the overall product quality.

The hypothesis in the introduction to the paper can therefore be regarded as proven. The most powerful influence is exerted by customer requirements and the innovation score (number of innovations during the year), where the greater number of innovations means higher performance. Performance is further augmented by the high quality of a product (as judged by the enterprise). Conversely, performance is reduced by a high number of defects and complaints. One surprising result is that a high projection of customer requirements onto the product reduces performance. It seems that this problem primarily relates to the correct ascertainment of customer requirements, which obviously these businesses are failing to achieve (caused by the unsystematic or random ascertainment of such requirements). However, overall these factors help to explain 20% of economic performance, therefore other factors exist which influence enterprise performance.

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Financial Literacy of Masaryk University Students with Focus on Socially Disadvantages Citizens

Martin Svoboda

Masaryk University
Faculty of Economics and Administration
Institute for financial market
Lipová 41a, 602 00 Brno, Czech Republic
E-mail: svoboda@econ.muni.cz

Abstract: *The aim of this paper is to analyze the current level of financial literacy of Masaryk University (MU) students. The empirical survey was conducted among students of the Faculty of Economics and Administration MU. It included both full-time and combined-study students who enrolled in the courses "Basic Finance", taught in the Bachelor study program, and "Financial investment", which is offered to university students in the master's degree study program. The questionnaire survey was conducted within the Citi Foundation program and it was based on the project of "Empirical verification of university students' literacy", whose aim was to test the financial literacy of individual respondents, i.e. university students. The sub-objective was to identify suitable students who are skilled enough to disseminate voluntarily financial literacy within their communities and will focus primarily on socially disadvantaged citizens. For this reason, the initial questionnaire survey was modified to incorporate questions that can be closely connected with this group of socially disadvantaged citizens. The paper also addresses the issue of possible specific requirements and different approaches of financial literacy to a group of socially disadvantaged citizens. The first part focuses on the summary of theoretical knowledge, definitions and description of the basic concepts. The second part includes the research, which was conducted in the form of a questionnaire survey. The final part analyzes the results of the research.*

Keywords: financial literacy, university students, personal budget, money, education, socially disadvantages citizens

JEL codes: A10, A22, I23

1 Introduction

People of the Czech Republic, as well as nationals of other countries in the world, still lack a sufficient level of financial literacy (Ministry of Finance, 2010). This is true both for the knowledge and attitudes or behavior. Besides the projects and programs of financial education, which, however, still have a limited range with respect to the number of inhabitants, many people can regard a request for advice from their immediate neighborhood as a quick solution (Roulet, 2009). Nevertheless, it is assumed that these natural advisors will themselves have sufficient financial literacy and will be able and willing to help. Given the fact that recent research in the Czech Republic and abroad shows that financial literacy increases with education attainment (CNB, 2010), it can be assumed that university students or graduates can be a suitable group of people possessing a higher level of financial literacy and the ability to provide correct advice.

Universities can offer the opportunity to engage their students in the process of financial education of adults. University students were identified as suitable carriers and disseminators of financial literacy as well as instructors of financial education in the society (Atkinson, 2005). As a large group present in all regions of the Czech Republic they can provide a nationwide reach. Long-term sustainability is guaranteed through the annual arrival of new students at universities. They are independent, respected and trustworthy people, which is an important fact for disseminating financial education in disadvantaged and vulnerable communities.

In their studies students receive financial education and skills needed for further dissemination. They will subsequently present financial education independently or in

collaboration with non-profit organizations. Hence, students will be given the opportunity to develop their knowledge and experience, and the opportunity to participate in volunteer activities. At the same time they will learn responsibility towards the society and they will also get to know its reverse side. The program should therefore encourage a further development of the civil society and responsible behavior throughout the Czech population.

2 Methodology and Data

Research by The University of Economics (Hradil, Křížek and Dvořák, 2012) showed that this target group possesses higher financial literacy than the adult 18+ population (MFČR 2010), but still with some deficits. The second major finding of the VŠE research is the fact that 62% of university students or graduates believe that they would be able to advise on personal finance. The ability to advise grows with the real financial literacy; respondents' answers suggest that those who understand finance relatively better would rather help their neighborhood. Therefore it implies that it is appropriate for universities to teach courses that (1) strengthen the financial literacy of students and (2) equip them with the knowledge and skills necessary to effectively strengthen the financial literacy of others.

The survey was based on the structure of the "Empirical verification of university students' literacy" project; the Faculty of Economics and Administration participated in this structure through the Institute for Financial Market. The questionnaire was modified by experts on financial literacy (Lusardi, Olivia and Vilsa, 2010) in order to find the level of financial literacy at our faculty, and also for the subsequent selection of students who are willing to engage in the dissemination of financial literacy among the socially disadvantaged people of the Czech Republic.

The modification of the original questionnaire was as follows:

- The original questionnaire comprising 70 questions testing financial literacy in the monetary, numerical, pricing, budgetary, information and legal areas was expanded by 28 questions that explicitly focused on the issue of specific requirements and different approaches to financial literacy of the socially disadvantaged citizens.
- These 28 questions included 3 questions, which are the subject of international comparisons. These are the questions on interest rates, portfolio diversification and inflation (Lusardi 2009).

We wanted to verify whether the students are really equipped with the knowledge of the issues concerning specific claims and different approaches to financial literacy of the socially disadvantaged citizens so that they themselves would be able to effectively strengthen their financial literacy. By incorporating 3 questions of international comparisons we can expect that these questions will be among the easier ones and students will have no problem to answer them correctly.

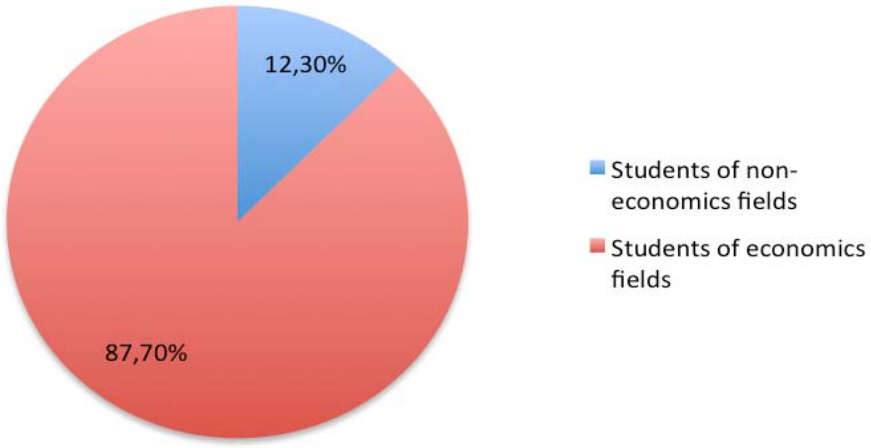
The survey of financial literacy included first-year students of the Bachelor's degree study program attending the course Basic Finance, third-year students of the Bachelor's degree study program attending the course Financial Markets, and first-year students of the Master's degree follow-up study program attending the course Financial Investment. Students of both forms of study, i.e. combined and full-time, were invited to participate (Masarykova Univerzita 2013). Overall, the survey conducted in 2013 included 918 students.

3 Results and Discussion

The total of 918 survey respondents included 473 women (51.5%) and 445 men (48.5%). The selected sample of respondents was well (almost ideally) diversified from a gender perspective. It was determined beforehand that the analysis will refrain from monitoring gender differences. It is assumed that knowledge of men and women are at the same level.

The survey included a relatively high percentage (12.3%) of respondents studying non-economic fields, which is shown in the Figure 1.

Figure 1 The ratio of students of economic and non-economic fields



Source: own calculations

It should be noted that most of the students studied the Financial and Insurance Mathematics program or the Mathematics and Economics program at the Faculty of Science MU. Given the fact that the students of these programs took several courses at the Faculty of Economics and Administration and their study programs are very close to finance, it was decided not to differentiate between students of economic and non-economic fields.

The conducted analysis also includes students of the joint inter-faculty bachelor's degree program "Finance and Law", offered by the Faculty of Economics and Administration and the Faculty of Law MU, and treats them as students of an economic field. The main guarantor of this study program is the Faculty of Economics and Administration; therefore, the students are treated as studying an economic field (Svoboda, Krajíček and Doláková 2013). Taking into account this as well as other specifics, the ratio of students in non-economic fields would exceed 20%, so we can speak of a significant representation of students from other faculties of Masaryk University.

The Faculty of Economics and Administration offers a wide range of degree Bachelor's, Master's programmes. In order to reflect the dynamics of social and occupational reality, the offer of studies provided by the faculty is diversified to a great extent. There are two forms of studies available at the faculty. Apart from the traditional full-time mode of studies, there is a form of studies designed to meet the needs of those with a more busy schedule – the combined mode of studies. The combined form of studies is based on a combination of direct teaching in blocks of lessons (mostly taking place during weekends) and self-studies enhanced by the use of the latest information technologies and teaching methods.

Full-time students accounted for more than three-quarters of the number (77.1%) while students of the combined form of study were in the minority and their numbers reached one quarter (22.9%). The exact structure of the monitored students based on their form of study is presented in the following Table 1.

From following analyses were excluded students that entered the test, answered only a few – or even no –questions and saved the test with zero point gain. Such students were in the test altogether 41.

Table 1 Students structure according the mode and the subjects of studies

Respondents according the mode of studies	**Full-time**	**Combined**	**Total**
Bachelor's programmes	655	194	849
Master's programmes	53	16	69
Total	708	210	918

Respondents according the mode of studies (%)	Full-time	Combined	Total
Bachelor's programmes	92.5	92.4	92.5
Master's programmes	7.5	7.6	7.5
Total	100.0	100.0	100.0

Respondents according the subjects:	**N**	**%**
Financial markets (Bachelor's program. combined)	53	5.8
Basics of finance (Bachelor's program. combined)	141	15.4
Financial investing (Master's program. combined)	16	1.7
Basics of finance (Bachelor's program. full-time)	329	35.8
Financial markets (Bachelor's program. full-time)	326	35.5
Financial investing (Master's program. full-time)	53	5.8
Total	918	100

Source: own calculations based on results of study

From following analyses were excluded students that entered the test, answered only a few – or even no –questions and saved the test with zero point gain. Such students were in the test altogether 41.

Students could get as many as 18 points from knowledge-based questions that explicitly focused on the issue of specific requirements and different approaches to financial literacy of socially disadvantaged citizens; each correctly answered question was rated 1 point and if there were more variants of correct answers to one question, we assigned an aliquot proportion of one point.

The number of points obtained is presented in Table 2.

Table 2 Total points

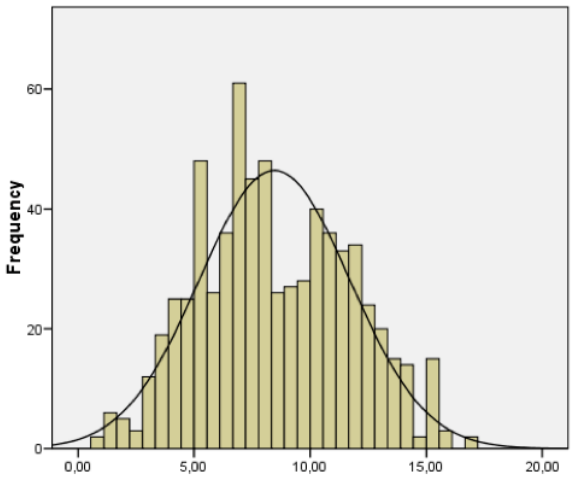
Mean		8.4635
Median		8.1667
Mode		7.17
Percentiles	25	6.0000
	50	8.1667
	75	11.000

Note: Mean – arithmetic average, Median – the value that divides the sample into 2 equal halves, Mode – the most frequently occurring value, Percentiles – who is better than 25% of people scored 6 points; who is better than 50% of people scored 8.1667 points; who is better than 75% of people scored 11 points.

Source: own calculations based on results of study

Histogram presented in the Figure 2 shows data distribution using a bar chart. The height of columns (y-axis) represents the frequency of scoring a certain number of points. The x-axis shows the number of points.

Figure 2 Histogram



Source: own calculations

A detailed segmentation of the average scores was conducted within analyzing the data files.

The results show that a higher score was reached by women, university graduates, and people at the Master's level of education in the combined form of study. People who are willing to participate in financial education reached in average the highest score (9 points).

Table 3 Willingness to participate in financial education

Score - quartile	lowest quartile	low quartile	higher quartile	highest quartile	Total
yes	20.5	21.8	25.7	28.8	24.1
no	18.7	15.1	11.4	13.8	14.7
maybe	49.4	53.1	56.9	53.1	53.1
I don't know	11.4	10.1	6.0	4.4	8.0
Total	100	100	100	100	100

Source: own calculations based on results of study

The results in the Table 3 shows that People who are willing to participate in financial education reached in average the highest scores. These people belong to the highest quartile – they reached a higher score than 75% of the others. Overall, the question was answered positively by 24.1% of the respondents; the option "maybe" was chosen by 53.1% of them.

The following Table 4 shows ten easiest and ten hardest questions. The questionnaire was structured into the following 19 sub-areas. The structure was: Introductory general issues (questions 1-3), Quiz questions (questions 4-10), Payment (in domestic and foreign currency) (questions 11-16), Pricing (questions 17-21), Inflation - the overall macroeconomic situation (questions 22-25), Management households (questions 26-30), Debts and debtors (questions 31-34), Surplus funds - investments (questions 35-38), APR-annual percentage rate of charge (questions 39-41), Interest rates (questions 42-46), Credit products - mortgages (questions 47-48), Insurance (questions 49-52), Deposit insurance (questions 53-55), Where to go to complain (questions 56-59), Contract, arbitration clauses, bills, contractual penalties (questions 60-62), Loss of credit cards (questions 63-64), Socio-demographic questions (questions 65-70). A separate segment consisted of 28 questions focused on the issues of socio-disadvantaged citizens (questions 71-98).

The results indicate that four out of the five most difficult questions were from the field focusing on the issue of specific requirements and different approaches to financial literacy of socially disadvantaged citizens. These results are presented in Table 4.

Table 4 Complexity of questions

	EASIEST	
vo31	Imagine, that you take a loan and after some months of regular repayment you lose your job and thus regular income. What will you do?	836
vo64	What is the first thing to do, if credit card is stolen?	823
vo50	Novaks have in their property (flat) electronics in the value of some tens of thousands and worry, that their new flat could be robbed. Which insurance contract should they sign?	813
vo97	Assume that you have entered $100 on your account, which bears 2% annually. How much money are you going to have on this account in five years?	794
vo98	Imagine that the interest rate on your account is 1% annually and inflation was 2 %in given year. How much can you buy with the money from your account after one year?	787
vo23	If current inflation grew, what would happen to the money saved in bank?	742
vo45	Debit card is payment card.	742
vo36	What is true about risk, rate of profit and liquidity?	733
vo63	If your payment card is stolen, what risk are you exposed to?	719
vo81	General rate of unemployment in Czech republic is higher for:	714
vo29	Employee working in Czech republic can lower his tax base by:	197
vo20	By comparing of prices in stone shops and internet shops:	170
vo12	What is not the advantage of payment system PayPal?	137
vo30	What are current taxes and contributions for social and health insurance for employees, entrepreneurs and firms?	126
vo25	What is the relationship of central state authority?	116
vo73	How many personal bankruptcies were approximately declared in the Czech Republic in 2011?	116
vo38	For investor who never bought securities and now for the first time wants to buy for example shares of ČEZ, a.s. at the Stock Exchange Praha, applies:	98
vo74	How many executions were approximately ordered by the courts in the Czech Republic in 2012?	87
vo79	In case of forced sales of chattels Czech law does not exclude from the enforcement:	52
vo82	When determining the eligibility for certain kinds of social benefits, such as childbirth allowances or child benefits, the relevant indicator is:	46
	MOST COMPLICATED	

Source: results of study based on own calculations

On the contrary, further results indicate that two of the three added questions, used for international comparisons, occurred among the five easiest questions. Particularly, these were questions on the issue of interest rates and inflation.

The questionnaire was evaluated as medium till very difficult (total 86,8% of people answered like that). Only 0.7% of respondents considered the questionnaire to be very simple and 3.4% of the respondents evaluated the questionnaire as very difficult. The results show the following Table 5.

Table 5 Difficulty of the questionnaire

What is the difficulty of the questionnaire according to you?	%
Very simple	0.7
Moderately difficult	9.9
Medium difficult	52.9
Difficult	30.5
Very difficult	3.4
Don´t know	2.6
Total	100

Source: own calculations based on results of study

4 Conclusions

Although research conducted in the past showed that university students have higher financial literacy than the adult population, their financial literacy still may have some deficits or limits. The fact that 62% of university students or graduates believe that they would be able to advise on personal finance can be problematic if we thoroughly deal with the issue of possible specific requirements and different approaches of financial literacy to the group of socially disadvantaged people.

The following conclusions can be drawn from the analysis of the questionnaire survey, which included in the issue of socially disadvantaged people:

- Socially disadvantaged people deal with more complex problems that go beyond the area of personal finance, which the students themselves sometimes perceive too narrowly.
- Students who are willing to participate in financial education reached in average the highest score.
- Questions focused on the issue of specific requirements and different approaches to financial literacy of socially disadvantaged people were among the most complex ones.

The presented results could be analyzed more thoroughly in the future, for example in terms of gender differences, more significant differentiation of economic and non-economic fields, or students of full-time and combined study programs.

Acknowledgments

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The Uncertainty Associated with the Estimated Lease Term and its Impact on the Financial Analysis Ratios

Patrik Svoboda, Hana Bohušová

Mendel University in Brno
Faculty of Business and Economics, Department of Accounting and Taxes
Zemědělská 1, 613 00 Brno, Czech Republic
E-mail:patrik.svoboda@mendelu.cz, hana.bohusova@mendelu.cz

Abstract: *The main aim of the paper is focused on the impact of the possibility of reviewing the expected lease term after the initial recognition of the leased subject on the financial analysis ration on lessee´s side. The authors´ approach to the right to use measurement is based on the IASB´s and FASB´s possible approaches to the uncertainty taking into account and its quantification in the case of the option to extend the lease term. Explanatory power of the financial statements is significantly dependent on the ability of management to estimate the probability of each possibility. Changes in external and internal environment during the amortization of rights to use may initiate completely different estimates of the remaining term of the lease and thus may lead to increase of volatility in reported values. Statistical methods concerning the probability are used for processing and financial analysis methods are used for evaluating of the impacts on affected items of financial reporting.*

Keywords: uncertainty, lease reporting, lessee, option to extend the lease term

JEL code: M410

1 Introduction

The objections against the current approach to the lease reporting have been arisen since the beginning of the 21st century. There is the IAS 17 – Leases published by the International Accounting Standards Board (IASB) and the Topic 840 - Leases under U.S. GAAP. The main reason for the criticism is that the current classification of lease agreements make possible to classify economically similar transactions in very different ways. It could affect the final decision of the financial statements users due to misleading assessment of the financial situation of lessee and lessor. According to El-Gazzar, Lilien, Pastena (1986) and Imhoff, Thomas (1988) firms are structuring leases as operating leases to avoid increasing of debt-equity ratio. According to the World Leasing Yearbook 2014, the annual volume of leases amounted to USD 868 billion in 2012. Leases could be currently treated in different ways. A lot of leases remain off-balance sheet and forcing analysts to make their own assessments about the assets and liabilities arising from lease agreements. For example Lipe (2001) demonstrates in his study that measures of investors risk can be better explained when unrecorded leases are included. The issue of possible way out of this situation has been discussed since the early seventies of the last century. The IASB and Financial Accounting Standards Board (FASB) have been working on the common project concerning leases since 2009. The main aim of their effort is to develop the unified approach to the lease reporting which does not allow structuring leases in connection to the intentions of the reporting entity.

The first published studies concerning the evaluation of the impact of capitalization of the vast majority of lease contracts in the balance sheet were published in the early seventies. For example Nelson (1963) initiated studies concerning the capitalization of all off-balance sheet lease obligations regardless to lease term. He conducted study within eleven companies in the USA and evaluated the impact on the financial statements and selected financial analysis ratios. Despite the fact that the models of operating leases capitalization differed significantly, the use of measurement based on expected cash flows over the lease period can be seen in majority studies (Houlihan, Sondhi (1984), Imhoff, Lipe, Wright (1993), Sannella (1989)), etc. Further studies were also carried out in the UK, New Zealand and Canada - e.g. Beattie, Goodacre, Thomson (2000). The

analysis results were not mutually quite comparable, since use quite different methods for leases capitalization.

The main supporters of these methods are Hartman, Heibatollah (1989), Kemp, Overstreet (1990), Comiskey, Mulford (1998). Similarly, according to Copeland, Koller and Murrin (1990) all leases give rise to assets and liabilities, Dieter (1979) suggests to focus on property right rather than ownership risk and mentions bottlenecks of current rules (US GAAP) application to lease classification, despite the fact that US GAAP is more precise than IFRS in this area.

On the other hand, currently used approach to lease reporting is based on off-balance reporting of majority of operating lease regardless to the lease term. The managements´ attitudes to off-balance financing are analyzed in publications as Abdel - Khalik, Rashad (1981), Imhoff, Thomas (1988) and Knutson (1993). Abdel-Khalik (1981) addresses gradual shift of operating leases due to distinction finance lease reported in the balance sheet and operating lease published in the notes in the USA in 1976. Similarly, Jifri, Citron (2009) stress that it is necessary to incorporate information efficiently regardless of whether it is in the financial statements or notes.

The idea of the capitalization of lease contracts (i.e. of recognition of at least part of the lease payment the lessee assets and the appropriate amount as a liability of lessee) can be seen also by G4 +1 group, which required the capitalization of all liabilities connected with non-cancellable lease contracts with one year or longer lease term. McGregor (1996), Nailor and Lennard (2000) and others in their contributions dealt with the general potential impacts of capitalization in the financial statements of reporting entities, Ryan et al. (2001), Helmschrott (2000), Fülbier, Pferdehirt (2005), dealt mainly issues of risk connected with reporting of contingent components of lease. Practically all above mentioned authors (and many others) are great supporters of the capitalization of a majority of lease agreements classified as operating leases, even though they are aware of the high amount that would be newly emerged in the lessee's balance sheet (and vice versa could be removed from the balance sheets of lessors). There are some model for simulation of effects of operating lease capitalization on balance sheet items and related items of income statement – factor model, capitalization model of Fülbier, Lirio, Pferdehirt (2008), of Beatie (1998), and the capitalization model of Imhoff, Lipe, Wright (1993). The main difference among the mentioned models is level of the simplicity. Fülbier, Lirio Silva, Pferdehirt´s (2008) and Beatie´s models (1998) do not consider the potential effect in equity and net income while Imhoff, Lipe, Wright´s (1993) does.

On the basis of the arguments resulting from studies carried out and in the effort to develop a single high-quality financial reporting system. The publication of the common Exposure Draft - Leases prepared by IASB and FASB in 2010 and its revision based on public comments in 2013 could be considered as the main achievements in this area. The unification of lease reporting was the aim of both Boards. The Drafts demand capitalization of majority of lease agreements. The Boards tried to develop a draft of a single model of majority lease agreements reporting. Despite this fact, the dual model of reporting on the side of lessor (performance obligation and derecognition approach) is used in the Exposure Draft (2010). Performance obligation approach, as shown by public discussion, appeared to be very problematic. The revised Exposure Draft (hereinafter Re-ED) was released in May 2013 as a response to the opinions of experts and the general public. The performance obligation approach was completely abandoned.

The idea of the new concept of lease reporting is the capitalization of leases using the right to use of the leased asset during the lease term as an item of tangible or intangible assets by the lessee for all leases over 12 months. The right to use is usually straight-line depreciated in the course of the lease term. At the same time the lessee recognizes the lease obligation. It is amortized over the lease term using the specific lease rate. According to Re-ED (2013) leases with term longer than 12 months are classified into two types. The classification is dependent on whether the lessee is expected to consume more than an insignificant portion of the economic benefits embedded in the underlying

asset. There is not mentioned any threshold for the insignificant portion in the Re-ED, so companies will have to make their own judgments to justify the classification. For the most leases of assets other than property (for example, equipment, aircraft, cars, trucks), a lessee would classify the lease as a Type A lease. In this case, it is expected that the lessee consumes more than an insignificant proportion of the economic benefits, affiliated to the leased asset during the lease term. Quite significant fall in value (moral) is often evident in the early years of useful life, it means that also shorter lease agreement of movable assets could be largely classified as lease type A. Lessee recognizes both operating expense due the right to use amortization and financial expense in a form of interest cost as a part of lease payments (decreasing in the course of time).

For most leases of assets in a form of property (i.e. land and/or a building or part of a building) a lessee would classify the lease as a Type B lease. The lessee recognizes only even operating expenses in this case. In the case of complex contracts may, however, if the current Re-ED is adopted, a number of unexplained situations occur. As the initial problem can be considered uncertainty in recognition and measurement of assets and liabilities arising from lease especially in cases where is a lessee´s option to extend the lease for one or more secondary specified periods or the lessee has the right to terminate the lease contract.

2 Methodology and Data

The paper is concerned with the evaluation of the newly proposed methodology for the lease reporting. The main aim is the assessment of the impact of the uncertainty in the case of option to extend the lease agreement in measurement of the right of use and lease liability in the financial statements and its impact in the financial statements and financial analysis ratios.

The model case is used for demonstration of a volume of differences due to subjective approach to the estimation of the lease term in case of possibilities to exercise the options for extension of the lease tem or termination of it. The effect of the subjective estimation of the lease term is shown through the financial position statement and the income statement and financial analysis ratios. The conclusion of this research should provide arguments for elimination of a subjective approach to the taking into account of uncertainty connected with options to extend the lease agreement in a way to increase the comparability of financial statements.

The paper presents results of the authors´ research concerning the uncertainty connected to the lessee´s lease assets measurement. The approach is based on the methodological procedure for the measurement of right to use the leased asset and the lease obligation. The estimated term of the lease in relation to the possibility of exercise the option to extend the lease contract and the probability of each variant in course of time of the lease contract are compared. According to the Boards´ proposal, it is necessary to use subjective assessment to determine the probability for each variant. It is the prerequisite for recognition and measurement of individual items of assets and liabilities connected with the lease contract**.**

Following the proposals under consideration five possible options can be taken into account:

I. measurement of assets and liabilities is based only on the primary lease term and the leased asset and the lease obligation are re-recognized at the moment of exercising the option based on the real time extension,
II. right to use and lease obligation measurement is calculated for a period of the most likely variant,
III. the reporting entity chooses variant for which is more likely to occur than that does not occur, i.e. the cumulative probability $kp_i > 0{,}5$ used for lease asset and liability measurement,
IV. the lease term as a basis for the leased asset and lease liability measurement is considered as "virtually certain", i.e. the probability exceeds a certain threshold,

V. the measurement is based on probabilistic variants, i.e. the time the lease is determined by the average length of the lease. The real period never corresponds with determined length of lease

The effect of the uncertainty associated with the leased asset on values of financial statements items and values of ratio indicators (profitability ratio, liquidity ratio, indebtedness ratio) is evaluated.

