

# Public Finance Balance of Smoking in the Czech Republic

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## Executive summary

**Based on up-to-date reliable data and consideration of all relevant contributing factors, the effect of smoking on the public finance balance in the Czech Republic in 1999 was positive, estimated at +5,815 mil. CZK.**

This report details the findings of a study commissioned by Philip Morris CR a.s. and undertaken by Arthur D. Little to quantify the effects of smoking on the public finance balance in the Czech Republic in 1999. The objective was to determine whether costs imposed on public finance by smokers are offset by tobacco-related tax contributions and external positive effects of smoking.

The study entailed analysis of data from scientific journals, reports by international and national health institutions, official statistics published by the Czech Statistical Office, data provided by the General Health Insurance Company and interviews with experts in health care, smoking, epidemiology and economics.

The results of the study show that the total public finance balance of smoking in the Czech Republic in 1999 was positive and amounted to +5,815 mil. CZK. This is a realistic estimate, which reflects the author's best professional opinion. The variety of expert opinion and input data put this estimate to the range of +1,347 mil. CZK to +13,650 mil. CZK. Our principal finding is that the negative financial effects of smoking (such as increased health care costs) are more than

offset by positive effects (such as excise tax and VAT collected on tobacco products). This conclusion would hold even if the indirect positive effects of smoking were neglected.

Public finance gained between 19,523 mil. CZK and 23,793 mil. CZK, with the realistic estimate of 20,270 mil. CZK, from smoking-related taxes. Public finance saved between 943 mil. CZK and 1,193 mil. CZK (realistic estimate: 1,193 mil. CZK) from reduced health-care costs, savings on pensions and housing costs for the elderly -- all related to the early mortality of smokers. Among the positive effects, excise tax, VAT and health care cost savings due to early mortality are the most important. Increased health-care costs, absenteeism-related social costs, lost income tax related to early mortality, and fire-induced costs total between 13,849 mil. CZK and 16,605 mil. CZK, with the realistic estimate totalling 15,647 mil. CZK. Our findings are summarized in Figure 1.

*Figure 1: The public finance balance of smoking in the Czech Republic in 1999 is estimated at +5,815 mil. CZK*

<b>Income and positive external effects</b>	<b>21,463 mil CZK</b>
Savings on housing for elderly	28, mil CZK
Pension & soc. expenses savings due to early mortality	196 mil CZK
Health care costs savings due to early mortality	968 mil CZK
Customs duty	354 mil CZK
Corporate income tax	747 mil CZK
VAT	3,521 mil CZK
Excise tax	15,648 mil CZK
<b>Smoking related public finance costs</b>	<b>15,647 mil CZK</b>
Fire induced costs	49 mil CZK
Lost income tax due to higher mortality	1,367 mil CZK
Days out of work related public finance costs	1,667 mil CZK
ETS related health care costs	1,142 mil CZK
Smoking (first hand) related health care costs	11,422 mil CZK
<b>NET BALANCE</b>	<b>+5,815 mil. CZK</b>

Results presented in the form of realistic estimates were verified by international comparisons

and through the use of alternative methods of quantification. Provided ranges reflect variety of expert opinion and input data from alternative sources.

## **Introduction**

### **Philip Morris CR a.s. commissioned this study to determine whether smoking imposes a