The following ratios are used:

- Return on assets $-ROA = \frac{EBIT(earnings\ befrore\ interest\ and\ taxes)}{total\ assets}$ (1)
- Re turn on equity $-ROE = \frac{Net\ income}{\text{shareholder's equity}}$ (2)
- Debt ratio $-Total\ indebtedness = \frac{total\ debt}{total\ assets}\ x\ 100$ (3)
- Liquidity ratios $-Current\ ratio = \frac{current\ assets}{short-term\ debts}$ (4)

3 Results

For the interpretation of individual variations that can occur when the lease agreement entered a model example is used. The lease of a fixed asset with an estimated useful life of 10 years is used for this purpose. Annual lease payment is 1.000.000 CZK with the incremental annual borrowing rate of 5.6%. There is an option to extend the lease period for two years, this option can be used up to three times, with an increase in payments during the third option - the annual lease payment is 1.200.000 CZK.

Based on the above mentioned methodology individual probabilities of particular variant are determined. There is the probability that the lease contract will not be extended ($p_1 = 0.26$), the probability to exercise an option to extend once ($p_2 = 0.74$), probability to exercise an option to extend twice ($p_3 = 0.6$) or three times ($p_3 = 0.6$). The probability of each variant is based on qualified estimates of management that takes into account factors such as the expected market development of products that are produced using the leased assets, expected development of the leasing market. The value and the course of costs associated with each proposed variants are subjects of the following tables. The primary lease term is two years, the right to use and the obligation is calculated in connection to the actual period (time) of use of the subject of the lease (2 years) for the purpose of comparability after the initial recognition.

The following tables show the selected values of the balance sheet items and items of income statement for variant I (only the primary term of the lease is assumed, it is two years, only in the case of exercise the option and the subsequent extension the values of leased asset and liability are re-estimated for the secondary period), II (the value of the right to use is determined for the most likely variant). This is with the 34.18% probability of a double extension, estimated lease period is 6 years old) and III (variant, in which is more probably that it happens than it does not, i.e. the cumulative probability exceeds 50% first time, in this case it is with the 74% probability the variant III, i.e. lease period is 4 years). Two more variants (IV and V) could be considered, they are the variants that have been appeared in some comment letters. The first one is based on the idea that it is appropriate to use option with probability "virtually certain" - when it exceeds a user-defined threshold, e.g. over 75% - all values correspond to variant I. Another possible variant (V) is based on an average lease term using the predetermined probability of each variant. It is 4.57 years in this case. The value of assets and liabilities is slightly higher than in variant III in this case.

Table 1 Calculation of the items affected by the lease agreement

Y	Liability			Interest			Liabilityamortization			Leasedasset			Depreciation		
	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III
0	1844	4980	3497							1844	4980	3497			
1	947	4259	2693	103	279	196	897	721	804	922	4150	2623	922	830	874
2	0	3497	1844	53	238	151	947	762	849	0	3320	1749	922	830	874
3		2693	947		196	103		804	897		2490	874		830	874
4		1844	0		151	53		849	947		1660	0		830	874
5		947			103			897			830			830	
6		0			53			947			0			830	

Source: authors' own calculation

Table 2 shows the values of selected balance sheet items at the lease commencement (0) and at the balance sheet data (31.12.) of each year of the lease term. The first column presents the values for the "current approach to the lease reporting" and the other three columns present values for each variant (I, II and III). Table 3 provides selected indicators of the income statement in a year 1 and 2 of the lease term. There is the same order of the columns as in the table 2. The calculations are made for the situation where the value of assets and liabilities are calculated using the methodology appropriate for each variant, but there is not exercised the option to extend the lease agreement after two years. There are not increased the values of assets and liabilities after 2 years for the variant I. It is necessary to derecognize the residual values of asset (right to use) and liability at the balance sheet date of the second period.

Table 2 Comparison of the financial position statements presented the individual variants of uncertainty consideration

Item/year	0				1				2			
	I	II	III	IV	I	II	III	IV	I	II	III	IV
Totalassets	26926	28770	31906	30423	36119	37041	40269	38742	55110	55110	55110	55110
Fixedassets	5023	6867	10003	8520	6349	7271	10499	8972	6521	6521	6521	6521
Currentassets	21534	21534	21534	21534	29008	29008	29008	29008	48119	48119	48119	48119
Inventories	539	539	539	539	798	798	798	798	798	798	798	798
Short-termreceivables	17902	17902	17902	17902	15131	15131	15131	15131	32044	32044	32044	32044
Cashandbankaccounts	3093	3093	3093	3093	13079	13079	13079	13079	15277	15277	15277	15277
Accruals	369	369	369	369	762	762	762	762	470	470	470	470
Equityandliabilities	26926	28770	31906	30423	36119	37041	40269	38742	55110	55110	55110	55110
Equity	13888	13888	13888	13888	17170	17145	17061	17100	23976	23976	23976	23976
Sharecapital	960	960	960	960	960	960	960	960	960	960	960	960
Funds	192	192	192	192	192	192	192	192	192	192	192	192
P/Lofpreviousperiods	9580	9580	9580	9580	12736	12736	12736	12736	16901	16876	16792	16831
P/Lofcurrentperiod	3156	3156	3156	3156	3282	3257	3173	3212	5923	5948	6032	5993
Liabilities	12939	14783	17919	16436	18949	19896	23208	21642	31134	31134	31134	31134
Provisions	0	0	0	0	0	0	0	0	0	0	0	0
Long-termliabilities	0	947	4259	2693	0	0	3497	1844	0	0	0	0
Short-termliabilities	12939	13836	13660	13743	17238	18185	18000	18087	27365	27365	27365	27365
Loans	0	0	0	0	1711	1711	1711	1711	3769	3769	3769	3769
Accruals	99	99	99	99	0	0	0	0	0	0	0	0

Source: authors' own calculation

Due to different ways of amortization of the right to use and the lease liability, the value of lease asset and lease liability differs. It is necessary to report this difference – it is reported in the income statement of the second year.

Table 3 Comparison of the income statement statements presented the individual variants of uncertainty consideration

Item/year	1				2			
	I	II	III	IV	I	II	III	IV
Total revenues	73 439	73 439	73 439	73 439	105 904	105 904	105 904	105 904
Sale margin	3 944	3 944	3 944	3 944	934	934	934	934
Production	62 445	62 445	62 445	62 445	87 643	87 643	87 643	87 643
Production consumption	59 422	58 422	58 422	58 422	76 320	75 320	75 320	75 320
Value added	6 967	7 967	7 967	7 967	12 257	13 257	13 257	13 257
Personnel expenses	1 851	1 851	1 851	1 851	2 420	2 420	2 420	2 420
Depreciation	1 280	2 202	2 110	2 154	1 219	2 141	2 049	2 093
Operating P/L	4 540	4 589	8 929	0	0	4 540	4 681	9 198
Interest revenues	1	1	1	1	3	3	3	3
Interest expenses	39	142	318	235	124	177	362	275
P/L from financial operations	39	-64	-240	-157	-457	-510	-695	-608
P/L	3 282	3 257	3 173	3 212	5 923	5 948	6 032	5 993
P/L before tax	4 550	4 525	4 441	4 480	8 394	8 419	8 503	8 464

Source: authors' own calculation

Table 4 Selected financial analysis ratios connected with individual variants

Ratio /year	1				2			
	I	II	III	IV	I	II	III	IV
ROA	14.56	14.18	13.19	13.63	18.67	18.66	18.59	18.62
ROE	21.13	20.99	20.51	20.73	28.79	28.93	29.40	29.18
Debt Ratio	50.58	52.69	56.98	55.05	54.90	55.38	56.97	56.23
Current Ratio	1.67	1.58	1.60	1.59	1.73	1.69	1.70	1.70

Source: authors' own calculation

As shown in Tables 2-4, the values of the affected items of the balance sheet and income statement are different for each variant. It is dependent on management´s estimations as assumed to exercise an option for extension at the end of primary lease term. This is a very subjective factor, which may have a significant effect on the values of reported items. If the final form of the standard Leases allows taking into account estimates of management at the reporting of leases, the same lease agreement can be reported in different ways by different entities. As seen from Table 4, there are also changes in selected financial analysis ratios. This ways of reporting allow intentional misrepresentation of financial statements for the presentation of an entity's in desired way and the comparability of financial statements of different entities is reduced.

4 Conclusions

Based on the model example it was shown that the value of financial statements items and financial analysis ratios are affected by the entity estimates used in the reporting of leases in cases where the lease agreement includes an option to extend the lease period. It leads to the reduction of the comparability of financial statements. For this reason, the authors tend to limit the influence of management´s estimates connected to the reporting of leases. The recognition based only on the primary lease term is considered as the best option to eliminate subjective judgment when reporting a lease with an option to extend the lease term. In cases, where the entity assumes to exercise the option to extend the lease term, it can describe this situation in the notes to the financial statements.

There are more negative aspects connected to other variants. The need for reassessment of values in the case of a change in estimate associated with the additional labor expenses and potential volatility of individual items of financial statements, which is not compensated enhanced presentation of the financial statements are the most significant negatives.

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Do Fiscal Drivers Matter for Sovereign Risk Spread in EU15?

Irena Szarowská

Silesian University
School of Business Administration, Department of Finance
Univerzitní nám. 1934/3, 733 40 Karviná, Czech Republic
E-mail: szarowska@opf.slu.cz

Abstract: *The price of government bonds reflects among other market confidence in governments' commitment towards sustainable fiscal policies. The aim of the paper is to examine the importance of fiscal fundamentals for sovereign risk spread in selected European Union member states in a period 1990-2012 and test if stronger fiscal discipline reduces sovereign risk premium. The empirical evidence is performed on unbalanced panel containing 15 EU countries and panel regression is a basic method of research. Next variables are used for testing impact on sovereign risk spread: German Bunds' interest, budget balance to GDP, debt to GDP, GDP growth and the fiscal rules index. The analysis uses data taken from Eurostat, OECD and Helgi database. Results confirm importance of fiscal variables and discipline for a sovereign risk spread. The improvement of fiscal position (expressed by budget balance increase and debt decrease) reduces sovereign yield spread. Contrary, changes of German Bunds' interest and fiscal rules index have not statistically significant impact on spread.*

Keywords: debt, budget deficit, sovereign risk spreads, fiscal discipline

JEL codes: E62, G15, H63

1 Introduction

The financial and economic crisis has been associated with significant heterogeneity in financial conditions, following a period of low and more homogeneous financing costs. Money markets have become impaired, especially across national borders, and sovereign bond yields have diverged significantly. Overall, there is increased evidence that country-specific effects have become more important in driving financial conditions (ECB, 2012). Part of this increase can be attributed to developments in public debt and contingent liabilities related to the banking sector (Gerlach et al., 2010). The price of government bonds reflects market confidence in governments' commitment towards sustainable fiscal policies. Iara and Wolff (2011) argue that fiscal governance has an impact on the sovereign yield spreads by reducing the probability of default.

The underlying causes of the sovereign yield spreads increase originate in the accumulation of fiscal, macroeconomic and financial imbalances in several countries prior to the crisis, fuelled in particular by decreasing interest rates around the start of EMU and by inadequate national and European policy responses. When the crisis erupted, the unsustainable nature of these imbalances became evident. The rapid acceleration in sovereign borrowing needs was boosted by the fiscal response to concerns about the possibility of a severe economic slump and the repricing of risks caused the real imbalances to spill over to financial developments.

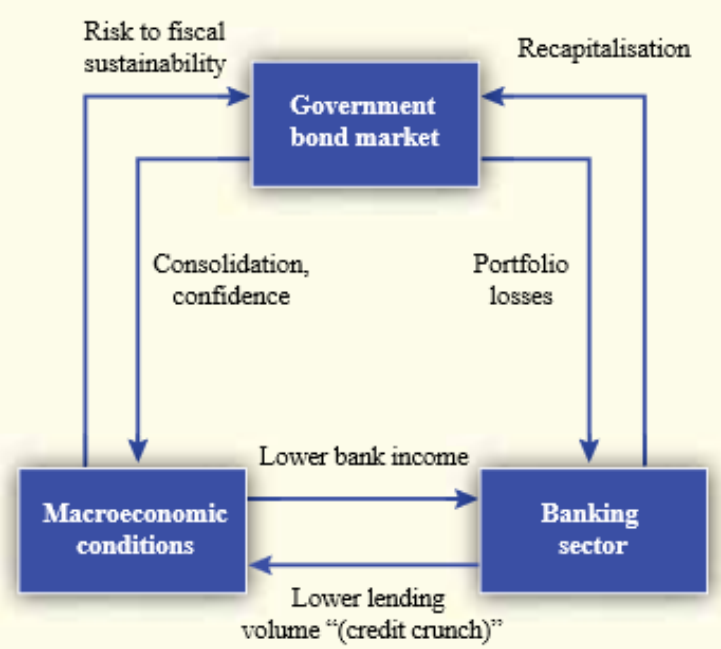
In the last six years, differences in government bond yields have sharply increased. The aim of the paper is to examine the role of fiscal fundamentals for sovereign risk spread in selected European Union member states in a period 1990-2012 and test if stronger fiscal discipline reduces sovereign risk premium.

2 Literature Review

The financial system is the primary channel through which monetary and fiscal policies affect the economy and ultimately prices. Figure 1 depicts the main linkages between the economy, the banking sector and government bond markets. Arrows indicate the channel through which deteriorating conditions in one area affect the other two areas. For instance, deteriorating macroeconomic conditions reduce bank’s income, e.g. from less

lending activity, and increase risks to fiscal sustainability, e.g. as deficits automatically increase, which is likely to be reflected in higher government bond yields.

Figure 1 Main Linkages between Macroeconomic Conditions, the Banking Sector and Government Bond Markets



Source: ECB (2012, p. 66)

The intention of the paper is to find the main fiscal drives for sovereign yield spreads of EU countries' government bonds. Generally, yield spreads result from several reasons. Apart from default risk, the yield spreads are influenced by liquidity risk and market sentiments toward investments in risky bonds. A wide range of literature deals with determinants of sovereign bond yield spreads. Table 1 summarizes results of main studies focused on bond spreads in the EU countries.

Table 1 Studies Focused on Bond Spreads in the EU Countries

Authors	Period	Sample	Statistically significant explanatory variables
Lemmen & Goodhart (1999)	1987-1996	13 countries	debt to GDP ratio, capacity to raise taxes, inflation, inflation variability
Codogno et al. (2003)	1999-2002	9 countries	debt to GDP ratio, US swap spread, US corporate bond spread
Bernoth et al. (2012)	1993-2005	14 countries	debt to GDP, deficit to GDP, debt service to revenues, maturity of the bond issue, corporate bond spreads, liquidity of the issue, EMU dummy, short-term US rate
Manganelli & Wolswijk (2007)	1991-2006	15 countries	ratings, short-term interest rate
Schuknecht et al. (2009)	1991–2005	13 countries and subnational governments	public debt to GDP, fiscal balance to GDP, maturity of the bond issue, US Corporate bond spreads, liquidity (size) of the issue, region dummies, short-term US rate

Schuknecht et al. (2010)	1991–2010	15 countries	central government debt to GDP, fiscal balance to GDP, maturity of the bond issue, US Corporate bond spreads, liquidity (size) of the issue, EMU dummy, short-term US rate, 'turmoil" dummy, crisis dummy
Maltritz (2012)	1999-2009	10 countries	budget balance to GDP, total government debt to GDP, average interest rate, GDP growth, inflation , inflation variation , capital formation, trade balance, openness, terms of trade growth, total government debt, total government debt to total government debt of all EMU countries, US interest rate, US corporate bond

Source: author´s compilation

The results are rather heterogeneous, not only for different samples, but even for rather similar samples, such as the Eurozone countries, which a comparison of results from Lemmen and Goodhart (1999) with those of Bernoth et al. (2012), for example, shows. To some extent, these differences may be a result of different observation periods. Another reason could be that papers in the literature also differ considerably with respect to tested variables.

Studies on EU government bond yields, fall into two broad categories, respectively covering the period prior to and following the global financial crisis. Both groups of studies follow the literature on government bond yields modelling the latter on three main variables (Manganelli and Wolswijk, 2007):

- International risk factor capturing the level of perceived financial risk and its unit price. Typically, this is empirically approximated using indexes of US stock market implied volatility or the spread between the yields of US corporate bonds against US treasury bills captured by volatility indices and/or corporate rate spreads.
- Credit risk reflecting the probability of default on behalf of a sovereign borrower, approximated using indicators of past or projections of future fiscal performance. Existing evidence suggests that markets attach additional risks to the loosening of observed fiscal positions and shifts in fiscal policy expectations (Afonso et al., 2012).
- Liquidity risk refers to the size and depth of the sovereign bonds market and captures the possibility of capital losses due to early liquidation or significant price reductions resulting from a small number of transactions. (Favero and Missale, 2012).

There is a growing literature focused on a crisis period. It is possible to identify two main findings. First, the observed widening in EMU spreads is largely driven by the increased global risk factor. Second, during the crisis period markets have been penalising fiscal and other macro-imbalance much more heavily than before (Afonso et al., 2012, Maltritz, 2012, Šperka and Spišák, 2013 or Hvozdenská, 2014). Although the most studies are focused on EMU, some authors analyze also Central and Eastern European countries. Alexopoulou et al. (2010) propose an empirical assessment of the determinants of borrowing costs of new European Union member countries. The results suggest that fundamentals still matter for market assessment of a country´s creditworthiness. In the context of heightened risk aversion, group of countries characterized by low fiscal discipline is more exposed to domestic sources of vulnerability as well as to swings in market perceptions of sovereign risk. Ebner (2009) studies the spread between 10 year Euro denominated Central and Eastern European (CEE) government bonds and their German counterpart. While higher ECB reference rate and market volatility increase bond spreads and turn out to be the main driving factors, there is no common pattern of macroeconomic fundamentals, pointing to strong heterogeneity within the CEE region. Overall, market variables are more significant than fundamentals during 1999 to 2007.

It is possible to summarize that results of empirical studies are rather heterogeneous, i.e. different papers report different variables as the main drivers of spreads. This may be due to differences in used econometric models, country samples, observation periods and considered variables (for more details look at Szarowská, 2013a,b). Maltritz (2012) emphasizes the fact that there is no consensus about the key determinants of sovereign yield spreads and it may be seen as indication for high uncertainty about the "true" empirical model.

3 Methodology and Data

The aim of the paper is to examine the role of fiscal fundamentals for sovereign risk spread in selected European Union member states in a period 1990-2012 and test if stronger fiscal discipline reduces sovereign risk premium.

We understand fiscal discipline as a compliance with targets for budgetary aggregates, such as the government budget balance, debt, expenditure, or revenue developments. It should be noted that the goal of this empirical analysis is not to find the ideal model describing the behavior illustrated by the variables, but a nature of relationships between sovereign risk premium and selected fiscal fundamentals in selected 15 members of the European Union. Paper uses unbalanced panel data and calculations are made in the program Eviews 7.

The empirical estimation is performed for 15 EU member states (EU15). The panel contains EU15 countries, namely Austria (AT), Belgium (BE), Finland (FI), France (FR), Germany (DE), Greece (GR), Ireland (IE), Italy (IT), Luxembourg (LU), Netherlands (NL), Portugal (PT), Spain (ES), CY, Denmark (DK), Sweden (SE) and United Kingdom (UK).

Model Specification

We use panel data as panel data have both cross-sectional and time series dimensions and the application of regression models to fit econometric models are more complex than those for simple cross-sectional data sets. We performed both fixed effects and random effects regressions before analysis. A Durbin–Wu–Hausman test indicated significant differences in the coefficients so model with fixed effects is used in the paper. A panel model with fixed effects can be formally written as:

$$yit = ai^* + \beta' X_{it} + u_{it},\ i = 1, 2, ..., N,\ t = 1, 2, ..., T \qquad (1)$$

where y_{it} depends on a set of K explanatory variables x_{it} and the constants are specific to the i-th unit (country) at time t, at the same time but are constant. β ' is the vector dimension $1xK$ constants and a_i^* is a constant representing the effects of those variables, which are characteristic of the i-th observation. u_{it} error component represents non-significant effects of variables inherent in the i-team observations and a given time interval. Furthermore, we assume it does not correlate with the vector x_{it}, for all the i and t, and it comes from independent identical distribution with zero mean and constant dispersion (Dougherty, 2007).

The sovereign bond spread is expressed as a difference to German data, which leaves a panel dataset of 14 countries. Germany is chosen as the benchmark country as the Bund is considered the benchmark bond in the respective bond market (for details see Dunne et al., 2007). Basic panel model identifiers are country i and time t. The dataset used in the analysis consists of annual data on sovereign bond spreads (*spread*) represented by a difference between the members´ 10-year government yields and the German Bunds' interest (*yield_de*), a budget balance in percentage GDP (*balance*), debt as a percentage GDP (*debt*) and the fiscal rules index (*FRI)*. The sources of data are the Eurostat, OECD and Helgi database.

The basic model is defined in (2) and variables are explained above:

$$spread_{it} = a_i^* + \beta 1 * BALANCE_{it} + \beta 2 * DEBT_{it} + \beta 3 * YIELD\_DE_{it} + \beta 4 * FRI_{it} + u_{it} \qquad (2)$$

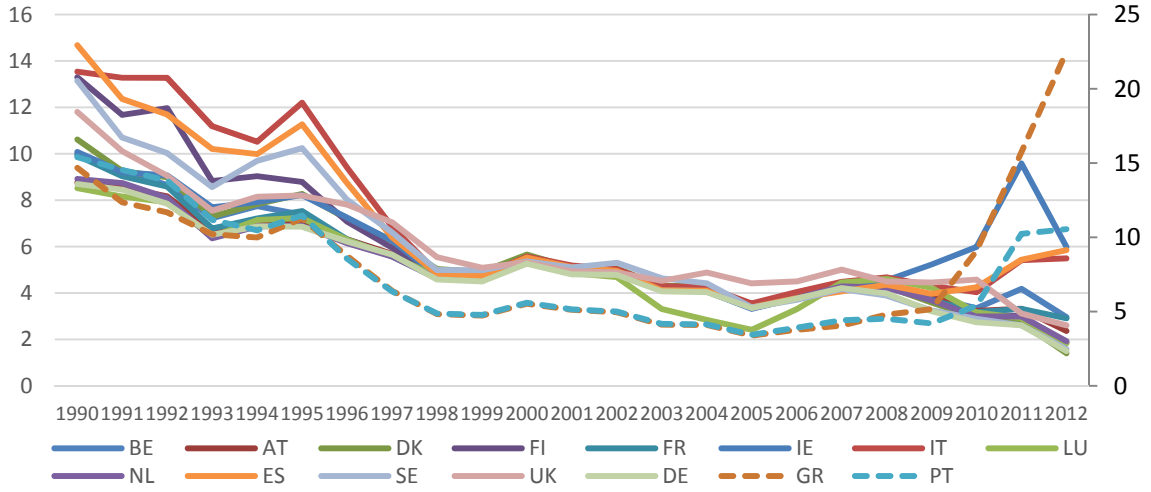
To focus on crisis impact, the dummy variable is added to the specification of a model. Dummy is equal zero in years 1990-2007, and equal 1 in a period 2008-2012. The final equation is defined in (3).

$$spread_{it} = a_i^* + \beta 1^* BALANCE_{it} + \beta 2^* DEBT_{it} + \beta 3^* YIELD\_DE_{it} + \beta 4^* FRI_{it} + dummy_{it} + u_{it} \quad (3)$$

3 Results and Discussion

Figure 2 shows development of 10-year government bond yield in percentage per annum. The two decades preceding the crisis witnessed a substantial decline in nominal interest rates and financing costs in all EU countries. The completion of the Single Market in financial services and deeper financial integration were associated with a strong convergence in financial conditions across the EU and especially in European Monetary Union (EMU).

Figure 2 Long-Term Interest Rate (10-Year Government Bond Yield) in % p.a.



Note: GR, PT (right-hand scale)
Source: based on data from Eurostat and Helgi database

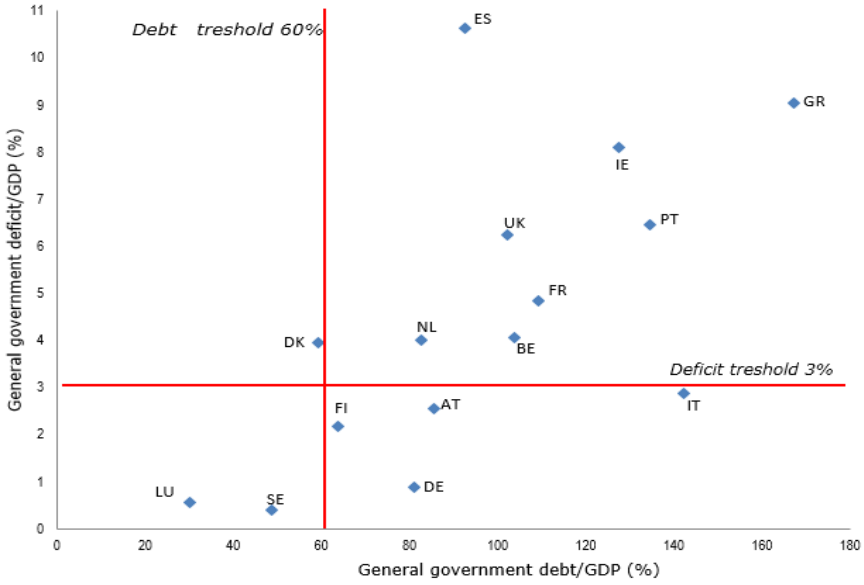
Prior to the crisis, the convergence of financial conditions masked divergences in national policies and the accumulation of fiscal, macroeconomic and financial imbalances in several euro area countries. These imbalances were not adequately addressed, either at the national or the European level. They created vulnerabilities in these countries and paved the way for the sudden return of differentiated financial conditions when risks were repriced. Imbalances related, for example, to government financial positions in some countries. Following the start of EMU, government finances benefited from the easier access to financing that emanated from the elimination of exchange rate risk, and an underappreciation of risk by financial market participants. However, progress towards sound and sustainable public finances was limited, owing partly to a loose and, over time, more relaxed interpretation of European budget rules. Market discipline was also weak, as reflected in the very limited dispersion in interest rates on government bonds. As a result, in particular those governments that had experienced high interest rates before joining EMU witnessed a major relaxation of financial conditions. Structural fiscal positions remained weak and vulnerable to changes in economic and financial conditions.

The financial crisis that erupted in September 2008 with the default of Lehman Brothers, marked a halt in the trend towards more homogenous financial conditions. Secured and unsecured money markets became increasingly impaired, especially across national borders. Public finances deteriorated sharply on account of the crisis, against the background of persistently high debt ratios and substantial banking sector support, especially in countries with a very large banking sector in relation to GDP. Rapidly increasing public deficits, debt and contingent liabilities raised questions about the

sustainability of public finances in some euro area countries, as reflected in higher sovereign bond yields (see Table 1) and a drying-up of liquidity in some markets. The sovereign debt crisis that erupted in May 2010 was initially centred on adverse fiscal developments in Greece, but then spread to Ireland and Portugal; at a later stage, Spain and Italy also became the subject of intensified market scrutiny. The lack of confidence in governments' willingness to tackle the crisis, in combination with the lack of an effective resolution mechanism, also spread to other governments. This phenomenon is referred to as "contagion" (ECB, 2012).

Tackling the problems in public finance, in the macroeconomy and in banks' balance sheets is complicated because of their close linkages. During a crisis, these links may be destabilizing and potentially self-reinforcing. For instance, substantial holdings of domestic government debt in their portfolios made banks in the affected countries vulnerable to rises in government bond yields, while at the same time, the weakened financial position of domestic banks required those governments to finance additional support to the banking sector (e.g. in Ireland).

Figure 3 Fiscal Position in 2012



Source: based on data from OECD and Helgi database

In line with public finance consolidation problems (look at Figure 3, which shows general government gross debt and government deficits in percentage GDP), governments have increasingly adopted numerical fiscal rules in last 20 years. There were in force 75 numerical fiscal rules in 2012 instead of 13 numerical fiscal rules in 1990 (OECD, 2014). Fiscal policy rules set numerical targets for budgetary aggregates. They pose a permanent constraint on fiscal policy, expressed in terms of a summary indicator of fiscal outcomes, such as the government budget balance, debt, expenditure, or revenue developments. The primary objective of fiscal rules is to enhance budgetary discipline. The dataset covers all types of numerical fiscal rules (budget balance, debt, expenditure, and revenue rules) at all levels of government.

Table 2 summarizes calculated estimations. Model 1 is expressed by (2), model 2 by (3). For identifying an optimal time lag, information criteria were used and it seems that the model 3 with 1 year lag is the most appropriate. Equation with one year lag has following form:

$$spread_{it} = a_i^* + \beta 1 * BALANCE_{it-1} + \beta 2 * DEBT_{it-1} + \beta 3 * YIELD\_DE_{it-1} + \beta 4 * FRI_{it-1} + dummy_{it} + u_{it} \quad (4)$$

Table 2 Summary of Estimations

	Model 1	Model 2	Model 3	Model 4
C	-2.28* (0.53)	-2.93*(0.55)	-1.74*(0.62)	-1.58*(0.57)
BALANCE	**-0.08***(0.02)	**-0.06****(0.03)		
BALANCE (-1)			**-0.12***(0.03)	**-0.11***(0.03)
DEBT	**0.05***(0.01)	**0.05***(0.01)		
DEBT(-1)			**0.03***(0.01)	**0.03***(0.01)
YIELD_DE	1.02 (0.08)	**0.20**** (0.09)		
YIELD_DE(-1)			0.12 (0.11)	0.09 (0.10)
FRI	0.06 (0.14)	0.01(0.14)		
FRI (-1)			0.10 (0.15)	
Dummy		**0.75*** (0.21)	**1.08***(0.20)	**1.08***(0.20)
Adjusted R2	0.52	0.54	0.52	0.53
DW stat	1.96	2.01	2.06	2.05

Symbols *, ** denote significance at the 1% and 5%, standard deviation are in parenthesis.
Source: author´s calculations

Results in Table 2 show the positive effect of budget balance and negative impact of debt on spread (even at 1% level). The budget balance is significant determinant of sovereign yield spreads found relevant also in several empirical studies above. The countries' budget balance plays the most prominent role in public discussion and is also named in the Maastricht Treaty as important stability criterion that EMU countries are required to fulfill. By the theory, a negative budget balance (deficit) is supposed to lead to higher market perception of default risk and to higher yield spreads. Total government debt reflects the hypothesis that higher indebtedness increases ceteris paribus the default risk and therefore yield spreads. This is the case because higher indebtedness means the country must spend more funds for debt servicing. For higher debt service payments the requirements on ability and willingness to pay are higher, and thus a default is more presumable, and sovereign yield spread is increased.

Impact of German yield is detected only in Model 2. Although increase of *FRI* expresses better fiscal discipline, results do not confirm expectation that *FRI* growth reduces the sovereign bond spreads as results are not statistically significant. The reason can be seen in a fact that the price of government bonds reflects market confidence in governments' commitment towards sustainable fiscal policies and only 48% numerical fiscal rules reflect development of central and general government. Moreover *FRI* is calculated ex-post and investors probably do not reflect its development. Model 4 is based on exclusion FRI from the equation, but it does not change impact of other variables.

4 Conclusions

The aim of the paper was to examine the role of fiscal fundamentals for sovereign risk spread in selected European Union member states in the period 1990-2012 and test if stronger fiscal discipline reduces sovereign risk premium. We understand fiscal discipline as a compliance with targets for budgetary aggregates (i.e. government budget balance, debt, expenditure developments). We performed estimation on panel data for 15 EU countries. We used German Bunds' interest, budget balance, debt, fiscal rules index, growth and inflation for testing the impact on sovereign bond spread.

Panel regression analysis identified the significant impact of fiscal position variables (budget balance and debt) on sovereign yield spread. This is the common trend for a whole panel and it confirms that debt and budget deficit are supposed to lead to higher market perception of default risk and to higher yield spreads and expectation that growing economies easier fulfill given payment obligations than for stagnating economies. The improvement of fiscal discipline, expressed by budget balance increasing, reduces sovereign yield spreads. Contrary, rising debt raises the possibility of state

bankruptcy and therefore debt´s increasing has negative impact on price of government bonds and spread. Surprisingly, changes of German Bunds' interest and fiscal rules index have not statistically significant impact on spread.

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World Financial Frictions and the Czech Economy

Karol Szomolányi, Martin Lukáčik, Adriana Lukáčiková

University of Economics Bratislava
Faculty of Economic Informatics, Department of Operations Research and Econometrics
Dolnozemská 1/b, 852 35 Bratislava, Slovak Republic
E-mail: szomolan@euba.sk, lukacik@euba.sk, istvanik@euba.sk

Abstract: *According to Uribe and Schmitt-Grohé (2014) business cycles in emerging market economies are correlated with the interest rate that these countries face in international financial markets. From this statement follows a question: what fraction of business cycle fluctuations is due to movements in country interest rate? Uribe and Yue (2006) offer the vector auto-regression model specification to quantify the macroeconomic effects of world interest rate shocks and country's interest spread shocks. We consider that Czech economy is small emerging and open. Therefore we use the specification to investigate the impact of world financial frictions on the Czech economic activity in the period 2001 – 2012 and, vice-versa, the impact of Czech overall economic activity on the Czech interest spread premium.*

Keywords: VAR model, world financial frictions, interest rate shocks, interest spread

JEL codes: C32, G15, O16

1 Introduction

The key models of real business cycle developed by Kydland and Prescott (1982) used the concept of shocks in total factor productivity. Their famous contribution led to development of microeconomic founded dynamic stochastic general equilibrium (DSGE) models that deliver quantitative predictions for short-run fluctuations in indicators that can be directly compared to actual data.

In the small open developing economies – such as Czech economy – different shocks can cause the economic fluctuations. Importance is the interest rate shocks caused by world financial frictions. Increasing interest rates faced by households and government of small open developing economy can cause a drop in economic activity caused by decreased mobility of capital. While shocks in total factor productivity have only a short-term impact, interest rate shocks may be theoretically more permanent and can affect the steady growth of the economy.

It could be considered that the risk premium of developing country described by the difference in interest rates faced by the rest of the world and the interest rates faced by households and domestic government, $r^* - r$, is an endogenous variable. It depends on the ability of economic agents to efficiently use resources. There is a large literature arguing that domestic variables affect the interest rate at which emerging markets borrow externally. See, for example, Edwards (1984), Cline (1995), and Cline and Barnes (1997).

The aim of the paper is to verify the impact of world interest rate and Czech interest spread on the overall Czech economic performance and, vice-versa, the impact of the Czech economic performance on the Czech interest spread premium.

2 Methodology and Data

We used vector autoregressive (VAR) models. It is well known that in these models every endogenous variable is a function of the lagged values of all endogenous variables in the system. See Lütkepohl (2005) for more details about VAR models. The mathematical representation of the unrestricted VAR model of order p is:

$$\mathbf{y}_t = \mathbf{A}_1\mathbf{y}_{t-1} + \mathbf{A}_2\mathbf{y}_{t-2} + \ldots + \mathbf{A}_p\mathbf{y}_{t-p} + \mathbf{u}_t \qquad (1)$$

where $\mathbf{y_t}$ is a k vector of endogenous variables; $\mathbf{A_1}$, $\mathbf{A_2}$, …, $\mathbf{A_p}$ are matrices of coefficients to be estimated; and $\mathbf{u_t}$ is a vector of innovations that may be contemporaneously correlated but are uncorrelated with their own lagged values.

The VAR model (1) can be interpreted as a reduced form model. A structural vector autoregressive (SVAR) model is structural form of VAR model and is defined as:

$$\mathbf{A}\mathbf{y}_\mathbf{t} = \mathbf{B}_\mathbf{1}\mathbf{y}_\mathbf{t\text{-}1} + \mathbf{B}_\mathbf{2}\mathbf{y}_\mathbf{t\text{-}2} + \ldots + \mathbf{B}_\mathbf{p}\mathbf{y}_\mathbf{t\text{-}p} + \mathbf{B}\boldsymbol{\varepsilon}_\mathbf{t} \tag{2}$$

It is assumed that the structural errors, $\boldsymbol{\varepsilon_t}$ are white noise and the coefficient matrices $\mathbf{B_1}$, $\mathbf{B_2}$, …, $\mathbf{B_p}$ are structural coefficients that in general differ from their reduced form counterparts and **B** is matrix of restrictions, typically diagonal or identity matrix.

A SVAR model can be used to identify shocks and trace these out by employing impulse response analysis and forecast error variance decomposition through imposing restrictions on used matrices. The problem of identification is explained in detail by Gottschalk (2001). The main purpose of structural vector autoregressive estimation is to obtain non-recursive orthogonalization of the error terms for impulse response analysis. This alternative to the recursive Cholesky orthogonalization requires the analyst to impose enough restrictions to identify the orthogonal (structural) components of the error terms.

Uribe and Yue (2006) proposed a specification of the VAR, through which we can determine the size of the impact of interest rate shocks and recognize endogeneity or exogeneity of risk premium in the form:

$$\mathbf{A}\begin{pmatrix} y_t \\ i_t \\ tb_t \\ r_t^* \\ r_t \end{pmatrix} = \mathbf{B_1}\begin{pmatrix} y_{t-1} \\ i_{t-1} \\ tb_{t-1} \\ r_{t-1}^* \\ r_{t-1} \end{pmatrix} + \mathbf{B}\begin{pmatrix} \varepsilon_t^y \\ \varepsilon_t^i \\ \varepsilon_t^{tb} \\ \varepsilon_t^{r^*} \\ \varepsilon_t^r \end{pmatrix} \tag{3}$$

where y_t and i_t are expressed relative cyclical components of output and gross investment, tb_t is the share of trade on production, r_t^* is the real world interest rate and r_t is the real domestic interest rate in each investigation period t. The matrix **A** is lower triangular matrix and matrix **B** is identity matrix. We assume that interest rate shocks ($\varepsilon_t^{r^*}$, ε_t^r) will be reflected in production, investment and trade balance with a lag of one period. On the other hand, domestic shocks (ε_t^y, ε_t^i, ε_t^{tb}) have an immediate impact on financial markets. We assume that the world interest rate is exogenous, so apply $a_{4j} = b_{4j} = 0$ for all $j = 1, 2, ..., 5$ and for $j \neq 4$, where a_{4j} and b_{4j} are elements in the 4th row and j-th column of matrix **A** and $\mathbf{B_1}$, respectively.

We estimated the parameters of the VAR specification (3). The selected lag of model (3) is validated by sequential modified likelihood ratio test statistic and information criteria and by the cross-correlograms of residuals and portmanteau test for autocorrelations. Significant values of cross-correlations for lower lags could be a reason to increase the lag order of an unrestricted VAR. We verified the stability of a VAR model (we verified if all roots have modulus less than one and lie inside the unit circle) and normality of residuals by joined tests of Jarque-Bera.

We used the real GDP, real gross capital formation, the share of trade in GDP obtained from the portal EUROSTAT. These economic indicators are seasonally adjusted using procedures Tramo/Seats in EViews program (original seasonally adjusted series are too short). We obtained monthly series of average interest rates on 10-year German and Czech government bonds traded on the secondary market from the website of the European Central Bank (ECB).

We received also monthly series of annual inflation rate calculated using the harmonized consumer price index from the portal EUROSTAT. We obtained quarterly series by averaging from the monthly data. We obtained the German and Czech real interest rates

by subtracting the natural logarithm of the inflation index expressed in the following year by the natural logarithm of the index expressed interest rates in each period.

Our analysis covers the period 2001 to 2012. Analyzed period is limited by disclose the extent of the time series of interest rates. Due to non-stationarity of the level variables tested by augmented Dickey Fuller test (1979), we used the first differences of the natural logarithm of GDP and gross capital formation, the first differences of the natural logarithm of the index terms of the share of trade in GDP and the first differences of the natural logarithm of the index expressed real interest rates.

At first we estimated the unrestricted VAR model specification. Then using Amisani and Giannini (1997) approach we estimated coefficients of matrix **A** and $\mathbf{B_1}$ in (3). We estimated the parameters of restricted and unrestricted specifications. Using the logarithm of the maximum likelihood functions of both specifications we calculated the likelihood ratio statistics and verified the significance of restrictions. Test procedure is explained in Lukáčiková and Lukáčik (2008).

We calculated the impulse response functions and realized variance decomposition to quantify the short-term impact of shocks. The methodology of VAR models, impulse response functions and variance decomposition is explained particularly in Lukáčik and Lukáčiková (2013).

3 Results and Discussion

Table 1 shows the VAR lag order selection criteria. All criteria: sequential modified likelihood ratio test statistic (LR), Schwarz information criterion (SC) and Hannan-Quinn information criterion (HQ) confirmed lag order 1 (asterisk nearby extreme value).

Table 1 VAR lag order selection criteria

Lag	LogL	LR	SC	HQ
1	678.2137	43.72764*	-31.9621*	-32.7826*
2	699.3285	30.31869	-30.6964	-32.2007
3	726.2440	31.74646	-29.7283	-31.9164
4	756.3781	27.81608	-28.9252	-31.7970

Source: authors' calculations

Table 2 shows the verification of the stability of a VAR model. All roots have modulus less than one and lie inside the unit circle. The VAR satisfies the stability condition.

Table 2 VAR stability condition check

Root	Modulus
0.59639	0.596390
-0.31388	0.313880
0.229197 - 0.047201i	0.234007
0.229197 + 0.047201i	0.234007
-0.00214	0.002136

Source: authors' calculations

The value of Jarque-Bera joined tests 14.45 is less than critical value of $\chi^2(10) = 18.31$ and also the value of Jarque-Bera test for every equation is less than critical value of $\chi^2(2) = 5.99$, this means that the residuals are normally distributed.

The analysis of the cross-correlograms of residuals showed only one significant value -0.51 between trade balance and German real interest rate of lag 2. We decided to realize also the portmanteau test for autocorrelations in order to eliminate the wrong conclusion about the order lag of model. Table 3 shows the results of the tests. The portmanteau tests for autocorrelations did not reject the null hypothesis of any residual autocorrelations up to lag *h*.

Table 3 VAR residual portmanteau tests for autocorrelations

Lags	Q-Stat	Prob.	Adj Q-Stat	Prob.	df
1	8.902079	NA*	9.119203	NA*	NA*
2	34.17298	0.1043	35.65365	0.0770	25
3	52.41008	0.3807	55.2936	0.2817	50
4	86.93651	0.1633	93.4544	0.0733	75
***The test is valid only for lags larger than the VAR lag order.**					

Source: authors' calculations

The likelihood ratio tests showed the exogeneity of German interest rate, so $a_{4j} = 0$ for all $j = 1, 2, ..., 5$ and for $j \neq 4$, where a_{4j} is an element in the 4th row and j-th column of matrix **A**. Moreover, according to the z-statistics a_{51}, a_{52} and a_{53} are statistically insignificant. It follows that the domestic economic activity hadn't an immediate impact on Czech risk premium. The interest rate for the government is immediately affected only by German interest rate.

Table 4 shows the estimates of the final SVAR model. The matrix **A** is lower triangular matrix, this means 10 restrictions needed for identification. The normalization means a further 5 unit restrictions. Step by step we restricted 6 from the remaining 10 parameters. All estimated parameters appear to be statistically significant.

The structural VAR model is over-identified, so we can test it by likelihood ratio statistics. The logarithm of the maximum likelihood function of unrestricted SVAR model is 709.76. We did not reject the null hypothesis of likelihood ratio test equal to 9.5193, which is less than critical value of $\chi^2(6) = 12.59$. This means over-identifying restrictions are valid.

Table 4 Structural VAR estimates with test of over-identification restrictions

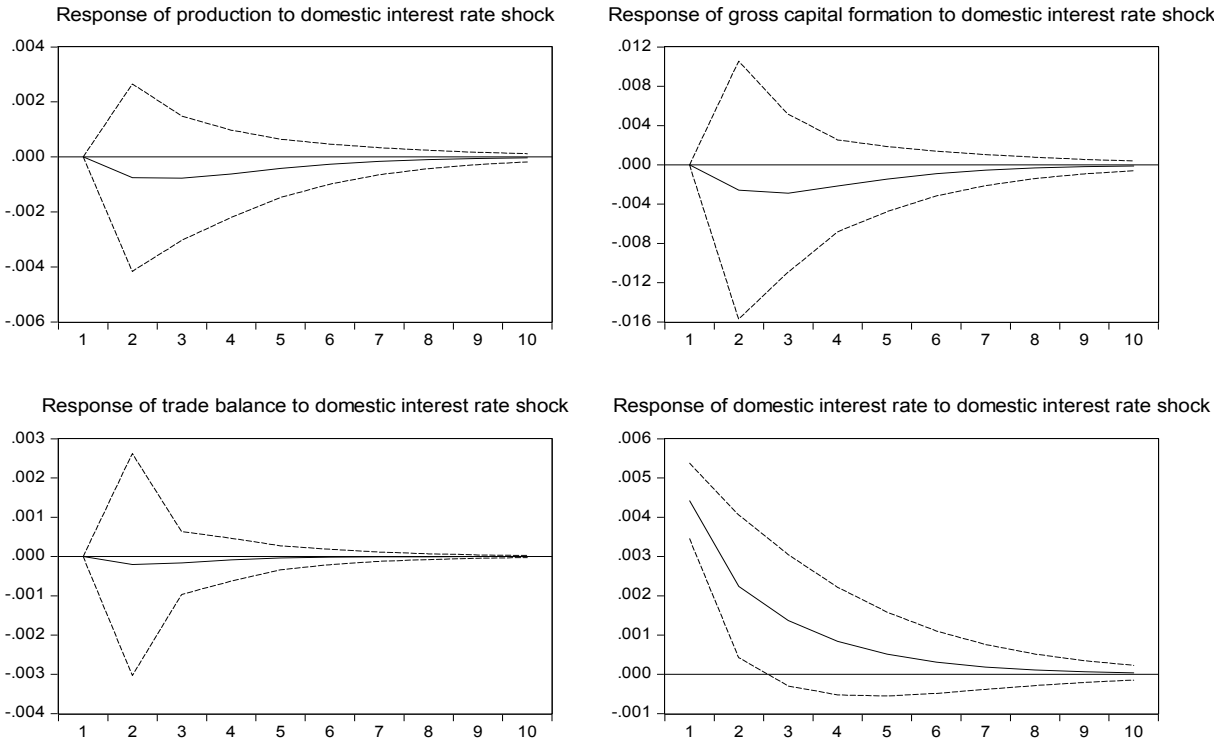
	Coefficient	Std. Error	z-Statistic	Prob.
$\mathbf{a_{21}}$	-1.501999	0.547714	-2.742307	0.0061
$\mathbf{a_{31}}$	-0.578098	0.078606	-7.354410	0.0000
$\mathbf{a_{32}}$	0.170735	0.020394	8.371728	0.0000
$\mathbf{a_{54}}$	-1.083702	0.183941	-5.891559	0.0000
Log likelihood	705.0006			
LR test for over-identification:				
Chi-square(6)	9.519335		**Probability**	0.1464

Source: authors' calculations

Figures 1-3 show the impulse response functions of GDP, gross capital formation, the share of trade balance to GDP and the real interest rate to structural one standard deviation Czech interest rate shock (ε^r), German interest rate shock (ε^{r*}) and productivity shock (ε^y), respectively. The solid line shows the impulse response function and the dotted lines are two standard deviation bands.

Figure 1 shows that interest rate shocks hadn't any impact on the economic cycle in the Czech economy in the period 2001 – 2012. As expected, production, gross capital formation and trade balance fell, however this decrease is clearly not significant, as it within the bands of two standard deviations may be considered by the rise in these variables.

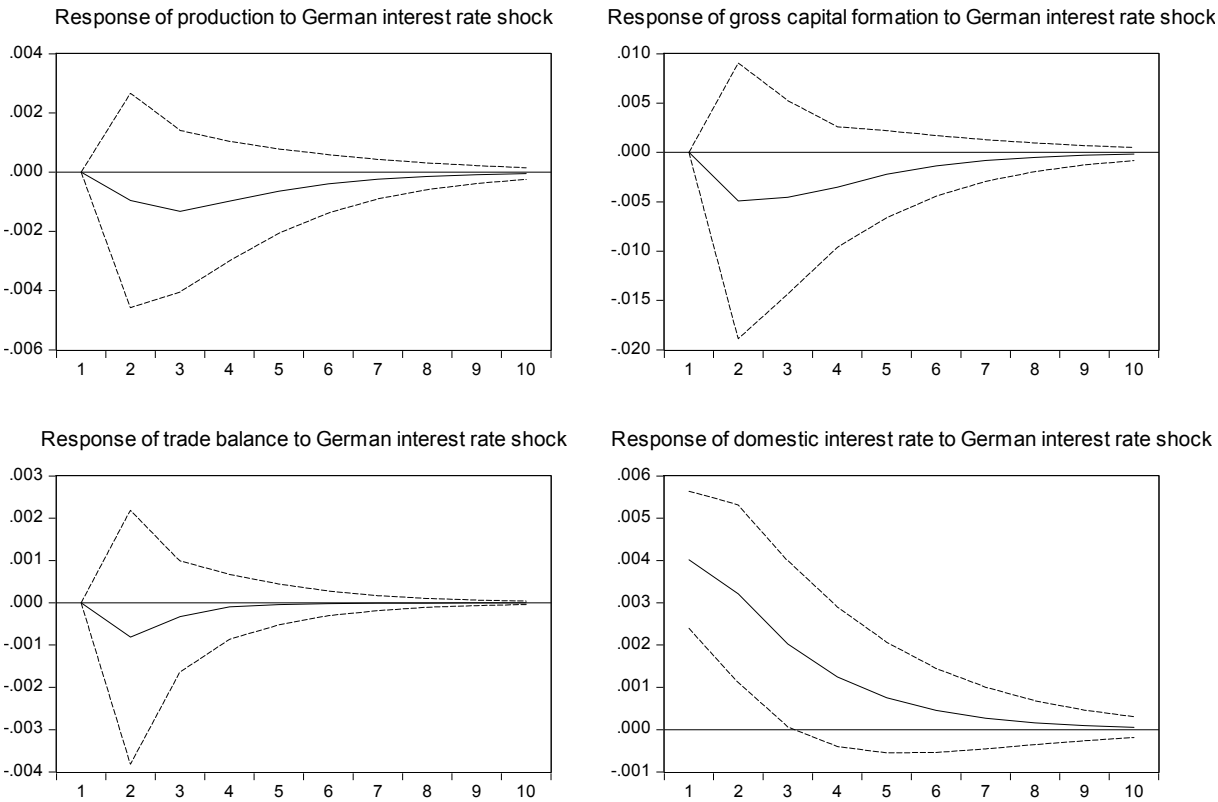
Figure 1 Impulse response functions to domestic interest rate shock



Source: authors' processing

Figure 2 shows that German interest rate shock had only statistically significant impact on domestic interest rate.

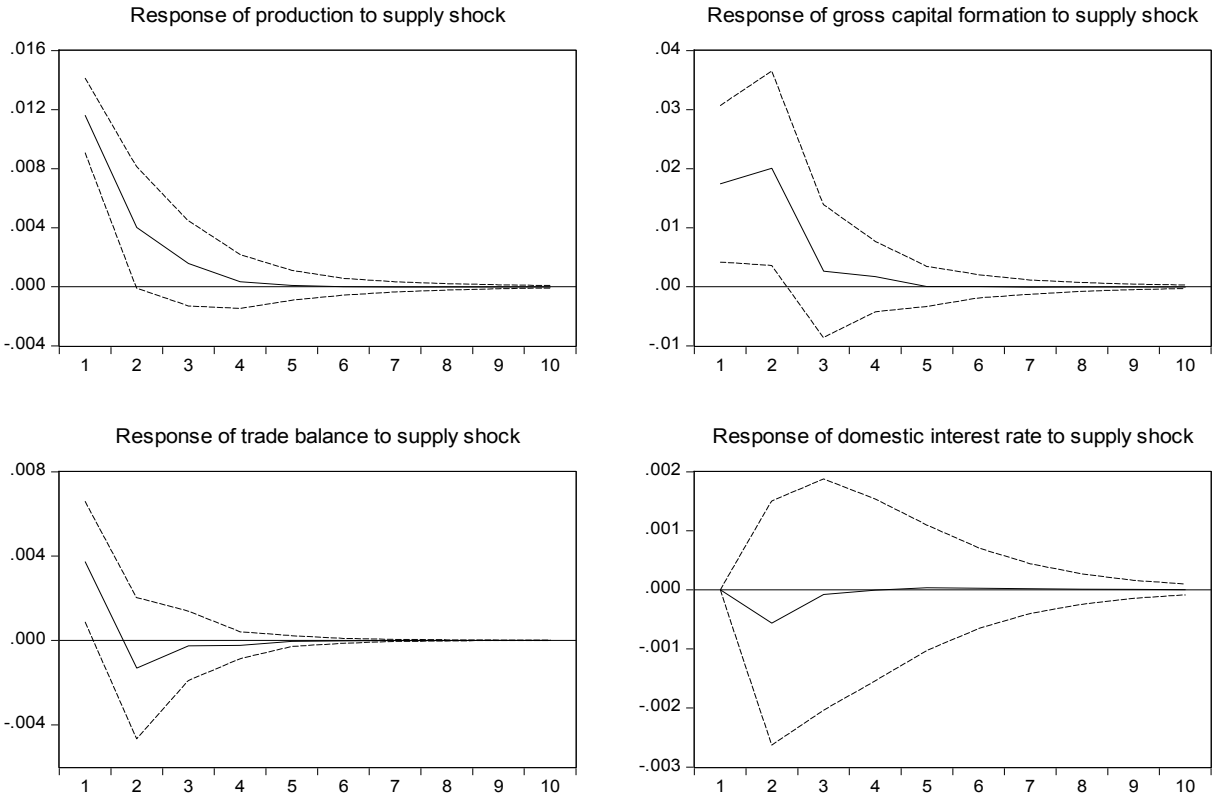
Figure 2 Impulse response functions to German interest rate shock



Source: authors' processing

Pro-cyclicality of gross capital formation and trade balance can be observed from Figure 3. We state that domestic economic activity has no statistically significant impact on the value of the interest rate faced by the Czech government.

Figure 3 Impulse response functions to supply shock



Source: authors' processing

By variance decomposition showed in Table 5 we conclude that interest rate shocks (shock 4 and shock 5) had a small impact on Czech economy. This impact had only about 3.8 % share to changes in production and only about 0.9 % to changes in trade balance. Production shocks (shock 1) had the significant impact about 95 %. At the same time shocks in domestic economic activity (shock 1, shock 2 and shock 3) had no significant impact on changes in domestic interest rate. Domestic shocks to these changes accounted for only about 1.1 %.

Table 5 Variance decomposition – factorization based on structural orthogonalization

Variance decomposition of production						**Variance decomposition of gross cap. formation**					
Period	**Shock 1**	**Shock 2**	**Shock 3**	**Shock 4**	**Shock 5**	**Period**	**Shock 1**	**Shock 2**	**Shock 3**	**Shock 4**	**Shock 5**
5	94.70	0.35	1.39	2.49	1.07	**5**	26.90	68.91	1.03	2.33	0.82
10	94.49	0.35	1.38	2.64	1.14	**10**	26.85	68.80	1.03	2.44	0.87
15	94.49	0.35	1.38	2.64	1.14	**15**	26.85	68.80	1.03	2.44	0.87
20	94.49	0.35	1.38	2.64	1.14	**20**	26.85	68.80	1.03	2.44	0.87

Variance decomposition of trade balance						**Variance decomposition of domestic inter. rate**					
Period	**Shock 1**	**Shock 2**	**Shock 3**	**Shock 4**	**Shock 5**	**Period**	**Shock 1**	**Shock 2**	**Shock 3**	**Shock 4**	**Shock 5**
5	16.32	52.11	30.69	0.81	0.08	**5**	0.53	0.43	0.17	53.80	45.06
10	16.32	52.11	30.69	0.81	0.08	**10**	0.53	0.43	0.18	53.90	44.96
15	16.32	52.11	30.69	0.81	0.08	**15**	0.53	0.43	0.18	53.90	44.95
20	16.32	52.11	30.69	0.81	0.08	**20**	0.53	0.43	0.18	53.90	44.95

Source: authors' calculations

4 Conclusions

The aim of the paper was to verify the impact of world interest rate and Czech interest spread on the overall Czech economic performance and, vice-versa, the impact of the Czech economic performance on the Czech interest spread premium. Our contribution doesn't reveal a significant impact of interest rate changes on the Czech economy. We state that the restrictions on financial markets faced Czech entities do not affect the medium-term economic activity.

The rejection of the impact of interest rate shocks on economic speech and vice versa and the rejection of the impact of domestic economic expression on risk premium in the period 2001 – 2012 doesn't necessarily mean that the economy of Czech Republic cannot also face to common problems of emerging economy, as Czech Republic is integrated part of the European economic system (although without common currency). Contingent European financial system breakdown surely could have influenced the Czech overall economic performance.

Our minor research outcome is relatively great impact of production shock on both output and gross capital formation. This result favours the small-open-economy-real-business-cycle models in the explanation of Czech short-run economic performance, see Mendoza (1991), Schmitt-Grohé and Uribe (2003). The main source of Slovak and Czech business cycles are real shocks that include term-of-trade shocks.

We stated the same results for Slovakia, with the exception of pro-cyclicality of trade balance (it was acyclic there); see Szomolányi et al. (2013). Emerging small open economies integrated in European economic system have face to different shocks as similar Latin American countries studied by Uribe and Yue (2006). This outcome probably coheres with our other outcome from Szomolányi et al. (2011) that both Slovak and Czech economies converge to the European average steady growth. While the European financial markets are stable, the Slovak and Czech economies will not experience Latin-American economic development.

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Using Modern Quality Management Tools to Improve Finance and Business University Courses

Zsuzsanna Eszter Tóth, Tamás Jónás

Budapest University of Technology and Economics
Faculty of Economic and Social Sciences, Institute of Business
Department of Management and Corporate Economics
2 Magyar Tudósok körútja, Building Q, 1117, Budapest, Hungary
E-mail: tothzs@mvt.bme.hu, jonas@mvt.bme.hu

Abstract: *The Institute of Business of the Budapest University of Technology and Economics is one of the largest financial and business higher education centers in Hungary both in terms of total student numbers and the number of undergraduate and graduate majors and courses. In this paper we report a project aimed at improving some of the core undergraduate finance and business courses. The specialty of this project is that the opinion of students is taken into consideration in a way that not only the given course but the whole survey and feedback process can be improved. Self-organizing maps (a hexagonal topologic structure with 5x5 neurons with the survey results considered as 22 dimensional vectors containing 11 importance and performance pairs) and statistical techniques were used to analyze the survey results. After processing the first evaluation questionnaires we have used problem solving techniques with active involvement of the students in order to lay the foundation for long-term course improvement actions and to identify the factors considered to be important by the students coupled with low actual performance. Based on the results obtained by using the developed questionnaire and feedback tool it is going to be used in all the undergraduate and postgraduate courses of the institute in order to provide education for our students that they also consider useful and important for their future jobs so their general financial literacy and business knowledge is improved. An important byproduct of the whole process is that students realize that their opinion is taken into consideration and that they are customers of the financial and business education of the institute. Furthermore as being an active part of such a quality improvement process students get familiar with the use and importance of modern quality management tools.*

Keywords: higher education, student satisfaction, PDCA, quality improvement actions, self-organizing map

JEL codes: I21, I23, C10, C45

1 Introduction

The issue of quality in higher education has received increasing attention in the last decade in Hungary. Hungarian higher education has become a mass-market service which can be described by an increasing number of students and by an increasing number and diversity of institutions. In Hungary, the need to measure the quality of teaching at university level has become a hot topic recently. Students are now generally recognized as the principal stakeholders of higher education. Student feedback of some sort is usually collected by most institutions, though, there is little standardization in how this kind of feedback is collected and what is done with it. There is still little understanding of how to use and how to act upon the collected data.

At the Budapest University of Technology and Economics (BUTE) students' feedbacks have been collected institutionally in several forms. Firstly, underclassmen have been asked about the motivations of their chosen career and about their social status since 1999. Secondly, graduates have provided details about starting their career since 1997. In the third form of measurements active students have been asked to evaluate each and every course they have attended during the semester since 1999. Formal measurement of course quality at BUTE is conducted through course evaluations completed by students at the end of a term. It is found to be useful to pinpoint the strengths of courses and

identify areas of improvement in order to understand the factors that contribute to student satisfaction.

Based on the existing course evaluation questionnaire our aim was to get more detailed picture about some of the finance and business courses lectured by our institute as a pilot project. In the second phase of our research brainstorming sessions were organized with the involvement of students so as to understand the problems highlighted by the questionnaire. Finally, cause and effect diagrams were constructed in order to reveal the root causes of the problems. As quality actions must derive from student concerns we ended up with an improvement action plan.

2 Measuring Student Satisfaction at BUTE

During our research we followed the steps of a TQM based course evaluation process proposed by Venkatraman (2007) aligned with the steps of the PDCA cycle representing continuous improvement (see Tóth et al., 2013). With the objective of understanding students' perceptions about the quality of educational service, we surveyed students on five of our finance and business courses in 2011, using a survey that was built for this particular purpose. The survey consists of a questionnaire of 11 questions (see Figure 1). Students were asked to express their opinions in two dimensions, namely, scoring the importance and the performance related to each question using an ordinal scale from 1 to 6. The performance dimension of a question reflects how much the students are satisfied with the educational performance in the particular field addressed, while the importance category is used to express how much they find important this particular topic similarly to Hernádi and Ormos (2012a and 2012b). The measurement was repeated with the same questionnaire in 2012 in the case of the Business Statistics course. The two-dimensional survey approach is built on the consideration that topics having higher importance scores should have higher performance values as students rightly expect higher service level in the areas which they consider more important. Figure 2 shows the total sum of importance scores and the total sum of performance scores for each question. Taking the five analyzed finance and business courses together into consideration, the biggest disconnects between the importance and performance dimensions are in the areas addressed by Question 5, 8, 9, 10 and 11 (see Figure 1).

Self-organizing Maps

A self-organizing map (SOM) with 5x5 neurons in a hexagonal topologic structure was trained with the survey results which can be considered as 22 dimensional vectors containing 11 importance and performance pairs. SOM in Figure 3 represents the input space by 25 typical vectors learnt by the neurons. The self-organizing property of the map means that any two representative vectors with small distance between them are located on the grid close to each other. Coloring of the map reflects the similarities between representative vectors. The abbreviation of the corresponding subject name such as BC1-BC5 (for the five analyzed finance and business courses) was associated to each input vector. The most frequently appearing subject name abbreviation of input vectors represented by each vector (neuron) in the grid is also shown in the map. It can be seen from Figure 3 that subjects form clusters in the input space, that is, there is certain homogeneity of students' answers for the same subject, while the answer vectors between different subjects are considerably dissimilar.

Figure 1 Survey questionnaire

Importance (1: Not important at all, 6: Very important)						Question	Performance (1: Minimum, 6: Maximum)					
1	2	3	4	5	6	1. How much do you find the topic highlighted in title of subject needful to establish your management and business knowledge?	1	2	3	4	5	6
1	2	3	4	5	6	2. How much do you feel so that the subject – considering the time frame given to the course – discussed the related sub-topics at appropriate level with appropriate importance?	1	2	3	4	5	6
1	2	3	4	5	6	3. In general, how much do you find the subject recommendable and fitting to the syllabus?	1	2	3	4	5	6
1	2	3	4	5	6	4. How much did the academic (lecturer) seem well-prepared?	1	2	3	4	5	6
1	2	3	4	5	6	5. How much did you find the teacher's lectures understandable and logical?	1	2	3	4	5	6
1	2	3	4	5	6	6. How much did you feel – considering the nature of subject – the teacher being vivid and thrilling?	1	2	3	4	5	6
1	2	3	4	5	6	7. How much did you find the supplementary materials and teaching aids prepared by the lecturer appropriately comprehensive and substantial?	1	2	3	4	5	6
1	2	3	4	5	6	8. How much did you feel the supplementary materials and teaching aids prepared by the lecturers well structured and easy to follow?	1	2	3	4	5	6
1	2	3	4	5	6	9. How much did the supplementary materials and teaching aids prepared by the lecturers help you following the lectures, making notes, and learning the subject?	1	2	3	4	5	6
1	2	3	4	5	6	10. How much were the examining circumstances correct and fair?	1	2	3	4	5	6
1	2	3	4	5	6	11. How much did you find the lecturer's examining method suitable to measure your real knowledge?	1	2	3	4	5	6

Figure 2 Total scores of importance and performance questions

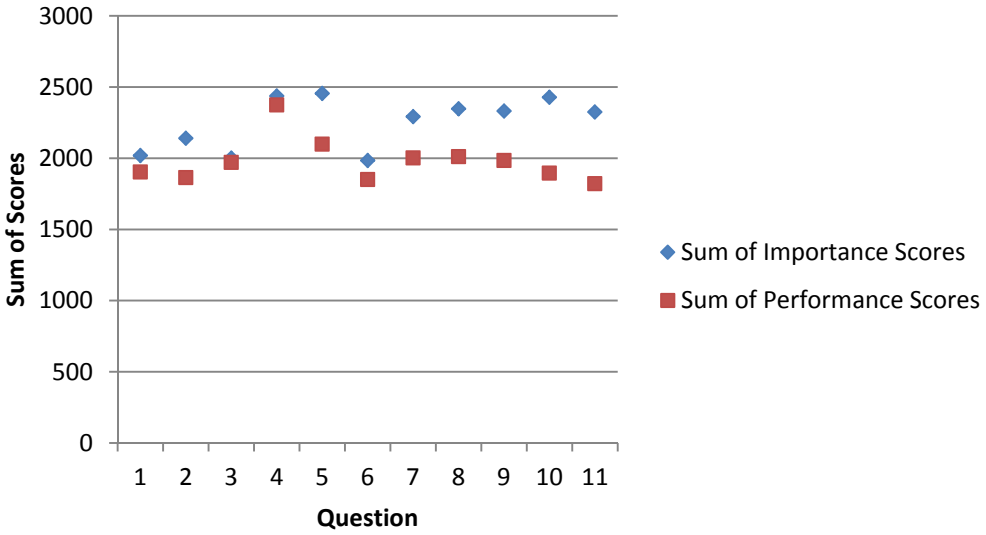
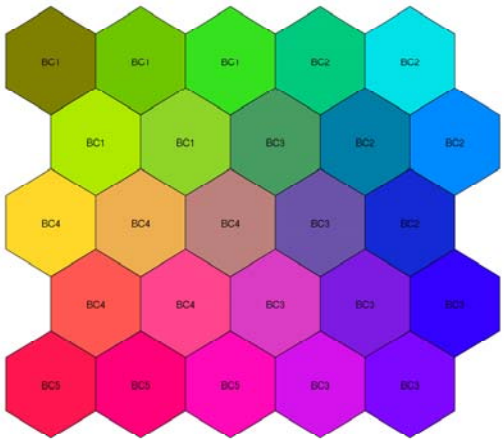
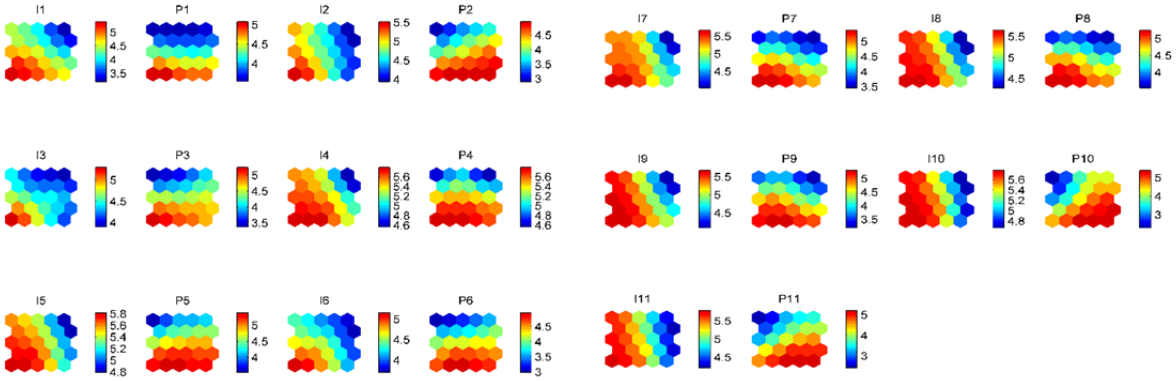


Figure 3 Self-organizing map with similarity coloring



Importance (I1-I11) and performance (P1-P11) components of the representative vectors are visualized in Figure 4. These figures together with the SOM in Figure 3 serve well for preliminary study purposes as some relations between the answer components can be easily identified by using them. For example, the five neurons in the upper-left corner of the SOM in Figure 3 belong to the Business Statistics course (see as BC1 in Figure 3), and we can see from the component planes that in case of question 11 the importance values of these neurons are high (red and orange colored), while their performance values are low (blue colored). It suggests that there is a considerably large disconnection between the importance and performance values for question 11 in case of this special course. A number of similar 'quick analyses' becomes possible based on the shown component planes. The conclusions that can be drawn from the component planes are in line with the ones which can be made based on statistical analyses.

Figure 4 Importance and performance components of the representative vectors



Brainstorming and Cause and Effect Analysis

Based on the five identified questions deriving from the evaluation of the survey questionnaire three questions were raised for the brainstorming session:

- How do you think the lecturer could develop the comprehension and logical structure of his/her classes? (Q5)
- What ideas come to your mind regarding the notes and educational supplementary material? (Q8, Q9)
- What would be the best exam system and conditions that could be used to assess realistically and fairly the students' knowledge about a given subject? (Q10, Q11)

Six groups of students were asked to brainstorm as many ideas as they could to answer the three brainstorming questions. The two groups involved, each of which consisted of 7 to 9 students, collected their answers separately from their own brainstorming sessions. After combining and harmonizing the answers for the three questions, they were divided into four categories according to the type of skill needed to be developed by the lecturer, namely human, pedagogical, technical skills and subject knowledge.

The ideas emerging from the first brainstorming question listed mainly the pedagogical/didactical preparedness and methods used by lecturers as problems. The inaccurate didactical, education technological and methodological knowledge of lecturers is mainly due to their lack of teaching qualifications and inappropriate teaching techniques. The intensification of this knowledge would be an important aspect while improving the quality of business courses. The development of pedagogical skills could also contribute to resolve some noted problems concerning human skills (see Gyökér and Finna, 2013). The second brainstorming question fostered ideas in connection with technical skills. Some of the deficiencies could be solved by developing the computer skills of lecturers. The other group of ideas (video records, audio books) would require a more significant financial investment from the university. Based on students' feedbacks lecturers should improve their presentation skills and put greater emphasis on demonstrating practical examples and case studies. The third brainstorming question addresses the issue of student performance evaluation. The performance can be measured in several ways see e.g. Ormos and Urbán (2012 and 2013). Most of the ideas can be associated with pedagogical and technical skills. Students require more strictness at exams and consistent sanctions for cheating. Students would need written, richly explained evaluations, more practical examples, more consultations, trial exams, etc. They also want more precise and more thorough evaluations (Bedzsula and Bérces, 2012, Tóth et al., 2013).

After the brainstorming session, cause and effects analyses were conducted with the participation of students by constructing Ishikawa diagrams trying to find the root causes of the aforementioned problems. The questions of the Ishikawa analysis were the following:

1. Why don't students find the lectures comprehensible? (see Figure 5)
2. What is the reason for the fact that the students are dissatisfied with the notes and written supplementary teaching material?
3. What is the reason for the fact that the students often don't find exams appropriate?

The two diagrams per question, which were created based on the three questions for the six groups have been combined and the results were illustrated by fishbone diagrams which have confirmed the conclusions of the brainstorming session. They demonstrate the causal relationships and the key problems concerning the three brainstorming questions in order to identify the most effective and important improvement actions (see Figure 5 as an example). Analyzing the cause and effect relationships it is conspicuous that the three fields addressed by the questions are strongly interrelated as some causes appear in more diagrams that allows us to conclude that there are a number of problems raised by the students which can be solved easily either by the lecturer or by the department responsible for the courses (Bedzsula and Bérces, 2012).

Survey Results from 2011 – Business Statistics Course

Figure **Chyba! Nenalezen zdroj odkazů.**6 shows a considerable gap between the averages of importance and performance scores in case of several questions. The conclusion that there is a lack of expected strong positive correlation between the average scores of the two survey dimensions is also supported by the correlation coefficient of 0.1328 calculated for averages of importance and performance scores. Based on these initial results, we focused on the questions with the largest gaps between averages of their importance and performance scores.

Based on the ideas of the brainstorming session and on the survey results of Business Statistics in 2011, we constructed a cause and effect matrix with the involvement of a group of Business Statistics students in order to set immediate goals.

Figure 5 Ishikawa diagram for Question 1 of cause and effect analysis

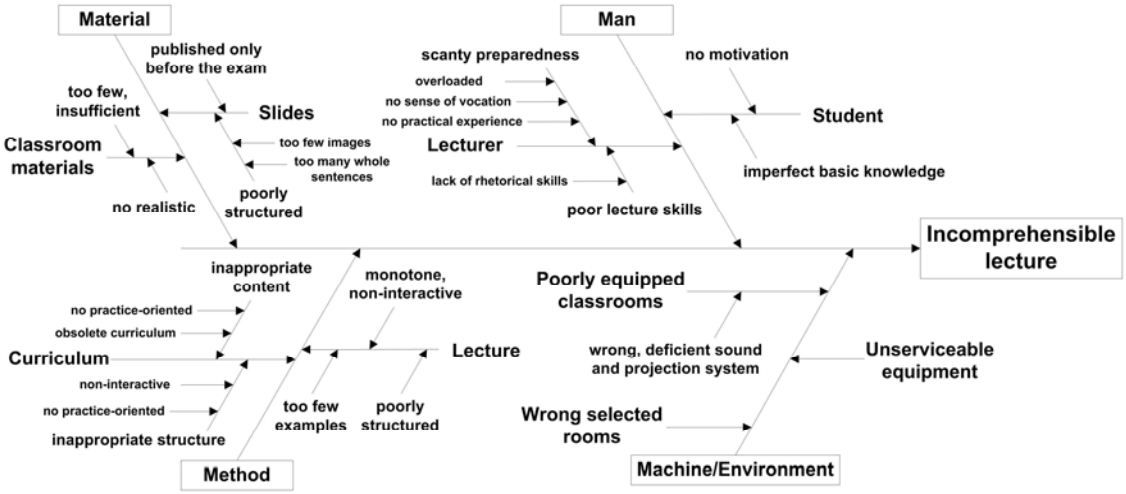
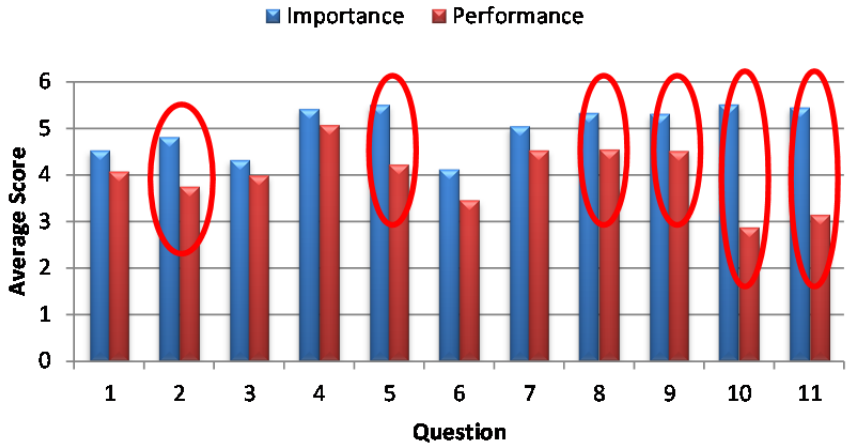


Figure 6 Averages of importance and performance scores in 2011



Actions Defined

Based on the initial statistical analyses of survey data from 2011 and on the results of brainstorming and the cause and effect matrix, the following actions were defined and implemented on the Business Statistics course in 2012 in the spirit of continuous improvement.

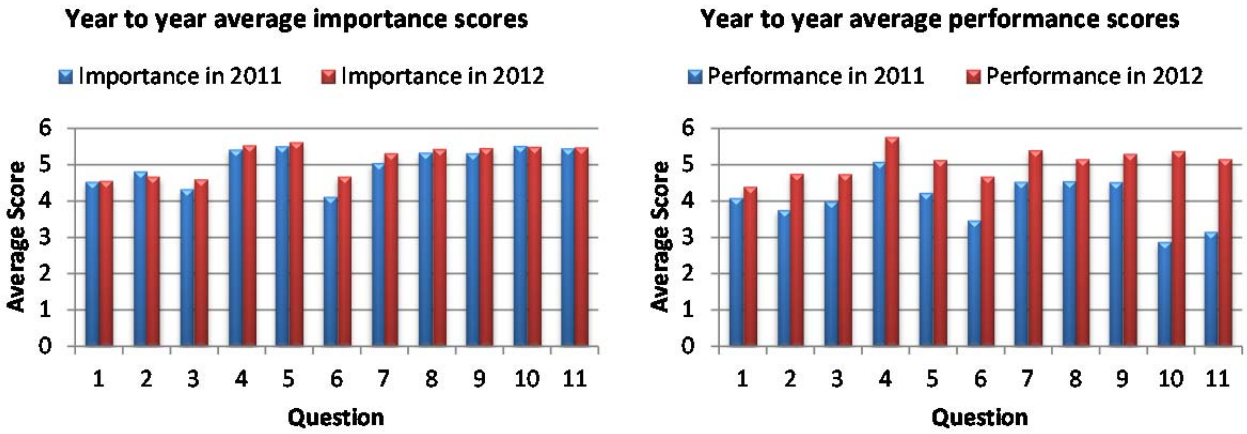
- Lecturers took part in the Lecturers' program organized by the Institute of Continuing Engineers Education at BUTE in order to improve their pedagogical skills (related survey questions: 5, 8, 9, 10, 11);
- Regular consultations emphasizing the most important theoretical topics were held one day before each midterm exam (related survey questions: 10, 11);
- Additional, comprehensive consultation materials were prepared for each consultation. The consultation materials were made available for students in presentation slides (related survey questions: 8, 9, 10, 11);
- Well-defined theoretical topics with outlines of required answers were prepared for each midterm exam consultation (related survey questions: 8, 9, 10, 11);
- The typical calculation exercises required in the midterm exams were summarized and overviewed during the consultations (related survey questions: 5, 8, 9);

- The weights of different sub-topics in the midterm exams were deliberately harmonized with the time spent on discussing and lecturing the corresponding sub-topic (related survey questions: 2);
- The entire course was taught by one lecturer instead of two or three lecturers teaching dedicated blocks of the course (related survey questions: 2, 8, 9).

Impact of Improvement Actions

After implementation of the improvement actions discussed above, we conducted the same survey at the end of the Business Statistics course in 2012 to see how the actions taken had acted upon students' satisfaction. Figure 7 shows the average scores for each survey question in 2011 and 2012.

Figure 7 Average scores in 2011 and 2012



The importance and performance scores can be considered as random variables, and so their averages can be taken as point estimates of their expected values. The graphs in Figure 7 suggest two hypotheses. On the one hand, we may assume that the gaps between expected values of importance and performance scores significantly decreased from 2011 to 2012 especially in the case of questions to which the actions taken are related. On the other hand, the average importance scores suggest that there was no significant change in the means of importance scores, that is, students' opinion about importance of topics addressed by survey questions did not change significantly.

The hypotheses that means of importance scores did not change significantly were tested in case of each survey question. Each H_0 hypothesis was tested by applying the two samples z-test as an approximate statistical test at significance level of 0.05. The results of conducted tests are summarized in Table 1. The change from 2011 to 2012 in students' opinion about the importance of topics addressed by survey questions is statistically insignificant; the only one exception is question 6.

Table 1 Z-values and p-values of tests on equality of importance score means and on equality of performance scores in 2011 and 2012

Question	z-value (imp.)	p-value (imp.)	z-value (perf.)	p-value (perf.)
1	0.1450	0.8847	-1.7961	0.0362
2	0.8825	0.3775	-6.0247	0.0000
3	1.5193	0.1287	-4.4889	0.0000
4	0.9639	0.3351	-5.2995	0.0000
5	1.0094	0.3128	-5.7277	0.0000
6	3.1319	0.0017	-6.9768	0.0000
7	1.9122	0.0559	-6.3250	0.0000
8	0.8230	0.4105	-4.1052	0.0000
9	1.2154	0.2242	-4.6541	0.0000
10	0.1811	0.8563	-14.6876	0.0000
11	0.1534	0.8781	-11.8384	0.0000

From the year-to-year average performance scores visible in Figure 7, we may assume that there was a significant increase from 2011 to 2012 in mean of performance score for each question. Similarly to the testing of importance scores, the results of statistical tests regarding performance scores are also summarized in Table **Chyba! Nenalezen zdroj odkazů.**1. Each p-value in Table 1 is less than 0.05 and so for each survey question the null-hypothesis is rejected and the alternative hypothesis is accepted at significance level of 0.05. It means that the mean of performance score for each survey question increased significantly from 2011 to 2012.

The correlation coefficient between the average importance and performance score for 2012 is 0.8669. The same correlation coefficient for 2011 was 0.1328, that is, the stochastic relationship between the importance and performance categories is much stronger in 2012 than in 2011.

In the light of our continuous improvement philosophy and following the Plan-Do-Check-Act cycle of course evaluation, the following actions are considered as having the potential to improve the educational performance of the Business Statistics course in the future. The entire curriculum is large and comprehensive. We need to review the structure of the curriculum and the lecture notes to ensure that the consecutive topics are in a logical and consistent order so that there is no topic which requires knowledge that is introduced later on. Calculation exercises are part of the lectures. Based on feedback from students and their representatives, it would be definitely more effective if the calculation exercises were discussed in smaller groups within seminars. Defining optional project exercises based on cases from different companies would challenge the students to solve some real-life problems using the tools and techniques learnt during the course. These changes are to come in the forthcoming term, now that we are in the phase of revising the whole course based on the aforementioned ideas. The applied pedagogical methods need a thorough reviewing in the long run as the brainstorming sessions highlighted these skills as urgent issues.

4 Conclusions

This kind of questionnaire structure and the validation of the presented dual approach would not only highlight the areas that need to be improved, but also students' involvement in improvement actions could have more aspects. The results may have implications for management responsible for resource allocations to various areas of the university services and infrastructure. Our aim is to make the necessary steps towards long term improvements and analyze regularly whether the actions have solved the most critical problems. This approach ensures that the voice of students is fully integrated into quality improvement efforts and contributes to a better understanding of the students' requirements. Moreover, students contribute actively to the improvement of courses by acquiring the knowledge necessary for the application of modern quality management tools at the same time.

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Cost and Benefit of Accounting Information in Slovakia: Do We Need to Redefine Relevance?

Miloš Tumpach, Anna Baštincová

University of Economics in Bratislava
Faculty of Economic Informatics, Department of Accounting and Auditing
Dolnozemská cesta 1, 852 35 Bratislava, Slovakia
E-mail: milos.tumpach@euba.sk

Abstract: *There are different groups of users of business information, whose interests are more often than not in mutual contradiction. As a result, it is almost impossible for general purpose financial statements to serve the best the interests of all stakeholders considered. Since the end of WWII, the accounting rules in Slovakia has been prescribed in a very detailed way by the government which on its own is one of the interested parties. In our paper we have examined whether, after 50 years, the current system of national financial reporting framework for businesses is not unnecessary context and if it is able to provide at least some information considered to be relevant by its apparent key users. More specifically, we have focused on the response of the creditors to the accounting information provided by their debtors´ financial statements. In order to meet our goal, we have analyzed selected data from 5 061 financial statements of 1 687 Slovak companies, covering three consecutive years (2010 through 2012). Though we have found evidence documenting unnecessary complexity of financial statements (which most certainly contributes to the cost of compiling them), we have also find a correlation between the selected accounting data and the relative cost of debt.*

Keywords: financial reporting, relevance, Slovakia

JEL codes: M41

1 Introduction

Being a primary source of information about the financial position and the performance of the companies, the accounting seems to be both a subject of criticism and (to a lesser degree) adoration. Yet, in general there is an assumption that the raison d'être of accounting is embedded in its very ability of providing relevant and reliable information to various stakeholders. The problem is that there are numerous groups of interested parties including, but not limited to, tax authorities, owners, creditors, business partners and general public. As a result, the shape of any accounting regulation is inevitably a product of trade-offs between the various groups of stakeholders. In its inspiring study, Watts and Zimmerman (1978) not only provide evidence to support this statement, but they also came to the conclusion that any governmental intervention could potentially increase the opportunity costs caused by the imperfect information. This is also a starting point in our quest for relevance of financial statements prepared in accordance with national accounting regulation in Slovakia.

It is true that the relevance of accounting has been a subject of numerous studies. For example Harris et al. (1994), Hung (2000), Hellström (2006), Kousenidis et al. (2009) and Hail (2013) among others raised questions about the relevance of accounting data for valuation purposes. Ryan (2008), Pozen (2009) Barth and Landsman (2010), Huizinga and Laeven (2012) and Tkáčová and Juhászová (2013) discussed the role of financial reporting (and more specifically, fair value measurement) as the factor which had contributed to the incitement of financial crisis. We agree with the statement that without the relevance of the data which is subject of manipulation (Hornická, Podmanická, Užík and Vašek, 2012; Kubaščíková, 2011)s, there is no incentive for such distortion and as a result, there will be no manipulation at all. Further evidence of relevance of accounting information is hence indirectly provided by the studies focused on the reasons and results of accounting choice made by the preparers of financial data (Francis, 2001) (Lennox et al., 2012) and manipulation of accounting data (Gowthorpe et

Amat, 2005), (Chen, et al, 2010), (Perols and Lougee, 2011) (Firth et al., 2011). Shen and Huang (2011) have been establishing the link between the earnings management and the cost of bank debt – the approach, which we will accommodate also in our paper.

There is also a common understanding about the inherent limitation of the relevance of accounting information provided within the governmentally regulated framework. Hopwood (1987) was inter alia examining such influence since the establishment of national accounting systems in numerous countries. Brilloff (1972), Burns and Noel (1981) and Cooper and Robson (2006) provided evidence of its presence and impact also in the countries with a strong and independent accounting profession. Further evidence has been provided by Ezzamel et al (2007) for China, Laughlin (2007) for Jordan and more recently by Nikolova (2014) for Bulgaria. Indeed, in majority of countries the government exercise at least moderate authority over the accounting regulation. But, with respect to a national accounting regulation, the situation in Slovakia is somewhat different. The first uniform accounting regulation for business companies, which contained principles, rules, chart of accounts and the content and the form of financial statements, has been promulgated by the government in then Czechoslovakia shortly after WWII. However after the coup in 1948, the economy has been switched to follow the central plan – a change which has an adverse impact on accounting too. In 1951 the Law No. 108/1951 made the accounting to be (co)regulated by the statistical authorities in a few yet vital areas. The devastating impact of this move on the common perception of accounting as a source of relevant and reliable information has not been fully recovered even after 60 years. Though not scientifically examined, there is numerous anecdotic evidence for this claim. For example, the Law No. 7/2005 on bankruptcies consider the excess of liabilities of a company over its assets to be a sound evidence of the deep financial troubles of such company. However, according to the law, in determination of such excess, an assessor´s report on the value of such assets and liabilities has a preference over the very information provided by the financial statements (sic!). It is also quite interesting to see that the amount of line items in compulsory form of the income statement prepared in accordance with national accounting regulation in Slovakia (as promulgated by the Ministry of Finance of Slovak Republic) not only vastly exceeds the content of the income Statement of some of the largest companies in the world, but it also beats another specimen of a bureaucratic accounting – compulsory content of the income statement established by the European directives (see Table 1).

Table 1 Line items presented and to be presented in the Income Statement

TYPE	US GAAP		EEC/EU Directives		Slovak Accounting Regulation			
	Microsoft Corp.	Google Corp.	78/660/ EEC	2013/34/ EC	2003 – 2006	2007 – 2008	2009 – 2010	2011 – 2014
A			23	20	64	57	61	61
B			26					
C	13	17	19	15				
D			19					

Note: A – multiple-step format, classification of expenses in accordance with their nature; B – single step format, classification of expenses in accordance with their nature; C – multiple-step format, classification of expenses in accordance with their function; D – single-step format, classification of expenses in accordance with their function.

Source: Income Statement of Microsoft Corporation for 2014, used in the Table 1 is available at: http://www.sec.gov/Archives/edgar/data/789019/000119312513310206/d527745d10k.htm and Income Statement of Google Inc. for 2014, used in the Table 1 is available at: http://www.sec.gov/Archives/edgar/data/1288776/000128877614000020/goog2013123110-k.htm

At first sight, the data presented in the Table 1 seem to be conclusive. Either the contents of the income statement presented by the US companies and requirements for income statement in European Union are insufficient in comparison with those bounded by the regulation in Slovakia, or the income statements in Slovakia are just unnecessary complex. Convincingly as it sounds, it lacks any sound evidence and we need to apply more quantitative analysis.

2 Methodology and Data

Data Specification

For further analysis we have been using data extracted from the balance-sheets and income statements of Slovak companies for years 2011 through 2012, prepared in accordance with the national accounting regulation and disclosed electronically via the Business Register. In order to maintain homogeneity of the data, we select only one type of the source financial statements: audited financial statements for which double-entry accounting principles were used. We are aware that this limits the extent of the data available, but we consider the resulting data to be more comparable and reliable (as they have been audited by an independent party).

All financial statements of Slovak companies, except for those in their first year of existence, shall contain data for precisely two consecutive years. As a consequence, financial statements examined in our study cover three years (2010 through 2012). In addition, because the data for 2011 are presented in both sets of financial statements (in 2011 presented as a data for current year and in 2012 as a data for comparable previous period) we can use this feature for a validation of data too. If the company has different balances for the same line and same year (2011), their financial statements are excluded from the analysis. Thus, final set of the data contains data from balance-sheets and income statements of 1 687 audited companies.

Model Specification

In our study we will assess two aspects of the relevance of accounting data in Slovakia and therefore two different tests need to be applied. *First one* is a low-level test for detection of unnecessary information. In our former unpublished study we have found that at least 16 % of compulsory balance-sheet line items have zero balances for 99 % of a sample of Slovak companies. We will follow this line of thinking by assessing the materiality of the 61 line items which have to be presented in the companies´ *income statements*. We will consider the line item to be irrelevant if it will have the balance equal to 0 % for each of the three years considered for 99 per cent of the companies. The threshold has been determined arbitrarily, but we consider that it reflects the substance of the materiality.

The *second test* is focused on the *relevance of accounting data*. We apply the underlying assumption that financial statements are indeed relevant for the government and its agencies (as they are the creators of the accounting regulation) and therefore our goal is to examine the possibility of using accounting data by some other key stakeholder. Because the credits and loans are the major sources of financing of companies in Slovakia (Morvay et al., 2013) we would focus our attention to finding the link between the accounting information and the actions made by the providers of credit financing. Following the results of previous studies (see Hajek, 2010), we would consider the most common financial ratios used in models for prediction of financial stress to be (in one or the other form) *indebtedness*, *return on assets* and *liquidity*.

Based on the study of Houghton (1983) and Niemi and Sundgren (2012), which have examined the impact of the accounting data on the availability of credits for companies, we will apply the same assumption of discreet, rather than continuous, response of the creditors to accounting data provided. However, due to lack of data about the rejected credit applications, we have introduced a different model. It has a nature of binary logistic regression, with a favorable decisions of creditors as a dependent variable and dummy financial ratios as categorical independent variables. From the point of view of our analysis, the creditors´ decisions would be considered favorable, if mean interest rate for a company for a year 2012 would be lower than a median of the interest rate for the total sample of companies for that year. Dummy financial ratios would have the value of 1 if the financial ratio is better (or equal) than the median of the values of respective ratio for a whole sample of companies for years 2011 and 2010 respectively. If statistically significant, the regression coefficients of the model will link the likelihood of the occurrence of interest rates for a given company in a year 2012 to be lower than

their median for all companies for that year with the occurrence of a dummy financial ratio with value equal to 1 in the previous periods (2011 and 2010). Subsequently we will use the LOGIT link function for transposition of the logistic regression into the odds ratios. The regression equation describes the probability of the incurrence of the favorable decisions of the creditors as follows:

$$P(INCENT = 1) = \frac{e^{(Y\prime)}}{1 + e^{(Y\prime)}} \quad (1)$$

where:

$$Y' = x_0 + x_1 IL_{11} + x_2 IL_{10} + x_3 ID_{11} + x_4 ID_{10} + x_5 IR_{11} + x_6 IR_{10} \quad (2)$$

Legend

IL_i is a dummy variable, which is equal to 1 if the liquidity ratio for a given year i and company is higher than the median of the same ratio for a whole sample of companies; ID_i is a dummy variable, which is equal to 1 if the ratio of indebtedness for a given year and company is lower than the median of the same ratio for a whole sample of companies; IR_i is a dummy variable, which is equal to 1 if the return on assets for a given year and company is higher than the median of the same ratio for a whole sample of companies; INCENT is a dependent variable, which takes the value of 1, provided that the mean interest rate for a given company and year 2012 is lower than the median of the mean interest rates for overall sample of 1 687 companies; x_i are regression coefficients. Index "i" is used for the respective period (2010, 2011, 2012).

3 Results and Discussion

Our first test was focused on detection of irrelevant financial statement data, which are required to be compiled and presented in the income statement. We have found that out of 61 compulsory line items in the income statement of Slovak companies, as much as 10 have zero relevance as defined in part 2 of this paper). In other words, for 99 % of companies, the ratio of balance of the line item to the three years´ average balance of all line items is 0.00 % (for 7 line items), 0.21 % (2 line items) and 0.67 % respectively (1 line item).

Our second test has been aimed on examination of the relevance of the accounting data from the point of view of creditors – that is, if they response to positive or adverse accounting information. In order to meet the goal, we have selected certain financial ratios (which are determined with reference to the balances presented in the financial statements) and transform them to binary (dummy) variables. These variables (described in more detail in part 2 of this paper) are initially included in the binary logistic regression model and subsequently backward eliminated if such elimination will improve the precision of the model. The result was a binary logistic equation which is providing the link between the favorable nature of financial ratios (IL_i, IR_i, ID_i) and the likelihood, that the mean interest rate is less than the median of mean interest rates for all companies in the sample (controlled by the variable INCENT). The equation takes the following form:

$$P(INCENT = 1) = \frac{e^{(Y\prime)}}{1 + e^{(Y\prime)}} \quad (3)$$

For Y´ we have established the following equation for the first step (that is, before backward elimination of variables):

$$Y' = -0{,}9483 + 0{,}582\, IL_{11} + 0{,}538 IL_{10} + 0{,}314 IR_{11} + 0{,}467 IR_{10} + 0{,}006 ID_{11} - 0{,}025 ID_{10}$$

However, in the second step, variables ID11 and ID10 with a P-Value over the level of significance (see Table 2; α = 0.05) were excluded from the model.

Table 2 P-Values for categorical predictors

Categorical predictors	P-Value
IL_{11}	0.000
IL_{10}	0.000
IR_{11}	0.013
IR_{10}	0.000
ID_{11}	0.881
ID_{10}	0.970

Source: authors' calculations

As a result, regression coefficients for determination of Y´ have been adjusted to a final form:

$$Y' = -0{,}9483 + 0{,}582\, IL_{11} + 0{,}531 IL_{10} + 0{,}313 IR_{11} + 0{,}466 IR_{10}$$

By using LOGIT link function, we can present the odds ratios for remaining categorical predictors IL_{11}, IL_{10}, IR_{11} and IR_{10} (see Table 3).

Table 3 Odds ratios for categorical predictors

Level A / Level B		Odds Ratio	95% CI
IL_{11}=1	IL_{11}=0	1.7887	(1.3377; 2.3919)
IL_{10}=1	IL_{10}=0	1.7000	(1.2735; 2.2695)
IR_{11}=1	IR_{11}=0	1.3676	(1.0688; 1.7498)
IR_{10}=1	IR_{10}=0	1.5939	(1.2441; 2.0421)

Note: Odds ratio is expressed for level A relative to level B

Source: authors' calculations

Test of good fitness have not provide enough evidence for rejecting the hypothesis of the relevance of selected accounting data for the creditors (see Table 4).

Table 4 Tests of good fitness

TEST	DF	Chi-Square	P-Value
Deviance	1 683	2 143.15	0.000
Pearson	1 683	1 687.34	0.466

Source: authors' calculations

4 Conclusions

The first of our tests has been focused on the unnecessary complexity of the compulsory accounting information provided by the Slovak companies. Due to a fact that our previous unpublished studies have confirmed such claim for balance-sheet line items, we have limit this test to the income statement line items only. Because it is hard to prove that the information contained in the financial statements is not used by any of the key relevant users, for the purpose of this test we consider the line item to be irrelevant if its balance is equal to 0 % for each of the three years considered for 99 per cent of the companies. We have found that in all three years considered (2010 – 2012) the strict condition of relevance has not been met by 7 line items. As a result, we can assume that there are indeed some line items which can be omitted without losing any relevance. Such complexity is not only increasing the cost of compilation and audit of financial statements, but also decreasing visibility and relevance of the potentially viable data. In this context it is quite remarkable to see that in 2012, 105 of the analyzed companies (out of 1 687) has a negative book equity. Astonishingly, 60 companies have negative equity in all three years considered, all of them having "clean" auditor´s report. While it is quite common to see the negative equity in other countries too (Brown et al., 2008) (Li and Lajbcygier, 2007), it is the magnitude of the negative book equity which has raised our concern. On the top, there is a company which has a negative book equity well over 126 mil. euros in all of three years (sic!).

Evidence that some of data are irrelevant is not a proof of the relevance of the rest. Therefore we have conducted the second test, which has been specifically designed on examination of relation between the decisions of the creditors and the selected accounting related data. In this case we consider accounting data to be relevant, if their values for a given company are correlated with mean interest rates of that company (in fact, rather than financial ratios on their own, we have been using dummy variables which have been determined with reference to those ratios). Out of three preselected ratios (liquidity, return on assets, indebtedness), regression coefficients have been determined for liquidity ratio and return on assets for both 2011 and 2010. We can interpret results of test of good fitness (see Table 4) as a lack of evidence for rejection for the statement arising from the results of the logit link function (see Table 3): *"other things being the same, the odds that mean interest rate of any given company would be lower than the median of it for all companies in population are increasing if the accounting ratio for that company is also better than the median of the respective ratio for the whole population"*.

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Tax Considerations and Merger Activity in National and International Context: Empirical Evidence from the Czech Republic

Petr Valouch, Oleksandra Lemeshko

Masaryk University
Faculty of Economics and Administration, Department of Finance
Lipová 41a, 602 00 Brno, Czech Republic
E-mail: valouch@mail.muni.cz, lemeshko@mail.muni.cz

Abstract: *Being closely interconnected with method of payment and structure of the deal, tax policies determine the scope of financial synergies from mergers. Majority of current tax regimes impose a significant burden on domestic firms earning foreign income. One of its major components is double taxation, which in combination with other tax issues significantly distorts ownership patterns and reduces cross-border and domestic investment flows. An exemption of foreign income and shareholder income from taxation helps to promote social welfare, although not to the global optimum. There is positive significant correlation between international tax rates and the probability of choosing a location for an affiliate of a multinational firm for both greenfield investments and cross-border mergers. The latter react less strongly to high tax rates than greenfield investments. Thus substitution of greenfield investments by cross-border mergers in some cases unambiguously intensifies tax competition, thus enhancing public welfare. As for the Czech Republic, the level of cross-border mergers is very low. Domestic mergers significantly outnumbered cross-border mergers during the last decade. On the other hand foreign investors own a lot of companies realizing the merger in this period. The aim of this paper is to identify whether companies going for mergers in the Czech Republic consider tax motives, problems and impacts of mergers in the process of the merger and to compare the obtained results with earlier existing evidence from the worldwide.*

Keywords: tax policy, merger, double taxation, tax savings, tax costs

JEL codes: M41

1 Introduction

On the doorstep of 21st century business combinations have become one of key driving forces of world economy convergence. By rough estimates currently companies takeover and consolidate within and across national borders at an annual growth rate of 7%. [1] The major reason for such magnitude of international business activity lies in large scope of benefits brought by such consolidation. Opportunities to acquire a new business model (Bragg, 2009), to achieve cost reduction and synergy benefits (Gaughan, 2007) provide an argument, which is substantial enough to pursue a large number of companies to go for business combinations. However, it is also important not to underestimate the potential threats imposed by such business deals. Among the major ones there is reduced competition (Gregoriou and Neuhauser, 2007) and massive layoffs (Devonshire-Ellis et al., 2011). Thus company's decision to undertake a business combination is rather disputable. There is no clear answer whether a combination with another business entity will increase such company's market value but not effect in the opposite way. That is why process of deciding turns into the choice in terms of marginal values. One variable the marginal effect of which cannot be ignored is tax considerations: sometimes taxation brings additional benefits for consolidation such as tax credits, exemptions and deductions, but also sometimes it turns out to be a source of substantial costs or even reason for rejection of such consolidation.

There is a vast body of literature investigating the impact of particular aspects of taxation on business combinations in general and merger in particular. Such studies evaluate the

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impact of tax rates on scope of financial synergies (Leland, 2007; Haufler and Schulte, 2011), research distortion of ownership patterns by foreign income taxation (Desai and Hines, 2004), analyze tax policy strategies for public welfare maximization (Fuest and Huber, 2004; Becker and Fuest, 2008; Becker and Fuest, 2011), investigate the relationship between cross-border taxation and free float home bias (Mishra and Ratti, 2013), evaluate the impact of international differences in taxes on cross-border mergers (Norbäck et al., 2009; Huizinga and Voget, 2009), investigate the impact of additional international taxation on target's income (Huizinga et al., 2012), evaluate systems of separate accounting and formula apportionment for cross-border mergers (Becker and Runkel, 2012), analyze the impact of differences in international tax rates on the probability of location of an affiliate under cross-border merger versus greenfield investment (GI) (Hebous et al, 2011).

This paper aims to identify whether companies going for mergers in the Czech Republic consider tax motives, problems and impacts of a merger and to compare the obtained results with existing evidence from the worldwide. The chosen methodology contained in a questionnaire survey addressed to Czech companies that underwent merger in 2001–2013.

2 Literature on Tax Considerations and Merger Activity

In the recent years there appeared a large number of studies dealing with relation between tax considerations and merger decision in national and international context. Such studies cover a wide range of subjects varying from general role of tax considerations in companies' merge decisions and up to the study of effect the international taxation has on cross-border mergers. Despite significant dispersion of their subjects all recent studies have some common characteristics, which distinguish them from the relevant Czech studies. Firstly, most recent studies do not differentiate between merger and acquisition so far and commonly use collective term "M&A" instead. From the viewpoint of substance of transaction these two types of deals should be differentiated, however under currently valid international regulatory framework it is authorized to use a collective term. Another common feature is focus on primarily cross-border deals and their analysis from microeconomic perspective, such as general equilibrium and welfare optimization. The last major distinction lies in direct and indirect comparison of effect of tax policies on mergers and GI. In general, all existing studies are explanatory and descriptive, that is, they research how mergers are influenced by taxation and measure scope of this effect.

The general effect of taxation on merger decision is researched by Leland (2007) and Haufler and Schulte (2011). Leland (2011) confirms the role of leverage effect as major source of financial synergies occurred under a merger. Haufler and Schulte (2011) find that under initially high level of national ownership prior to cross-border merger, a national deal will lead to more efficient tax policies, as compared to the international one.

The impact of international taxation on the cross-border business combinations is the subject of studies by Desai and Hines (2004), Fuest and Huber (2004), Mishra and Ratti (2013), Norback et al., (2009), Huizinga and Voget (2009), Becker and Fuest (2011), Huizinga et al. (2012), Becker and Runkel (2013). Here it is necessary to state that earlier existing studies on this subject are focused mainly on foreign investments which take form of GI. However, since recent years a constantly increasing share of foreign investments occurs in form of M&A, which leads to a change in the ownership of existing production facilities, instead of a relocation of economic activity. Thus recent studies are aimed to fill the gap in this field of research. In particular, Desai and Hines (2004) insist on introduction of international tax provisions as appendages to domestic corporate tax, thereby permitting taxpayers and a country to benefit from more efficient resource allocation and international diversification. Fuest and Huber (2004) rationalize tax policy patterns referring to combination of corporate income tax exemption system with dividend imputation system. Mishra and Ratti (2013) confirm statistical significance of dividend imputation and tax credit in reducing float adjusted home bias and traditional

international portfolio home bias. Norback et al. (2009) and Huizinga and Voget (2009) research the impact of international differences in profit and capital gain tax policies on cross-border investments in form of mergers. Norback et al. (2009) finds that if goodwill from foreign merger is not fully deductible, reductions in capital gain taxes can trigger efficient cross-border deals. If foreign entry takes place through M&A with domestic entity possessing the sufficiently scarce domestic assets, domestic tax revenues can increase due to competition between foreign firms over the scarce domestic assets. Huizinga and Voget (2009) confirm that double taxation distorts ownership patterns and reduces cross-border investment flows through discourage of formation of multinationals operating in two countries. Designing the optimal taxation system, Becker and Fuest (2011) find that neither deduction nor exemption tax regime leads to global optimality and prove that international differences in residence based taxation do not necessarily distort ownership patterns. Huizinga et al. (2012) concludes that the perceived additional tax rate closely resembles the additional statutory tax rate implied by cross-border merger; thus any activities that the multinational undertakes to evade or avoid additional international tax burden triggered by foreign ownership are limited or rather costly. Becker and Runkel (2013) confirm that both separate accounting and formula apportionment distort the international allocation of ownership.

Studies from the last group, which is dealing with impact of particular international taxation policies on cross-border mergers versus GI, focus mainly on overall role of taxation in explaining the international allocation of investments and their effect on the public welfare. On the basis of findings presented in these studies it is possible to assume that: (1) GI location decision is more sensitive to differences in international tax rates than the location decision of cross-border mergers; and that (2) presence of cross-border mergers in contrast to GI intensifies domestic tax competition thus promoting domestic welfare. Hebous et al (2011) finds a strong positive correlation between international tax rates and probability of choosing a location for an affiliate of a multinational for cross-border mergers and GI. Becker and Fuest (2008) analyze the implications of choice made by foreign investors between cross-border mergers and GI for the welfare effects of tax competition and find that cross-border mergers react less strongly to high tax rates than GI. Thus the possibility of substituting of GI by cross-border mergers unambiguously intensifies tax competition, thus enhancing public welfare, but only if there is no acquisitions tax. In their further research Becker and Fuest (2011) find that international differences in residence based taxation do not always distort ownership patterns and tax competition allows to reduce positive and negative externalities giving tax neutrality in the result.

Out of Czech authors, mainly Skálová (2012) deals with taxation in relation to mergers. She views the issue from the perspective of the tax obligations the merging and merged companies have to meet. Similar approach is adopted by Vomáčková (2009).

3 Methodology and Data

In light of stated above the paper aims to identify whether companies going for merger in the Czech Republic consider tax motives, problems and impacts of mergers on the basis of existing studies from worldwide and evidence obtained in the Czech Republic.

As concerns research methods, a questionnaire survey was conducted among Czech companies that implemented a merger in 2001–2013 (especially the last three years) with the aims: (1) to find out whether the merging companies had tax related motives as well when making decisions about the mergers; (2) to identify these tax related motives behind mergers; and (3) to identify the problems with taxes these companies had to face related to the mergers. Moreover, several counselling agencies that operate within mergers and acquisitions were addressed to take part in the survey and they also contributed their opinions to the assessment of the questionnaire survey. In total, a sample of 54 Czech companies that either went through a merger or represent a merged company which has its headquarters in the Czech Republic – so such sample was made

up for further survey. The chosen companies were selected randomly from the database of companies implementing mergers in the Czech Republic in 2001–2013.

4 Results

The subject of the questionnaire survey was mainly the question whether one of the motives behind a merger implementation was the taxes. Out of the 54 participating companies, 14 (that is, about 26%) stated that one of the motives that led to the final decision to implement a merger was the tax motive. To be specific, the most frequent tax related motive behind a merger implementation was the simplification of the administrative load within the tax field - reduction of the number of tax reports submitted, reduction of paperwork, reduction of tax transactions between the merging companies, etc.. This motive was named as the main tax related motive by ten companies (about 18.5%). The other tax related motives behind merger implementations were tax savings (two companies), the possible use of a tax loss of merging companies as an item deductible from the tax base of the merged company, and the possible use of interests on the loans of the merging companies as a tax-deductible expense of the merged company – these motives were mentioned once each. Tax related motives behind mergers also appeared in the replies of the counselling agencies as the main as well as auxiliary motives. The main tax related motives behind mergers mentioned by the counselling agencies include the achievement of the optimum tax structure by mergers of companies with one owner, removal of tax inefficiencies (especially by transferring assets to one successor company, integration of activities, integration of debt financing, and higher probability of applying tax and other financial expenses as tax-deductible expenses for the successor company, consolidation of tax losses), simplification of administration related to taxes (but also legal, accounting and auditing agenda), as well as cost savings in these fields and a general achievement of tax savings.

Another issue explored within the questionnaire was the question whether the merging companies faced problems with taxes during the merger implementation. Both groups of respondents, that is, the merged companies and the counselling agencies, faced several problems related to taxes during mergers. Out of the total number of 54 companies, 12 (that is, about 22.2%) gave an affirmative answer to this question. Some of the companies answered negatively; but at the same time, they provided several ideas of how to simplify the merger process from the tax perspective (see further).

Similarly, all the three counselling companies answered that they met with troubles and ambiguities in relation to taxes when implementing mergers. The main tax related problems the merging companies had to face were: (1) the complicated and ambiguous legal regulations concerning particular tax obligations; (2) the unpredictable length of the first taxation period of the merged company; (3) the complicated legal regulations concerning tax deductions of tangible assets of merging and merged companies; (4) unclear instructions about the potential application of the tax loss of a merging company by the merged company; (5) the measuring procedure that is sometimes different based on accounting and taxation regulations; (6) the relatively short periods to submit tax reports on income taxes for the period before the decisive day unless it is the taxation period in the sense of the income tax act; (7) the uncertainty of the tax deductibility of counselling costs related to mergers; (8) the imperfect harmonization of tax related legal regulations in the particular EU member states; (9) and the unclear regulations concerning tax deposits on income taxes of legal persons the merged company should pay. The counselling agencies also named some problems in the tax field that they had to face during their counselling activities concerning mergers and that make the accomplishment of the merger process complicated. The main problems they mentioned were the potential double taxation within cross-border mergers if the Czech company is the one being dissolved, no permanent establishment of the foreign successor company is opened after the company transformation, the transformation decisive day precedes the day of the transformation entry for legal purposes in the trade register or similar register abroad, and the relevant foreign jurisdiction also applies the concept of the retrospective decisive day. In this case there is the potential threat that both tax

jurisdictions will claim the right to tax the profits of the period between the decisive day and the day of the transformation (merger) entry for legal purposes. Another problem mentioned was, similarly to what mentioned the companies, the limitations related to the application of tax losses transferred from the merging companies to the successor company. In this case, the problem is that it is not sufficiently specified based on what criteria and to what detail they should proceed when identifying the appropriate tax loss the successor company can apply as tax-deductible in relation to the ratio of revenues on their own outputs and goods. It would be suitable if these procedures where specified in the act on income tax, e.g. in relation to particular items of the profit and loss account. Another problem mentioned was the troublesome transfer of intangible assets from a foreign merging company to a Czech successor company in the case of cross-border mergers. The counselling agencies also see as troublesome the fact that the act on income tax does not establish a clear rule as to how to determine the income tax deposits for the successor company in the case of cross-border mergers. The tax solution of a situation when more transformations take place within one year is not clear either. The counselling agencies then often have tackle the issues such as what effect this situation has on the deadlines to submit tax reports or how to determine the first taxation period for the income tax of legal persons in the case of the successor company, how to determine the deposits for particular taxes, what mode of tax deductions of tangible assets use, etc. The takeover of tax adjustments and reserves from the dissolved company by the successor company was mentioned as partially troublesome. Counselling agencies also often meet with a situation when a company purchases another on credit and then merges the company into itself as a parent with the motive to ensure the tax deductibility of the interests on the credit gained for the purchase of the subsidiary (referred to as debt push down merger). The problem in this type of mergers from the tax perspective is the fact that unless the successor company proves that the motive of ensuring the tax deductibility of the interests on the credit gained for the purchase of the subsidiary was not the main motive behind the merger, the entire merger can be challenged by the tax administration authority which poses a risk that some of the tax-deductible costs will not be allowed for the purposes of reducing the tax base and the tax can be additionally measured.

The analysis of the questionnaire survey thus shows that the tax solution of mergers is not completely without difficulties and the process of merger implementation in the Czech Republic is complicated.

5 Discussion

Being closely interconnected with method of payment and structure of the deal, tax issues determine the scope of financial synergies from merger activity. There is a positive impact of leverage effect of taxation on the magnitude of financial synergy and, thus, level of merger activity. Majority of current tax regimes impose a significant burden on domestic firms earning foreign income. One of its major components is double taxation, which distorts ownership patterns and reduces cross-border investment flows. Corporate income and dividend tax exemption enhances social welfare, but only to a certain degree.

Both separate accounting and formula apportionment distort the international allocation of ownership. One way to double taxation relief is implementation of dividend and income tax credits, which, however, in case of high taxation for foreign investors are found to be not adequate to recapture all the taxes paid. International differences in residence based taxation do not necessarily distort ownership patterns. If there is initially high level national ownership of domestic firms prior to cross-border merger, a national deal will lead to more efficient tax policies, as compared to the international one. If foreign entry takes place through a cross-border merger with domestic entity possessing the sufficiently scarce domestic assets, domestic tax revenues can increase due to bidding competition between foreign firms over the scarce domestic assets. The interaction effects between higher international tax rates and probability of choosing a location for an affiliate of a multinational firm are positive and significant for both cross-border mergers and GI.

For Czech companies, which underwent mergers in 2001-2013, the most frequent tax related motives were simplification of administrative load within tax field, tax savings, possible use of a tax loss of merging companies as an item deductible from the tax base of the merged company, and possible use of interests on loans of the merging companies as tax-deductible expense of the merged company. From the viewpoint of counseling agencies, responsible for realization of merger procedure, the most widespread motives were achievement of optimal tax structure in mergers of companies with one owner, removal of tax inefficiencies, simplification of administration related to taxes as well as legal, accounting and auditing agenda, and achievement of tax savings in general and cost savings in this particular field.

Another issue discovered within questionnaire survey was a number of tax related problems, with which Czech merging companies were faced during merger implementation. Both the merged companies and the counseling agencies documented the following problems: (1) the complicated and ambiguous legal regulations concerning particular tax obligations; (2) the unpredictable length of the first taxation period of the merged company; (3) the complicated legal regulations concerning tax deductions of tangible assets of merging and merged companies; (4) unclear instructions about the potential application of tax loss of the merging company by the merged company; (5) the measuring procedure which is sometimes different due to differences in accounting and taxation regulations; (6) the relatively short periods to submit tax reports on income taxes for the period before the decisive day unless it is the taxation period in the sense of the income tax act; (7) the uncertainty of the tax deductibility of counseling costs related to mergers; (8) the imperfect harmonization of tax related legal regulations in the particular EU member states; (9) and the unclear regulations concerning tax deposits on income taxes of legal persons the merged company should pay. Additionally there were documented some tax related problems which significantly complicated the accomplishment of merger process. They were potential double taxation, limitations in transfer of tax losses from the merging companies to the successor company, tax complications with transfer of some intangible assets and absence of clear rules for determination of income tax deposits for the successor company under cross-border mergers.

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The Development of Profitability of Merged Czech Companies

Petr Valouch[1], Daniel Němec[2]

[1] Masaryk University
Faculty of Economics and Administration, Department of Finance
Lipová 41a, 602 00 Brno, Czech Republic
E-mail: valouch@econ.muni.cz

[2] Masaryk University
Faculty of Economics and Administration, Department of Economics
Lipová 41a, 602 00 Brno, Czech Republic
E-mail: nemecd@econ.muni.cz

Abstract: *The aim of this paper is to analyse the development of profitability of merged Czech companies realizing the merger in the period of years 2001 – 2010. The analysis is based on the sample of more than 300 companies realizing and completing successfully the process of merger during the above mentioned period. Regression techniques are used to reveal the most important factors standing behind the changes of profitability of merged companies. The factors under consideration are foreign ownership, the size of the company and the influence of macroeconomic development in the Czech Republic. Moreover, the relative importance of all controlled variables is evaluated as well.*

Keywords: mergers, profitability, macroeconomic development, panel data model

JEL codes: G34, C23

1 Introduction

Especially at the time of crisis, from the economic point of view, business entities endeavour to make their activities as efficient as possible. One of the ways leading to this objective is combining business entities by means of mergers. A frequently declared main economic goal of mergers is an increase in efficiency of the merging companies, in consequence of the 'synergic effect'. The other expected goals of mergers are increases in profitability, cost-effectiveness and production efficiency of a merged company after the merger. The issue of the economic evaluation of a merger success has been studied in many papers and analyses, the most significant of them being (Lang, 2003, Weech-Maldonado, 2002); similarly, there are studies on the evaluation of factors affecting the merger success (see especially Dorata, 2012, Komlenovic and Mamun and Mishra, 2011, Marks, 1997, Vu and Shi and Hanby, 2009). As regards the efficiency of mergers in the Czech Republic, similar studies have not been performed so we cannot reliably state whether the mergers conducted between business entities in the area of the Czech Republic have met their main economic goals.

This paper provides an initial result of an evaluation of results and impacts of mergers of business entities in the Czech Republic, focusing on the effect of mergers on the development of the profitability of merging before and merged companies after the merger. The study results have been gained within the project of the Czech Science Foundation no. P403/11/0447 - The Analysis of Taxation and Accounting Practices during Mergers implemented in the Department of Finance, the Faculty of Economics and Administration, Masaryk University in Brno, Czech Republic. The development and economic impact of mergers have been a topic of several publications within the above mentioned project as well as by other Czech authors (especially Hýblová and Sedláček and Křížová, 2012; Sedláček and Valouch and Hýblová, 2012; Sedláček and Valouch and Konečný, 2011; Skálová and Tumpach, 2010; Špatná, 2010). However, as regards specific economic impacts, only the effect of mergers of Czech companies on the value of their assets and on the EBIT after the merger has been explored (Valouch and Králová 2012, Valouch, Konečný, Králová, 2013). Now, in this paper, we are interested in the development of profitability of merged Czech companies realizing the merger in the period of years 2001 – 2010.

2 Aim and Methodology

The aim of this paper is to analyse the development of profitability of merged Czech companies realizing the merger in the period of years 2001 – 2010. The analysis is based on the sample of more than 300 companies realizing and completing successfully the process of merger during the above mentioned period. Regression techniques are used to reveal the most important factors standing behind the changes of profitability of merged companies. The factors under consideration are foreign ownership, the size of the company and the influence of macroeconomic development in the Czech Republic.

The indicator of profitability is based on financial statements of merged companies from analysed sample, concretely on the profit and loss statements and the balance sheets. The analysis examined 310 merged companies selected from a set of 2396 mergers conducted in the Czech Republic in the monitored period. The sample consists of the companies that properly published their financial statements at the moment of the merger and in the three years after the merger in the collection of documents of the Trade Register of the Czech Republic, as stipulated in Act no. 563/1991 Coll., on accounting. The discrepancy in the numbers indicates that nearly 87% of the merging or merged companies did not meet their legal obligation at least in one of the accounting periods regarding the publishing of financial statements.

Data

Our data set consists of a panel of 310 companies realizing the merger in the period of years 2001 – 2010. This unbalanced panel has been converted into the balanced panel where historical time has been taken as relative to the year of merger. We are thus able to observe financial and other qualitative indicators of the merged companies within the period of 4 successive years.

The aim of our paper is to explain the factors standing behind the changes of profitability of merged companies. We use two indicators of profitability: return on equity and return on assets. The explanatory variables used are as follows:

- Dummy variable ***Merged*** indicating the year of merger (*Merged* = 0) and the years after the merger (*Merged* = 1). We have created three other dummy variables ***Merged 1***, ***Merged 2*** and ***Merged 3*** that equal one for the observations for the period of one year, two years and three years after the merger respectively (and zero otherwise). In this case the basic category is the year of merger.
- Variables ***Total debt ratio***, ***Investing rate*** (***return on investment***), ***Financial leverage***, ***Wage productivity***, ***Employment coefficient*** and ***GDP growth*** (year on year growth of the real GDP; source Czech Statistical Office).
- Three dummy variables indicating the sum of total assets of merged companies in the year of merger. These variables are ***Company size S*** (equals one if the sum of assets is less than 100 million crowns and zero otherwise), ***Company size M*** (one for the sum of assets between 100 and 500 million crowns, zero otherwise) and ***Company size L*** (variable equals one for the sum of assets exceeding 500 million crowns, zero otherwise). Variable ***Company size S*** is treated as a basic category (group) in all of our models.
- Dummy variable ***Foreign ownership*** that equals one if the share of foreign ownership of the merged company is greater than 50 percent.

Econometric Methods and Models

The most appropriate method dealing with the panel data are individual effects models. This kind of regression models incorporates the unobserved heterogeneity across the investigated units (companies) into the model equations using the fixed effect term or individual effect term. In this case, we use standard econometric methods. More technical details may be found in the standard books of panel data econometrics (see e.g. Baltagi, 2008). In this part of our paper we will describe only the basic principles of our methodology.

Although we would expect unit root (or deterministic trend) in our dependent variables, the short time span (four years) of our panel does not allow us to test this feature. But, as is well known, the non-stationarity problem is not important in the short panels. This conclusion has some advantages in our applications. It is not necessary to work with stationary variables using the differences. That means we do not lose the first observation which is connected with the year of the merger of each company and we are thus able to incorporate and control these observations in our analysis.

We have estimated two groups of models. The first group of model consists of all available variables in their basic (level) form. We prefer to use the random effect model due to fact we are working with a random sample of merged companies. Moreover, this model may estimate the marginal effect of the time-invariant explanatory variables on our dependent variables. We have performed all necessary diagnostic tests in all model specifications. If the test of common intercept (i.e. no heterogeneity in the data generating process) does not reject the null hypothesis we will perform the pooled regression. The reliability of the random effect model has been tested using the Hausman test of exogeneity. Rejecting the null hypothesis means that the random effect model estimates are not consistent. In this case, fixed effect estimates are carried out. Unfortunately fixed effect model does not allow us to estimate the marginal effects of the time-invariant variables. All these effects are included in the individual effect term.

The second group of model specifications includes the interaction terms. We are thus able to verify the possibility of different marginal effects among various categories of the companies described by the corresponding dummy variables. The estimation strategy is the same one as in the case of first group of the models. In both specifications, we started with the model with all the available explanatory variables. Sequential eliminations procedure led to the best fitting models with statistically significant variables only. In case of fixed effect models and pooled models, the robust covariance matrix estimators were computed. These estimates of the covariance matrix are robust to heteroskedasticity and autocorrelation. To be more precise, we use the Arellano estimator (see Arellano, 2003) which is a robust estimator for the panels with a large number of cross-sectional units and relatively few observed time periods.

3 Results and Discussion

Estimation results may be found in the tables 1 to 4. Table 1 presents the estimates for the return on equity where no interaction terms were used. Columns denoted as "RE model 1" and "RE model 2" show that the Hausman test does not reject the null hypothesis about the consistency of the random effect estimator. Tests of common intercepts suggest that it is possible to use the pooled models. We will interpret the final results obtained after sequential elimination procedure.

We can see that the dummy variable ***Merger*** is statistically significant in both model specifications. It means that the returns on equity are greater than the returns after the merger, especially in the second year after the merger. The marginal effect of the third year is significant as well. It should be noted that this conclusion is based on the fact, that we have controlled all other possible variables. The models fit the data very well although it is straightforward to see that the most influencing (with negative sign) variable is the ***Financial leverage***. Dummy variables are not able to explain too much variability in the data but they are important for including and testing important heterogeneity factors across the observed sample. As for the other dummy variables, we can see that the size of the assets of merged companies play an important role for the large companies (assets greater than 500 millions). It seems that these firms tend to increase their profitability (measured by the return on equity) in comparison with their smaller counterparts (in the Table 1, column 4, we show the estimates including the statistically insignificant dummy variable of the medium-sized companies with p-value 0.13 which is not too far from the commonly accepted 10 % level of significance). The similar conclusion holds for the companies with foreign ownership where merged companies with foreign ownership tend to have increased returns on equity relatively to

the merged companies with fully domestic ownership. The influence of economic growth was not proved. To be more specific, this factor may be a part of variability of ***Financial leverage*** variable.

Table 1 Models for return on equity (models without interaction terms)

	RE model 1	**RE model 2**	**Pooled model 1**	**Pooled model 2**
Constant	-1.5276** (0.6164)	-1.6079*** (0.6186)	-1.4252* (0.8496)	-0.6723 (0.4346)
Merged	1.1198*** (0.4267)	-	1.0603** (0.4870)	-
Merged 1	-	0.6724 (0.5113)	-	-
Merged 2	-	1.5811*** (0.5262)	-	1.1271** (0.4959)
Merged 3	-	1.1836** (0.1960)	-	0.6845** (0.2966)
Debt ratio	0.0024 (0.1960)	0.0088 (0.1960)	-	-
Financial leverage	-0.1169*** (0.0010)	-0.1168*** (0.0010)	-0.1167*** (0.0091)	-0.1166*** (0.0091)
Return on investment	0.0729 (0.3882)	0.0959 (0.3885)	-	-
Wages productivity	-0.00002 (0.0003)	-0.00002 (0.0003)	-	-
Employment coefficient	-0.2893 (0.3614)	-0.3018 (0.3614)	-	-
Real GDP growth	4.4464 (5.3934)	5.9644 (5.4875)	-	-
Company size M	0.6821 (0.4888)	0.6803 (0.4885)	0.6915 (0.4596)	-
Company size L	1.0841** (0.5004)	1.0893** (0.5002)	1.091** (0.5246)	0.6610* (0.3406)
Foreign ownership	0.7261* (0.3894)	0.7279* (0.3892)	0.6827*** (0.2551)	0.7225*** (0.2568)
Common intercept test (p-value)	*0.9546*	*0.9223*	-	-
Hausman test (p-value)	*0.9996*	*0.9994*	-	-
R^2	-	-	*0.9270*	

Source: own computations (robust standard errors in parenthesis; *, ** and *** denote the significance of coefficients at 10%, 5% and 1% significance levels respectively)

As a second step of our investigations, we have performed the estimates of the model for the returns on assets (see Table 2). Surprisingly, our results differ from those obtained by using the returns on equity as a proxy for the profitability. Unfortunately there is no possibility to use the results from the random effect model estimates. Hausman test of exogeneity concludes that random effect term is correlated with one or more explanatory variables. As a consequence, we have to use fixed effect model (pooled model is not appropriate regarding the results of common intercept tests). This method does not allow us to estimate the effect of time-invariant regressors. These effects are included in the company specific individual effect terms.

Compared to the model for returns on equity, the most influencing factor of the returns on assets is debt ratio. The explaining power of our dummy variables is insignificant excluding the effect of the merger in the first year after the merger. This effect is positive

but substantially smaller than those one obtained in the model for returns on equity. Very similar results hold for the variable ***Financial leverage*** (see Table 2, column 5).

Table 2 Models for return on assets (models without interaction terms)

	RE model 1	**RE model 2**	**FE model 1**	**FE model 2**
Constant	0.2983*** (0.0227)	0.3015*** (0.0228)	0.3208*** (0.0013)	0.3136*** (0.0033)
Merged	0.0063 (0.0124)	-	-	-
Merged 1	-	0.0186 (0.0148)	-	0.0280** (0.0114)
Merged 2	-	0.0062 (0.0152)	-	-
Merged 3	-	-0.0090 (0.0153)	-	-
Debt ratio	-0.4244*** (0.0067)	-0.4249*** (0.0067)	-0.4498*** (0.0030)	-0.4496*** (0.0030)
Financial leverage	0.00001 (0.00003)	0.00001 (0.00003)	-	0.00002* (0.00001)
Return on investment	0.0387*** (0.0137)	0.0373*** (0.0131)	-	-
Wages productivity	0.00001 (0.00001)	0.00001 (0.00001)	-	-
Employment coefficient	0.0112 (0.0137)	0.0118 (0.0137)	-	-
GDP growth	0.1813 (0.1696)	0.1239 (0.1730)	-	-
Company size M	-0.0798*** (0.0213)	-0.0798*** (0.0213)	-	-
Company size L	-0.0505** (0.0217)	-0.0507** (0.0218)	-	-
Foreign ownership	0.1021*** (0.0170)	0.1022*** (0.0170)	-	-
Common intercept test (p-value)	0.0000	0.0000	0.0000	0.0000
Hausman test (p-value)	0.0000	0.0000		
R^2	-	-	0.9810	0.9810

Source: own computations (robust standard errors in parenthesis; *, ** and *** denote the significance of coefficients at 10%, 5% and 1% significance levels respectively)

Table 3 and Table 4 show the final estimates of model specification with all possible interaction terms. In this way, we try to further enhance our previous results by incorporating specific marginal effects for various categories of analysed companies. The results in both tables suggest that including of interaction terms may play an important role in determining the factors standing behind the development of profitability.

Model for return on equity was estimated using the pooled model and the model for return on assets was treated as fixed effect model. These approaches are based on the results of standard diagnostic tests (common intercepts and exogeneity tests).

Table 3 shows that the merger influenced the effect of ***Total debt ratio*** and ***GDP growth***. GDP growth had negative influence on returns on equity in the year of merger. But, in the years after merger this effect was reversed. Debt ratio has positive effect on the return on equity in case of medium-sized companies (compared to the small and large companies) and companies with foreign ownership (in comparison with the

domestic companies). The development of the return on equity seems to be more systematically influenced by the financial leverage and the return on investment of the medium-sized companies. From this point of view, the signs of the corresponding effects may help to understand the reasons for merger of medium-sized companies (their profitability is more sensitive to the returns on investment, to the total debt ratio and less sensitive to the financial leverage).

Table 3 Pooled model for return on equity (model with interaction terms)

	coefficient	**std. error**	**p-value**
Constant	0.1647	0.0806	0.0413**
Debt * Merged	-0.4901	0.1839	0.0078***
GDP growth * Merged	11.4481	5.7017	0.0449**
Debt * Foreign ownership	0.5315	0.1711	0.0019***
GDP growth	-10.5942	5.9581	0.0756*
Debt * Company size M	0.7074	0.2051	0.0006***
Fin. leverage * Company size M	-0.1248	0.0003	0.0000***
Return on inv. * Company size M	0.4693	0.1910	0.0141**
R^2	*0.9897*	-	-

Source: own computations (robust standard errors in parenthesis; *, ** and *** denote the significance of coefficients at 10%, 5% and 1% significance levels respectively)

Table 4 describes the estimation results for the factors determining the return on assets. This kind of profitability is significantly explained by returns on investment (with positive sign) of all categories of investigated companies. In case of large-sized companies, this influence is relatively smaller in comparison to the small- and medium-sized companies (see the negative signs on variable ***Return on inv. * Company size L***). The marginal effect of financial leverage changes is similar for the medium-sized and large-sized companies and is thus larger than this effect for the small-sized companies (but this effect was not proved).

Table 4 FE model for return on assets (model with interaction terms)

	coefficient	**std. err**	**p-value**
Constant	0.1086	0.0118	0.0000***
Return on investment	0.1915	0.0642	0.0029***
Wages productivity	-0.000004	0.000002	0.0275**
Fin. leverage * Foreign ownership	-0.0021	0.0009	0.0164**
Debt * Company size M	-0.2683	0.0320	0.0000***
Fin. leverage * Company size M	0.0021	0.0009	0.0156**
Fin. leverage * Company size L	0.0021	0.0009	0.0165**
Return on inv. * Company size L	-0.1653	0.0648	0.0110**
Employment coeff. * Company size L	0.1716	0.0704	0.0149**
Debt * Merged	-0.0944	0.0216	0.0000***
Wages productivity * Merged	0.00002	0.000007	0.0071***
GDP growth * Merged	0.3521	0.1458	0.0160**
Foreign ownership * Merged	0.0493	0.0263	0.0607*
Common intercept test (p-value)	*0.0000*	-	-
R^2	*0.9957*	-	-

Source: own computations (robust standard errors in parenthesis; *, ** and *** denote the significance of coefficients at 10%, 5% and 1% significance levels respectively)

The returns on assets are significantly connected with total debt ratio, wages productivity, real GDP growth and foreign ownership in the years after the merger. In case of total debt ratio it means that the merger lowered the influence of this indicator on return on assets. On the other hand, merged companies with foreign ownership increased the return on assets (see positive coefficient of variable ***Foreign ownership ****

Merged) and they are able to get more profit from the economic growth (positive sign of variable ***GDP growth * Merged***).

4 Conclusions

Our results show that the development of profitability of merged Czech companies was influenced by factors related to the period after the merger, GDP growth, size of the companies (measured by the total amount of assets of merged companies) and by the main financial indicators. Revealed factors vary according to the chosen indicator of profitability. The process of merging was proved to be significant for the development of profitability especially when measured by returns on equity. Comparing the year of merger and the year after it, it was shown that the marginal effect of merging was positive and directly related to the profitability. In case of returns on assets we have observed significant tendencies of negative sensitivity changes of these returns on total debt ratio. In this way, the total debt ratio has diminishing effect on the profitability after completing the merger.

Surprisingly, the growth of real GDP does not influence directly the profitability. But, the returns on equity and assets are positively related to the GDP changes after the merger. Foreign ownership is an important profitability factor as well. It seems, that returns on equity of foreign merged companies are more sensitive to the debt ratio. This positive sensitivity is reversed in the periods after the merger. Foreign ownership is more important in case of the return on assets where domestic companies tend to have lower profitability after the merger than similar companies with foreign ownership.

Obtained results suggest the relevance of the size of assets in a way where medium-sized and large-sized companies showed significant differences in the influence of the key financial indicators in comparison with the small-sized companies.

Our preliminary results are encouraging for the further research in this area. It may be of great concern to investigate the factors which may influence the probability of positive profitability changes including the lag length (related to the year of merger) and all other qualitative and quantitative factors included in our paper. Other interesting enhancement of our study will be to control the influence of the particular sectors of business activity of the analysed companies.

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Act no. 125/2008 Coll., on transformations of trading companies and cooperatives.

Assessing the Consequences of Global Financial Crisis in the System of Credit Risks Insurance

Eva Vávrová

Mendel University in Brno
Faculty of Business and Economics, Department of Finance
Zemědělská 1, 61300 Brno, Czech Republic
E-mail: vavrova@mendelu.cz

Abstract: *Considering the global financial crisis, the paper highlights the importance of the export credit insurance provided both on a commercial basis and with the state support. The main scientific objective of this paper is to analyse the export credit insurance on the Czech insurance market including the assessment of ECA's activities for the selected time period with respect to the changes in the territorial structure and the volume of insurance exposure. At first, the method of description is used to define risks in exports of goods and services. The paper deals with the market penetration of export credit insurance, changes of the market structure and also with defining the largest credit insurance companies operating in this specific market including the determination of their market share. It analyses the development of the volume of insured exports and risk exposure. The analysis of the development of the Czech credit insurance market is concentrated to the insurance companies EGAP and KUPEG, whose market share together is 84%. This method allows to divide the analysis for the short-term insurance (KUPEG) and medium- and long-term insurance (EGAP). Finally, the paper focuses on actions taken in the connection with the consequences of the global crisis.*

Keywords: credit risks insurance, export credit agency (ECA), market share, risk exposure, financial crisis

JEL codes: G22, F36

1 Introduction

The main objective of this paper is to analyse the export credit insurance on the Czech insurance market including the assessment of ECA's activities for the selected time period with respect to the changes in the territorial structure and the volume of insurance exposure. The paper deals with the market penetration of export credit insurance, changes of the market structure and also with defining the largest credit insurance companies operating in this specific market including the determination of their market share. Furthermore, the paper analyses the development of the volume of insured exports and risk exposure.

The classification of the risks in the international trade is resulting of the coverage of the risks by credit insurance. There are two different types of risks which can endanger a payment of foreign claims: commercial risks and territorial / political risks.

The commercial risks are connected with the economic and financial situation of a foreign buyer. According to Böhm (2009), these situations can be influenced by the buyer. When paying for goods, an insolvency or a protracted default of a debtor are the most frequent. In case of the proved insolvency, the buyer is unable to pay its debts primarily due to a declaration of bankruptcy proceedings on the debtor's property or by reason of a composition agreement or out-of-court settlement between a foreign debtor and his creditors. The protracted default is reflected by a debtor refusing to pay his claim without any legal reason. The claim is not paid even after the expiration of its maturity date. In this case, a trade agreement or a trade contract is not accomplished due to a foreign buyer.

Territorial / political and other non-commercial risks are those ensueing from economic and political events and actions in a debtor's home country. Unlike commercial risks, the territorial risks are not a result of a foreign buyer‘s economic or financial situation. The

territorial risks endanger the maturity of exporters‘ foreign claims or decrease the rentability of the foreign investments. The debtor is unable to influence these risks, as they have the nature of vis maior. Political events that can affect contractual relationships subjected to a civil law can be taken as a territorial risk. According to Böhm (2009), the political events are:

- an annulment or a non-renewal of an export or import license or other already issued authorizations which are necessary for the realization of the contract,
- a war and other unrests in the country of a buyer which can affect the fulfillment of the contract,
- the risk of the transfer or conversion of payments to the exporter´s country (such as a moratorium on payments or an implementation of a foreign currency regime restricting the transfer of the money abroad),
- the risk of the transfer of payments from the third countries to the exporter´s country, i.e. measures preventing the realization of the contract or the transfer of payments to the exporter‘s country,
- a risk of natural disasters in a buyer‘s country,
- a failure to pay a claim by a public importer,
- an expropriation in a form of nationalization, confiscation or an expropriation of a foreign company without appropriate compensation provided by the government of a debtor‘s country or by the government of a country where the foreign investment is located. Government deprived the investor of fundamental rights associated with the investment for at least six months.

The classification of credit risks into commercial / territorial risks is not purposeless. It has a great significance for insurance purposes in a possibility to utilize the state support when insuring. Legal acts of the European Union focus on them and differentiate them into (Böhm, 2009):

- market hedgeable risks – marketable risks,
- market non-hedgeable risks – non-marketable risks.

Market non-hedgeable credit risks are usualy political, territorial and commerical risks which are caused by extraordinary situations in the country to which the export is implemented or from which the payment should be made or in case of an export to the third country.

2 Aim of the Paper, Methodology and Data

The main scientific objective of this paper is to analyse the export credit insurance on the Czech insurance market including the assessment of ECA's activities for the selected time period with respect to the changes in the territorial structure and the volume of insurance exposure. At first, the method of description is used to define risks in exports of goods and services. The paper deals with the market penetration of export credit insurance, changes of the market structure and also with defining the largest credit insurance companies operating in this specific market including the determination of their market share. According to Čejková, Martinovičová and Nečas (2011), the market share of an insurance company is defined as its share on the insurance market expressed in premiums written. Furthermore, the paper analyses the development of the volume of insured exports and risk exposure. The analysis of the development of the Czech credit insurance market is concentrated to the insurance companies EGAP and KUPEG, whose market share together is 84%. This method allows to divide the analysis for the short-term insurance (KUPEG) and medium- and long-term insurance (EGAP). The loss ratio is defined as the ratio of paid compensations to premiums written, after Ducháčková (2009). Finally, the paper focuses on actions taken in the connection with the consequences of the global crisis.

3 Results and Discussion

There are several forms of the export credit insurance at the insurance market which differ according to an insured credit maturity length, the character and the level of the risk. According to the length of the maturity we can distinguish short-term credit insurance, mid-term credit insurance and long-term credit insurance. Based on the type of an export credit insurance coverage Jus (2013) speaks about two basic groups:

- commercial based insurance,
- insurance with a state support.

The commercial credit insurance companies specialise in providing a short-term credit insurance (within two years) in market-insurable countries. The term commercial credit insurance arises from the fact that this type of insurance is offered on a commercial basis, i.e. without any state support. The offered export credit insurance deals with the debtors‘ risks as a consequence of their particular economic and financial situation. The commercial credit insurance is supported by market reinsurance and its market in the developed countries is considerably extensive. In a number of countries there are several competitive commercial credit insurance companies. On the basis of the EU and its member states‘ legislation, which enables commercial insurance companies to establish a branch and provide its services in any member state of the EU, the competition is not limited by national boundaries, and that means it is supranational (Baranoff, 2012).

The services of credit insurace companies also focuse on the prevention of an insolvency or a protracted default of customers, on monitoring of existing customers, they assist to gain a compensation in case of failure of payment and assist when enforcing claims. According to Jus (2013), the insurance companies provide informations to their clients about an existing or potential foreign customers‘ ability to pay. Furthermore, the credit insurance companies in comparison with the information agencies have a big advantage since they guarantee the level of the credit limit - in case of insurance event, the credit insurance company pays an indemnity. The fact that when enforcing claims the credit insurance companies share the costs connected with its enforcement up to 85 % can be taken as another advantage (Jus, 2013).

The purpose of state support provided with credit insurance is to enable the realization of export with a deferred maturity to countries where the risks connected with a business transaction are too big for an exporter or a bank to accept (Fabozzi, Neave, Zhou, 2012) and simultaneously, the risks are non-insurable or it is very difficult to insure them by private commercial insurance companies. States offer the support of export via institutions called export credit agencies (ECA). ECAs mainly insure mid-term and long-term export credits (i.e. more than two years) to the non-insurable countries. According to Böhm and Janatka (2004), the activity of ECAs is, when insuring long-term commercial and territorial risks, ensured by the state in the form of taking over warranties for their activity.

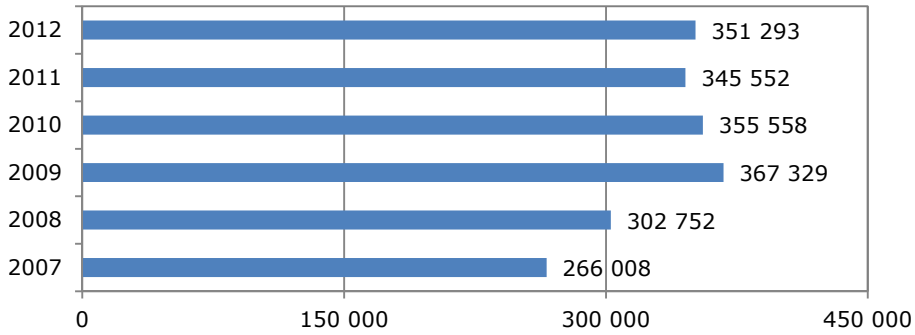
The role of ECAs is to insure, finance the export and provide the preferential rates under previously set conditions. ECAs work in order to benefit the export of individual states. For this reason, their main task is to help domestic exporters export goods and to help reduce risks and ensure favorable conditions for providing credits within the established rules (Zweifel, Eisen, 2012).

ECAs declare to be able to work independently without any direct state subsidy. However, due to the volatility on the world markets, the ECAs are subsidized by the state budgets, if necessary. Neverthless, most of ECAs endeavour to have a sustainable and balanced financing without the state subsidies. But in a short-term period it will not be possible for most of them to work without it (EEIP, 2011). ECAs are a part of the export credit insurance market in majority of developed countries. Despite the fact that there are different systems of financial support in individual countries, it is possible to identify the basic elements of export financing support which is similar in all countries. That is primarily support in a form of export credit insurance, the preferential rates, the

willingness to accept longer terms of credit maturity and providing diverse types of warranties and guarantees.

Figure 1 shows that there was a relatively large increase of bankruptcies in the last years all over the world. The largest amount of bankruptcies was monitored in 2009. There is a 40% growth in comparison with 2007 when the amount of bankruptcies was the lowest. Such a remarkable increase is connected with an impact of the financial and economic crisis. In 2010 and 2011, there is a gradual reduction (in 2010 the year-to-year reduction was 3,2%, in 2011 2,8%) which is subsequently interrupted by a slight increase (the year-to-year increase was 1,7%). The year-to-year growth of bankruptcies mostly in Europe (in 26 countries analysed by Euler Hermes) can be considered the primary source. The reason may be in persisting problems in the Eurozone together with the reduction of the GDP growth in the European Union. In comparison with Europe, the reduction of bankruptcies was recorded in 2012 mainly in America, South Africa, Asia and Pacific area.

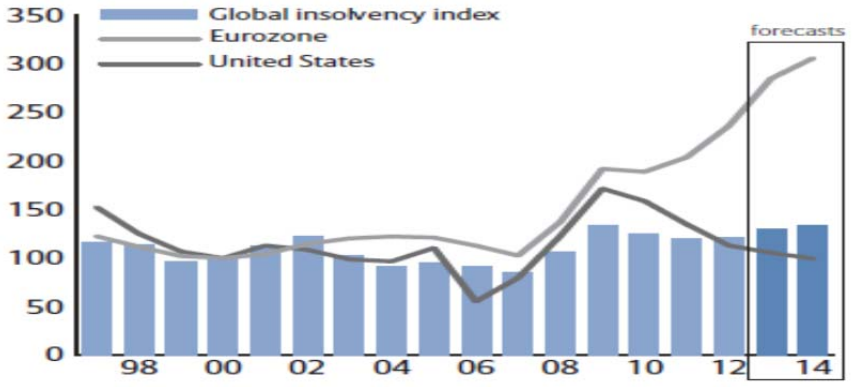
Figure 1 Development of company bankruptcies



Source: based on Euler Hermes (2013)

There is the development of an indicator „global insolvency index" shown in Fig. 2. Its calculation is based on the biggest world credit insurance company Euler Hermes' methodology. Besides the global insolvency index, there is also an insolvency indicator for the Eurozone and the United States and its prediction for 2013 and 2014.

Figure 2 Development of the global insolvency index



Source: Euler Hermes (2013)

As we can see, the european insolvency indicator had not detected any substantial fluctuation until 2008. Since that year, there is a large increase which continues in 2013 and 2014, also based on a Euler Hermes' predicition. The US insolvency indicator has stayed under the level of the Eurozone indicator since 2002, which implies that, for the last 10 years, the Eurozone area has been more predisposed to insolvency. The US insolvency indicator also went through an increase between the years 2006 and 2009. The decreasing real GDP growth in 2006 and 2007, the negative figures of the GDP

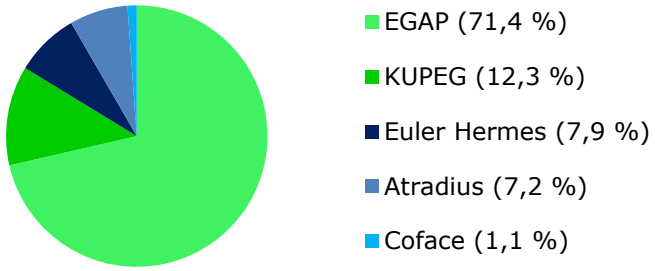
growth in 2008 and 2009 and an outbreak of the financial and economic crisis are presumable reasons for the growth of the US insolvency index. After 2009, there is a reduction of this indicator which is also predicated for the years 2013 and 2014.

Currently, there are several subjects specialising on the export credit insurance on the Czech insurance market. EGAP provides insurance with the state support. Considering commercial credit insurance, there are the 3 biggest world credit insurance companies which offer their services in the Czech Republic. According to Czech National Bank, these are:

- Euler Hermes Europe SA, organisational unit,
- Atradius Credit Insurace N. V., organisational unit,
- Coface, organisational unit Czech Republic.

The Czech commercial credit insurance company KUPEG competes with the foreign subjects. It is not possible to tell the current market share of the commercial credit insurance companies on the Czech market due to the unavailability of the data describing the amount of the premiums written. For this reason, it can be illustrated by the size of the achieved market shares in 2010 (see Fig. 3). However, it is presumable that there has been no significant change lately. EGAP can be considered the leader of the Czech credit insurance market, the second largest market share is that of the credit insurance company KUPEG. The companies Euler Hermes and Atradius have almost the same market shares on the Czech market. The market share of Coface is in comparison with the other companies relatively negligible.

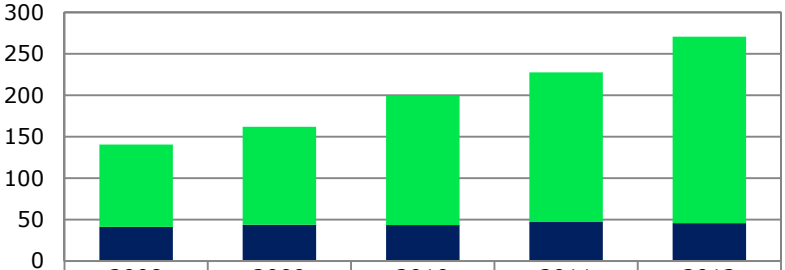
Figure 3 Market shares of the credit insurance companies in the CR in 2010 (in per cent)



Source: based on EGAP (2013), Veselý (2011)

The risk exposure connected with the Czech export achieves higher extent in the mid-term and long-term insurance (see Fig. 4). This follows from the nature of the functioning of ECAs, i.e. insuring such export credits that are impossible to insure on the commercial base due to higher risks. The high risk connected with the export credits insured by EGAP causes that the level of its risk exposure is two times or sometimes even three times higher than the volume of the insured export.

Figure 4 Risk exposure in the Czech Republic (bilions CZK)



	2008	2009	2010	2011	2012
EGAP	99,1	118,1	155,9	180,3	224,8
KUPEG	41,4	43,8	43,5	47,2	45,8

Source: based on EGAP (2013)

Table 1 indicates the percentage of the loss ratio. The level of the loss ratio is connected with the premiums written and paid compensations. In 2008, there was an insolvency growth of debtors due to an outbreak of the financial crisis. The EGAP loss ratio has not exceeded a limit 100% in contrast to the KUPEG loss ratio which exceeded the limit in 2009, 2010 and 2012. As a result, KUPEG has got into a substantial loss due to insuring foreign claims. It can be described as an economically unbalanced insurance. However, KUPEG fulfilled its task by supporting the Czech exporters when neither Czech nor the world's economy was doing well. During the analysed years, EGAP and KUPEG managed to recover a part of the unpayed insured claims. Because of that, the credit insurance companies were able to reduce their costs of compensations payed.

Table 1 Loss ratio of EGAP and KUPEG (in per cent)

	2008	**2009**	**2010**	**2011**	**2012**
KUPEG	48	181	165	62	116
EGAP	33	91	67	38	66

Source: based on EGAP (2013)

4 Conclusions

In comparison to the world insurance market, the Czech credit insurance market reaches a substantial level of penetration. Czech exporters can use the offer of domestic export credit insurance companies and also the offer of foreign subjects which have established their branches in the Czech Republic. Through the entry of the foreign insurance companies to the Czech export credit insurance market, the market can be considered as a highly competitive. It has the benefit of the pressure on insurers to reduce their insurance premium rates and to improve the level of provided services.

The global financial crisis was the first one that the Czech credit insurance market could experience. That may be the reason why the loss ratio was so high. In 2009, the loss ratio in the world was aproximately 88% for a short-term insurance, for a mid-term and long-term insurance it was 66%. In the Czech Republic, the loss ratio reached to 181% for a short-term insurance presented by KUPEG, for a mid-term and long-term insurance it reached to 91%. Higher loss ratio values were in the Czech Republic achieved even before the financial crisis – for a short-term insurance it was approximately 50%, for a mid-term and long-term insurance 33%. In the world credit insurance, the loss ratio was for a short-term insurance in the range 35-40%, for a mid-term and long-term insurance in the range of 29-35%.

When the crisis broke out and the claims for indemnification began to grow dramatically, commercial credit insurance companies all over the world were forced to tighten rules for new clients and even for existing clients when renewing contracts. According to Veselý (2011), the commercial credit insurance companies acceded to the following measures – a gradual projection of the higher risk to the price of insurance and a reduction of the risk exposure for certain territories or fields. It was necessary to take the actions because of an increasing demand for foreign commercial insurance claims due to worsening payment discipline and due to continuous deterioration in the risk environment. The risk exposures of commercial insurers have reduced by more than 25% all over the world (Veselý, 2011). This fact has also reflected in the development of credit limits associated with short-term insurance.

More authors evaluate measures adopted or drafted in response to the financial crises (Baranoff, 2012; Fabozzi, Neave, Zhou, 2012). Regarding the prediction of the development in the credit risks insurance, we can generally expect the most risky territories with ongoing war and civil unrest, such as Egypt, Iraq, Syria, or countries in imminent insolvency, for example Argentina. There will be a minimum space for the commercial credit insurance. Within the European Union, which includes more than 75% of the global volume of premiums paid for credit insurance, southern European countries belong to the worst payers, such as Portugal, Italy, Spain. Even the neighboring Poland

underwent significantly deteriorating development in 2013. Considering the future development of the credit risks insurance, we can agree with the statement of Jus (2013): Credit insurance does not guarantee safe trade and does not provide quality financial services only, but in addition to financial guarantee of a credit insurance company for indemnification of the loss sustained it also provides sometimes even more important services. Such outsourcing is cost-effective and insured companies can focus on their main activities, that is, product development, acquisition of new customers.

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Performance Measurement in the Public Sector

Jana Vodáková

University of Defence
Faculty of Economics and Management, Department of Economy
Kounicova 65, 621 00 Brno, Czech Republic
E-mail: jana.vodakova@unob.cz

Abstract: *This paper deals with performance measurement in the area of the public sector. Performance management is an important part of the public finance reforms and it is also referred as a crucial assumption of the stable public finances and effectiveness of the budget spending. The paper summarizes a current state of performance measurement in OECD countries. The main accent is put on government and the state administration. Preliminary findings suggest that OECD countries use various tools for performance evaluation. It also seems there exist significant differences among specific countries as to extent and methods of performance evaluation. The Czech Republic seems to be at very beginning from this point of view. On the other hand even countries that measure performance of the state administration organization regularly have no or little evidence of its positive impact on effectiveness of the public sector at present. Main reasons of this state may differ from country to country.*

Keywords: performance, performance measurement, state administration, public sector

JEL codes: H11, H70, H83

1 Introduction

A need of performance measurement was nowise urgent in the public sector until the late 80s of the 20th century. This period was characterized by relatively low indebtedness and institutional way of financing. The amount of aliquot budget resources was modified by indexation method and their evidence proceeded almost solely on the cash basis. Financial control lied in budget incomes and outcomes monitoring and legislative compliance mostly. Near the end of 80s the situation has started to change due to increase of indebtedness of the public sector and its relatively low performance. An attention aims to business sector and business-like tools and methods of management.

Initiatives connected with implementation of managerial tools to the area of the public sector are usually referred as the new public management. Hood (1991) commented this process in connection with public finance reforms among the firsts. He summarizes that the new public management means an attempt to introduce performance indicators to the public sector, to decrease expenses of the public sector activities and to improve its financial control in fact. Lynn (1998) introduces three possible beneficial impacts of the new public management initiatives on the organizations of the public sector:

- Strong accent on performance motivated administration and its implementation to the internal environment,
- International dialog and stronger comparative background for research of the public sector theories,
- Complex utilization of economic, sociological and other advanced conceptual models and procedures in the public sector practice.

Though the author considers some of these impacts, especially the third one, as partly controversial he states that both concepts of management, i.e. business and the public sector can be surprisingly similar in many aspects. In the course of 90s of the 20th century business-like methods and tools start to penetrate to the area of the public sector more intensively. Simultaneously a barrier of poor data sources has arisen. Traditionally accounting of the public sector was organized under the cash basis and its outputs represented mainly budget incomes and expenditures. However for the purposes of new public management also other data, for example expenses or long-term debts were needed. For that reason a change of accounting methodology became an inevitable

part of the public sector reforms and accounting data are prepared under the accrual basis mostly at present. As a consequence accounting outputs are comparable mutually and with the business entities and their transparency and information capability increases significantly (Vodáková, 2012).

Fist practical knowledge concerning implementation of the business-like tools to the public sector emerges around the turn of the century and it seems to be slightly inconsistent. Monro (2003) for example points out a discrepancy between former high expectations and present reality. The author proclaims that nevertheless considerable effort to set and utilize performance indicators their role is limited by indirect responsibility and other factors. Common managerial framework for organizations of the public sector examined also Martin and Jobin (2004) who proposed a cycle of several gradual steps for implementing of performance management to the public sector. Moynihan and Pandey (2005) reflect a relationship between management and performance and finally they maintain position that management is supposed as a crucial factor of performance improvement in the public sector organizations. But on the base of empirical data inquiry the authors observe that this assumption is conditioned by various external and internal factors. Fundamental external factors include a support of elected deputies, an influence of the public or media. An organizational culture, an emphasis on performance by way of clearly defined aims, and decentralization of authority can be mentioned as internal factors.

Present period can be characterized by systematic implementation of business-like methods not only to the performance measurement but to the strategic management of the public sector organizations generally. Also the role of performance audit changes significantly from former individual control of legislative and financial compliance to institutionalized performance evaluation. Relatively numerous group of authors (for example Sanger, 2012, Attila, 2011 or Saravia and Gomez, 2008) advocate that even increase of transparency and performance indicators utilization lead to performance improvement only rarely. On the other hand there are authors like Poister, Pasha and Edwards (2013) or Guo (2012) who on the base of empirical data proclaim that wider utilization of performance measurement techniques can contribute to increase of organizational performance. It is also evident that the situation differs across various parts of the public sector.

2 Methodology and Data

This paper deals with performance measurement in the area of the public sector. Its content is divided into four chapters. The first chapter introduces a brief review of a historic development of performance management in the public sector. The second chapter describes the aim of the paper, used scientific methods, limiting conditions and main data sources. The third chapter summarizes main findings of the paper and comments some questionable points. Principal conclusions are formulated in the fourth chapter finally.

The aim of the paper is to find out a real situation in performance measurement of the public sector organizations. The most important research questions are following:

- Do the public sector organizations develop any kind of performance data?
- Do they use these data for managerial purposes and do conclude any consequences from them?

Description, analysis, comparison and synthesis were used as basic scientific methods in the paper. With respect to a considerable extent of the public sector the paper is limited to the state administration observation only. There are several reasons for this decision. The first one lies in importance of the state administration as a significant user and redistributor of budgetary sources. The second is connected with our preliminary findings and hypothesis that the state administration may be more resistant to performance measurement implementation than other parts of the public sector such as municipalities. Further limiting condition concerns the scope of compared countries which

includes the Organization for Economic Co-operation and Development (OECD) member countries.

As main data sources scientific papers relating to performance measurement were used for review of historical development. Further OECD statistics and research data were gathered, analyzed and summarized for the purposes of the third chapter.

3 Results and Discussion

As implies from the table 1 only two OECD member countries i.e. Belgium and the Czech Republic (6.7 %) declare they did not elaborate any kind of information to evaluate non-financial performance of the state administration in 2007 and 2008. To the contrary vast majority of OECD countries prepared more than one kind of such information, mostly performance targets, performance measures and evaluation reports.

Table 1 Types of Performance Information Produced

Country	None	Performance targets	Performance measures	Evaluation reports	Benchmarking	Other
Australia		x	x	x	x	
Austria		x	x	x		
Belgium	x					
Canada		x	x	x	x	
Czech Republic	x					
Denmark		x	x	x	x	
Finland		x	x	x	x	x
France		x	x	x		
Germany			x	x	x	
Greece		x				
Hungary			x	x		
Iceland			x	x		
Ireland		x	x	x		
Italy		x	x	x		
Japan		x	x	x		
Luxembourg				x		
Mexico		x	x	x	x	
Netherlands		x	x	x	x	
New Zealand		x	x	x		
Norway		x	x	x	x	
Poland		x	x	x		
Portugal						x
Slovak Republic				x		
Korea		x	x	x		
Spain			x	x		
Sweden		x	x	x	x	
Switzerland		x	x	x		
Turkey		x	x			
United Kingdom		x	x	x		
United States		x	x	x		x
Total	2	21	24	25	9	3

Source: own, based on OECD data (2008)

Four countries (13.3 %) i.e. Greece, Luxembourg, Portugal and Slovak Republic elaborated only one type of performance information. Other four countries (Hungary, Island, Spain and Turkey) worked out two types of performance information introduced in the table 1. Majority of 11 countries (36.7 %) creates simultaneously three types of performance information, 8 countries (26.7 %) four types and one country (Finland, i.e. 3.3 % of total) even five types of performance information.

The most frequently (in 25 cases, i.e. 83.3 %) evaluation reports were used for monitoring of the state administration performance. Also performance measures were used very often (in 24 cases, i.e. 80 %) or performance targets (21 countries, i.e. 70 % of total.) 9 countries (30 %) used benchmarking for evaluation purposes, i.e. Australia, Canada, Denmark, Finland, Germany, Mexico, Netherlands, Norway, and Sweden. Three countries (Finland, Portugal and the United states) then used also other types of performance information.

Table 2 Consequences in the Case of Failure to Meet Performance Targets

Consequence of failure to meet performance targets and its probability		Number of countries	Number of countries in %
Program elimination	Almost never (0-20%)	14	46.7
	Rarely (21-40%)	3	10.0
	Sometimes (41-60%)	3	10.0
	Often (61-80%)		
	Almost always (81-100)		
	Missing answer	10	33.3
More intense monitoring	Almost never (0-20%)	3	10.0
	Rarely (21-40%)	3	10.0
	Sometimes (41-60%)	6	20.0
	Often (61-80%)	5	16.7
	Almost always (81-100)	5	16.7
	Missing answer	8	26.7
Negative consequences for the size of the budget	Almost never (0-20%)	8	26.7
	Rarely (21-40%)	5	16.7
	Sometimes (41-60%)	4	13.3
	Often (61-80%)		
	Almost always (81-100)	1	3.3
	Missing answer	12	40.0
Negative consequences for the pay of the head of the organization	Almost never (0-20%)	13	43.3
	Rarely (21-40%)	2	6.7
	Sometimes (41-60%)		
	Often (61-80%)		
	Almost always (81-100)	2	6.7
	Missing answer	13	43.3
Negative consequences for future career of the head of the organization	Almost never (0-20%)	12	40.0
	Rarely (21-40%)	2	6.7
	Sometimes (41-60%)	2	6.7
	Often (61-80%)	1	3.3
	Almost always (81-100)	1	3.3
	Missing answer	12	40.0
Other consequences	Almost never (0-20%)	1	3.3
	Rarely (21-40%)		
	Sometimes (41-60%)		
	Often (61-80%)		
	Almost always (81-100)		
	Missing answer	29	96.7

Source: own, based on OECD data (2008)

The table 2 summarizes possible consequences if performance targets of the state administration activities and programs are not met. These possible consequences may include program elimination, its more intense monitoring, decrease of the size of the budget, reduction of the pay of the responsible persons, limitation of their future career possibilities and other. As implies from the data relatively high number of countries (nearly one third) did not answer at all in this case. Generally it seems that a probability of any negative consequences in connection with a failure to meet performance targets is relatively low with the exception of more intense monitoring of the activity or program. For example 14 OECD countries (46.7 %) confirm that almost never the program is eliminated while no country declares that it is eliminated often or almost always.

Similar findings are observed as far as other negative consequences. 8 countries (26.7 %) answered that budget cuts come almost never in the case of failure and according to 5 countries it comes (16.7 %) only rarely. As far as negative personal impacts findings seem to be even worse. 13 countries (43.3 %) announce that pay recourses occur almost never in the case of failure while the same number of countries did not answer at all. 12 countries (40 %) then think that also restriction on future carrier of responsible persons occur almost never. There are only two countries (Korea and Denmark) proclaiming that negative consequences happen almost always in relation to pay and one country (Korea) proclaiming that they happen almost always in relation to future carrier of a responsible person.

Probably the only more frequent consequence of a failure to meet performance targets is future more intense monitoring of a program or activity. 5 countries, i.e. Australia, Ireland, the Slovak Republic, Korea, and the United States even proclaim that this consequence is used almost always, i.e. in more than 80 % of cases of failure. Further 5 countries think this happen often (between 61 and 80 %). But still a high number of OECD member countries (8, i.e. 26.7 %) did not answer this question.

Main findings concerning possible consequences in the case of poor performance results are introduced in the table 3. It again seems that poor performance is not sufficient reason for program elimination. Anyway 13 countries (43.3 %) state that program elimination occurs almost never and further 4 countries (13.3 %) think it happens rarely. No country thinks it happen often or even almost always while 8 countries did not answer. Also negative impacts on the size of the budget are not noticeable. Only two countries (the Slovak Republic and Korea) claim they occur almost always.

Negative personal consequences are applied only occasionally in the case of poor performance. 15 countries (50 %) quote that pay restrictions occur almost never and 12 countries (40 %) not even answered. Also impacts on future carrier opportunities occur almost never (12 countries) while the same number of countries did not answer at all. Only one country (Korea) declares that poor performance results have almost always negative consequences on pay resources of heads of ministries or other responsible persons. Further one country (Finland) states that apart from more intense monitoring it uses also other impacts without any detailed specification.

It again comes true that the only more probable consequence of negative performance development seems to be more intense monitoring of a program or activity that 6 countries uses almost always and 5 countries often. There are also 6 countries (Belgium, Czech Republic, France, Hungary, Italy, and Portugal, i.e. 20 % of total) that did not comment any problem introduced in the table 3.

Analysis of OECD data implies that vast majority of OECD member countries prepared some kind of information to evaluate performance of the state administration in 2007 and 2008. Only Belgium and the Czech Republic declared they elaborated no performance data for this purpose. Mainly performance targets, performance measures and evaluation reports were prepared and monitored by majority of countries but some of them used even more tools such as benchmarking or others. From this point of view the Belgium and Czech Republic fell behind not only the other developed countries but also some developing countries in 2008. As for the Czech Republic the situation has

started to change slightly only in 2013 when the Government of the Czech Republic has introduced the system of key analytical indicators with the intention to evaluate performance of the state administration entities and to use indicators within the budget negotiation process.

Table 3 Consequences in the Case of Poor Performance

Consequence of poor performance and its probability		Number of countries	Number of countries in %
Program elimination	Almost never (0-20%)	13	43.3
	Rarely (21-40%)	4	13.3
	Sometimes (41-60%)	5	16.7
	Often (61-80%)		
	Almost always (81-100)		
	Missing answer	8	26.7
More intense monitoring	Almost never (0-20%)	2	6.7
	Rarely (21-40%)	2	6.7
	Sometimes (41-60%)	9	30.0
	Often (61-80%)	5	16.7
	Almost always (81-100)	6	20.0
	Missing answer	6	20.0
Negative consequences for the size of the budget	Almost never (0-20 %)	8	26.7
	Rarely (21-40%)	7	23.3
	Sometimes (41-60%)	3	10.0
	Often (61-80%)		
	Almost always (81-100)	2	6.7
	Missing answer	10	33.3
Negative consequences for the pay of the head of the organization	Almost never (0-20 %)	15	50.0
	Rarely (21-40%)	1	3.3
	Sometimes (41-60%)	1	3.3
	Often (61-80%)		
	Almost always (81-100)	1	3.3
	Missing answer	12	40.0
Negative consequences for future career of the head of the organization	Almost never (0-20 %)	12	40.0
	Rarely (21-40%)	4	13.3
	Sometimes (41-60%)	1	3.3
	Often (61-80%)		
	Almost always (81-100)	1	3.3
	Missing answer	12	40.0
Other consequences	Almost never (0-20 %)		
	Rarely (21-40%)		
	Sometimes (41-60%)		
	Often (61-80%)		
	Almost always (81-100)	1	3.3
	Missing answer	29	96.7

Source: own, based on OECD data (2008)

Research findings further suggest that even if countries create various kinds of performance information these data are not used during managerial process intensively. Practically the only probable negative consequence of failure to meet performance targets or poor performance seems to be more intense future monitoring. Almost never budget size is cut or responsible persons are affected by pay sanctions or restrains of their carrier opportunities. It seems that performance data are often recorded formally and they are used for managerial purposes only sporadically which confirms also some authors (for example Sanger, 2012). Barrett (2012) in this connection underlines the role of accountability and better setting and understanding of performance objectives. De

Vries (2010) further points out an importance of utilization of proper measurement methods.

4 Conclusions

The paper deals with performance measurement in the area of the public sector, more precisely in the state administration. On the base of its main findings it can be summarized that majority of OECD member countries prepare some kind of information for evaluation of the state administration performance. However these data are often prepared formally and do not serve decision-making purposes. Also negative consequences of failure to meet performance targets or low performance occur only rarely in the state administration. Reasons of this situation may be various among others an absence of accountability system, inconvenient performance aims or methods of performance measurement, political pressure, contradictory legislative or inconvenient internal environment.

The Czech state administration seems to be at very beginning as for performance measurement. Only in 2013 the Government of the Czech Republic has introduced several so called key performance indicators with the intention to evaluate performance of the state administration organizations. It is evident that these indicators and their utilization will need additional adjustment in future.

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Profitability Ratios in the Stock Selection Process on the Warsaw Stock Exchange. Analysis between 2001 and 2011.

Tomasz Węgrzyn

University of Economics in Katowice
Department of Applied Mathematics
Ul. 1 Maja 50, 40-287 Katowice, Poland
E-mail: tomasz.wegrzyn@ue.katowice.pl

Abstract: *The process of a portfolio optimisation is preceded by a stock selection. The article is concentrated on using the synthetic measure of development in the stock selection process. The synthetic measure of development proposed by Hellwig (Hellwig, 1968) is one of the methods of linear arrangement. It enables the classification of companies in relation to the set variables. In case of the paper the set variables are financial ratios. The purpose of the paper is to choose which set variables: financial ratios describing each area of company activity or profitability ratios should be used in order to point out stocks for the portfolio. Companies are divided into five quantile portfolios due to their position in the ranking that is constructed on the base of the synthetic measure of development. The synthetic measure of development is computed using given set variables. The author uses data of companies listed on the Warsaw Stock Exchange between 2001 and 2011. The rankings and portfolios are built separately for each year. As a result, it can be stated that the second portfolio of the ranking constructed on the base of all chosen financial ratios is better than any portfolio constructed on the base of profitability financial ratios.*

Keywords: financial ratios, stock selection, synthetic measure of development

JEL codes: C38, G11, G32

1 Introduction

A stock selection is an important part of a portfolio construction. There are many methods that allow to choose stocks and one of them is the method based on the synthetic measure of development. The synthetic measure of development was proposed by Hellwig (Hellwig, 1968). Tarczyński (Tarczyński, 1994) is the first one who proposed using the synthetic measure of development in order to construct securities portfolio on account of their financial strength. He introduced the notion of the TMAI that is Taxonomic Measure Attractiveness of Investment (Tarczyński, 2002). The possibility of using the TMAI was examined in details by Tarczyński (Tarczyński, 2002) and Łuniewska (Łuniewska, 2003). They use the chosen financial ratios as the set variables. Their results are in accordance with other researches that pointed out the accounting-based market anomalies (Subramanyam & Wild, 2009, p. 45).

Węgrzyn proposed to use financial ratios that describe each of four areas of a company activity as a set variables for the synthetic measure of development (Węgrzyn, 2013a). These four areas of companies activity are measured by profitability ratios, turnover ratios (asset utilisation and efficiency ratios), liquidity ratios, leverage ratios (capital structure and solvency ratios) (see Subramanyam & Wild, 2009; Bodie, Kane & Marcus, 2008). Węgrzyn also proposed to include dynamics of financial ratios measured by the relative growth rate (Węgrzyn, 2013b). Moreover, Węgrzyn studied if it is possible to select stocks for the portfolio using dynamics of profitability ratios and their nominal values instead of ratios and their dynamics that describe each area of companies' activity (Węgrzyn, 2013b).

The purpose of the article is to study if it is possible to use only profitability ratios in order to select stocks into portfolio, when the quantile portfolio is constructed on the base of the synthetic measure of development. Two sets of ratios are used and performances of constructed portfolios are compared. In the first set, there are financial ratios that are describing each of four areas of a company activity. Whereas in the

second set, there are profitability ratios. The synthetic measure of development is computed on the base of each set of variables separately. Then, companies are linear arranged by the value of the synthetic measure of development. As the result, companies are selected to one of five quantile portfolios by the position in the ranking. The structure of each quantile portfolio is not optimised. Performances of quantile portfolios are compared with the performance of well-diversified proportional portfolio that contains all analysed companies. The study is performed in the period between 2001 and 2011 for the companies listed on the Warsaw Stock Exchange in Poland.

The purpose of the article is not to construct optimal portfolios that lie on the efficient frontier. Such portfolios can be constructed on the base of Markowitz portfolio theory (Markowitz, 1952). Moreover, Sroczyńska-Baron point out the possibility of using the game theory in order to construct the optimal portfolio (Sroczyńska-Baron, 2013a; Sroczyńska-Baron, 2013b).

2 Synthetic Measure of Development

The synthetic measure of development is one of the methods of linear arrangement. It enables the classification of companies in relation to the set variables (Hellwig, 1968). In case of companies' analysing, the value of the synthetic measure of development points out the financial strength of companies (Tarczyński, 2002). The synthetic measure of development for a given company is computed as follows (Tarczyński, 2002):

$$TMAI_i = 1 - \frac{d_i}{d_0} \tag{1}$$

Where,

d_i – Euclidean distance between the company and the model object given by the formula:

$$d_i = \sqrt{\sum_{j=1}^{m} \frac{1}{m} \cdot \left(z_{ij} - z_{0j}\right)^2} \tag{2}$$

z_{ij} – value of the j^{th} variable for i^{th} company (after standardisation)

z_{0j} – value of the j^{th} variable for the model object:

$$z_{0j} = \max_{j=1}^{m}\left(z_{ij}\right) \tag{3}$$

d_0 – the norm that guarantees the value of TMAI between 0 and 1:

$$d_0 = \max\left(d_{0j}\right) \tag{4}$$

As it can be noticed from the equation (2), it is assumed that each financial ratio has the same weight in the synthetic measure of development.

Variables (financial ratios) are divided into stimulants and destimulants. Stimulants are those financial ratios for which an increase is assessed positively. Whereas destimulants are those financial ratios for which an increase is assessed negatively. Then variables (both stimulants and destimulants) are standardised.

3 Financial ratios

The following financial ratios are used:

A. Profitability ratios:

- ROE – return on equity (Jerzemowska, 2006),
- ROA – return on assets (Jerzemowska, 2006),
- ROS – return on sales (Jerzemowska, 2006),
- Mzbs – gross profit on sales (Jerzemowska, 2006),
- Mzop – operating profit on sales,

- Mzb – gross profit margin (Helfert, 2003),

B. Liquidity ratios:

- Wpb – current ratio (Jerzemowska, 2006 and Helfert, 2003),
- Wps – quick ratio (Jerzemowska, 2006 and Helfert, 2003),
- Wpp – acid test (Jerzemowska, 2006),
- RGS – operating cash flows on sales (Waśniewski & Skoczylas, 1996),
- RGZ – net profit on operating cash flows (Waśniewski & Skoczylas, 1996)

C. Asset turnover ratios (activity ratios or efficiency ratios):

- RA – asset turnover in days (Helfert, 2003),
- RNal – receivables conversion period (in days) (Jerzemowska, 2006),
- RZap – inventory conversion period (in days) (Jerzemowska, 2006),
- Cop – operating cycle (in days) ,
- RZob – payables conversion period (in days) (Jerzemowska, 2006),
- CKG – Cash Conversion Cycle (Jerzemowska, 2006),
- RMO – current assets turnover in days (Jerzemowska, 2006),

D. Financial leverage ratios (debt ratios):

- Szo – debt ratio (Waśniewski & Skoczylas, 2002),
- WPM – equity to fixed assets,
- WOZ – sum of depreciation and financial costs to net profit (Jerzemowska, 2006),
- WPZ – current liabilities to sum of annual interest expense and depreciation,

4 Data and Assumptions

In the study the nonfinancial companies that are listed on the WSE between 04.2001 and 04.2012 are included. They are included, in the end of March for a given year, in one of the following indexes: WIG20, mWIG40[1] or sWIG80[2]. From among such companies the following are excluded:

- banks, insurances companies and lease companies,
- companies included in the following sectors: finance or finance-other,
- companies for which there is no full financial statements for a previous year[3],
- companies that in balance (that is used in order to compute financial ratios) have negative value of the shareholders equity,
- companies that in the income statement (that is used in order to compute financial ratios) have value of revenues from sales equal to zero.

As the result in the consecutive years there are between 95 and 118 companies qualified for the study. The number of companies qualified for the study for a given year is shown in the Table 1.

For each company qualified for the study in a given year the financial ratios described in the section 3 are computed. In order to compute the financial ratios the financial statements for a previous year are used. It means that historical values of financial ratios are used. However, as Barczak points out, it is possible to forecast values of the financial statements using Grey Models (Barczak, 2013a; Barczak 2013b). As a result it is possible to achieve forecasted financial ratios.

The values of historical financial ratios are used to the construction of the synthetic measure of development. Two synthetic measures of development are computed, the first one (called TMAI) is computed on the base of all financial ratios presented in the section 3. The second one (called TMAI_P) is computed on the base of profitability ratios that are presented in the section 3 A.

[1] If there was not an index mWIG40 then an index midWIG is used.
[2] If there was not an index sWIG80 then an index WIRR is used.
[3] In the study are used financial statements from the following data bases prepared by the Notoria Serwis: 1(39)/2003, 3(45)/2004, version 18.30 may 2010, version 20.50 march 2012.

Table 1 The number of companies qualified for the study in the consecutive years

Year	Number of companies
2001	96
2002	95
2003	97
2004	102
2005	108
2006	105
2007	106
2008	113
2009	117
2010	118
2011	116

Source: Own study

Each synthetic measure of development is used in order to conduct a linear arrangement of the companies separately for each year. In case of the first one the ranking is called TMAI. While in case of the second one it is called TMAI_P. The position of the company in each ranking separately allows to assign it into one of five quantile portfolios in the following way:

- into the first portfolio, 20% of companies with the highest position are put,
- into the second portfolio, next 20% of companies with the highest position are put that are not included in the first portfolio,
- into the third portfolio, next 20% of companies with the highest position are put that are not included in the first or second portfolio,
- into the fourth portfolio, next 20% of companies with the highest position are put that are not included in the first or second or third portfolio,
- into the fifth portfolio, remaining companies are put.

As the result five equipotent portfolios for each ranking are constructed. Each portfolio is bought during the last session in the first week of April a given year and sold during the last session in the first week of April a next year. In each company 10,000 PLN is invested, quantity of stocks is rounded down to integer. The quantity of stocks is constant during the investment period.

In the study the financial companies like banks, insurance companies and lease companies are not included. As the result, the WIG index or any other index cannot be a benchmark. The benchmark portfolio is constructed like other portfolios. In the benchmark portfolio all companies qualified for a study in the given year are included. In each company 10,000 PLN is invested, quantity of stocks is rounded down to integer. The quantity of stocks is constant during the investment period.

Assessment of each portfolio is done by:

- average geometric rate of return for an eleven-years-period of investment,
- cumulated rate of return,
- investment rate of return,
- a Sharpe ratio (Sharpe, 1966).

5 Results

In the Table 2 there are investment rates of return for each constructed portfolio between 2001 and 2011. In case of the TMAI ranking, the comparison of returns achieved by each portfolio with the return for the benchmark portfolio points out that the Portfolio 2 the most frequently gives the rate of return that is higher than the rate of return for the benchmark portfolio (that situation occurs 7 times during 11 years). Whereas, in case of the TMAI_P ranking that situation is for the Portfolio 2 (6 times during 11 years the Portfolio 2 gives higher rate of return than the benchmark portfolio).

When returns achieved by the Portfolio 2 of the TMAI ranking and the Portfolio 2 of the TMAI_P ranking are compared than it can be noticed that the Portfolio 2 of the TMAI_P ranking 6 times during 11 years gives higher rate of return than the Portfolio 2 of the TMAI ranking.

Table 2 Investment rate of return for constructed portfolios

	Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
	Benchmark portfolio	-13%	-6%	187%	16%	143%	82%	-28%	-55%	61%	7%	-23%
TMAI	Portfolio 1	-48%	-37%	**278%**	**25%**	123%	**106%**	-46%	-57%	42%	**28%**	-34%
TMAI	Portfolio 2	-26%	**-2%**	**193%**	8%	**343%**	**95%**	**-11%**	-57%	**83%**	**8%**	-27%
TMAI	Portfolio 3	**-6%**	-7%	148%	**26%**	88%	65%	**-26%**	**-54%**	**68%**	-7%	-30%
TMAI	Portfolio 4	**11%**	**7%**	**207%**	8%	67%	81%	-29%	**-54%**	52%	3%	**-16%**
TMAI	Portfolio 5	**5%**	**11%**	113%	12%	101%	64%	-29%	**-51%**	59%	4%	**-11%**
TMAI_P	Portfolio 1	-34%	-42%	**243%**	16%	**407%**	81%	**-19%**	-55%	47%	**28%**	-39%
TMAI_P	Portfolio 2	-21%	-19%	**230%**	**22%**	61%	79%	-31%	**-54%**	**75%**	**13%**	**-21%**
TMAI_P	Portfolio 3	-18%	**18%**	179%	**28%**	62%	**103%**	-31%	**-50%**	**67%**	-3%	-24%
TMAI_P	Portfolio 4	**-7%**	**2%**	**200%**	3%	86%	81%	**-26%**	-55%	57%	-8%	-23%
TMAI_P	Portfolio 5	**14%**	**13%**	87%	9%	107%	67%	-34%	-59%	57%	4%	**-11%**

Note: Bold font is used for values that are higher than they are for the benchmark portfolio.
Source: Own study

There are cumulated rates of return and geometric average rates of return in the Table 3. When geometric average rates are analysed then it can be noticed that the Portfolio 2 in the TMAI ranking gives the highest geometric average rate of return, that is 8.1 pp (percentage points) higher than the geometric average rate of return for the benchmark portfolio. As the result, the cumulated rate of return for the Portfolio 2 is more than 2 times higher than it is for the benchmark portfolio. While, in case of the TMAI_P ranking, the Portfolio 1 gives the highest geometric average rate of return, that is 1.1 pp higher than the geometric average for the benchmark portfolio. In case of the Portfolio 2 in the TMAI_P ranking, the geometric average rate of return is 3.5 pp lower than it is for the benchmark portfolio.

Table 3 Cumulated rate of return and geometric average rate of return

		TMAI					TMAI_P				
	Benchmark portfolio	Portfolio 1	Portfolio 2	Portfolio 3	Portfolio 4	Portfolio 5	Portfolio 1	Portfolio 2	Portfolio 3	Portfolio 4	Portfolio 5
Cumulated rate of return	519%	201%	**1094%**	313%	510%	463%	**581%**	374%	487%	368%	366%
Geometric average rate of return	16.2%	6.6%	**24.3%**	10.9%	16.0%	15.0%	**17.3%**	12.7%	15.5%	12.6%	12.5%

Note: Bold font is used for values that are higher than they are for the benchmark portfolio.
Source: Own study

There are Sharpe ratios for constructed portfolios in the Table 4. Analysis of Sharpe ratios for the benchmark portfolio points out that it has a positive value 6 out of 11 times. When the Portfolio 2 in the TMAI ranking (the most profitable one) is compared with the benchmark portfolio due to positive value of the Sharpe ratio, it can be noticed that the Portfolio 2 is better twice than the benchmark portfolio, while the benchmark portfolio is better four times than the Portfolio 2. Whereas the Portfolio 3 in the TMAI_P ranking is compared with the benchmark portfolio due to positive value of the Sharpe ratio, it can be noticed that the Portfolio 3 is better four times than the benchmark

portfolio, while the benchmark portfolio is better three times than the Portfolio 3 in the TMAI_P ranking.

Table 4 The Sharpe ratio for constructed portfolios.

	Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
	Benchmark portfolio	-2.1	-1.5	4.5	0.5	3.5	2.3	-1.4	-2.9	2.5	0.2	-1.5
TMAI	Portfolio 1	-4.1	-3.0	4.1	**0.7**	2.3	2.1	-1.8	**-2.7**	1.1	**1.1**	-1.9
TMAI	Portfolio 2	-2.6	**-0.7**	3.6	0.1	2.6	2.2	**-0.6**	-3.1	**3.1**	**0.2**	-1.5
TMAI	Portfolio 3	**-1.4**	**-1.4**	3.7	**1.0**	**3.6**	2.1	**-1.1**	**-2.7**	**2.6**	-0.8	-1.8
TMAI	Portfolio 4	**-0.3**	**-0.2**	4.1	0.1	2.7	2.0	-1.7	-2.9	2.3	-0.1	**-1.1**
TMAI	Portfolio 5	**-0.7**	**0.0**	3.2	0.4	2.9	1.8	-1.5	**-2.3**	2.3	-0.1	**-0.7**
TMAI_P	Portfolio 1	-2.9	-2.6	3.5	0.4	3.1	2.0	**-0.9**	**-2.4**	1.2	**1.1**	-2.2
TMAI_P	Portfolio 2	-2.8	-1.7	3.8	**0.7**	2.3	1.8	-1.4	-2.9	**2.9**	**0.5**	**-1.4**
TMAI_P	Portfolio 3	**-2.1**	**0.5**	4.3	**0.9**	2.8	**2.5**	**-1.3**	**-2.5**	**2.9**	-0.6	**-1.5**
TMAI_P	Portfolio 4	**-1.6**	**-0.6**	4.3	-0.1	**3.6**	1.8	-1.5	**-2.7**	2.2	-0.9	**-1.3**
TMAI_P	Portfolio 5	**-0.1**	**0.2**	2.6	0.2	3.2	2.0	-1.7	**-2.8**	2.5	0.0	**-0.7**

Note: Bold font is used for values that are higher than they are for the benchmark portfolio.
Source: Own study

The comparison of positive value of the Sharpe ratios for the Portfolio 2 in the TMAI ranking and the Portfolio 3 in the TMAI_P ranking points out that in case of 5 years it is higher for the Portfolio 3 in the TMAI_P ranking than it is for the Portfolio 2 in the TMAI ranking. The opposite situation is twice. It means that when the Sharpe ratio is maximized then the Portfolio 3 in the TMAI_P ranking should be chosen. This portfolio is better than any portfolio of TMAI ranking.

Conclusions

The article is an attempt to point out the set of financial ratios that should be used in the process of stock selection to the portfolio. Two sets of financial ratios are studied: all financial ratios (they are used in the construction of TMAI ranking) and profitability ratios (they are used in the construction of TMAI_P ranking). As the result, it can be stated that when returns are examined then the Portfolio 2 in the TMAI ranking is better than any other portfolio in the TMAI_P ranking. It means that when the investor is maximizing the return (for example the constructed portfolio will be mixed with the index portfolio) he or she should choose the Portfolio 2 in the TMAI ranking. As the result he or she should use all financial ratios. However, when the investor is maximizing the Sharpe ratio (for example the constructed portfolio will be complete portfolio) he or she should choose the Portfolio 3 in the TMAI_P ranking rather than the Portfolio 2 in the TMAI ranking. It means that he or she should use only profitability ratios instead of all financial ratios.

Węgrzyn (Węgrzyn, 2013b) studied the possibility of using dynamics of profitability ratios and their nominal values instead of financial ratios and their dynamics that describe each area of companies' activity. In the paper it is stated, that it is better to use all financial ratios and their dynamics than only profitability ratios and their dynamics. Comparing results of that two researches it can be stated that in case of profitability ratios it should not be used their dynamics.

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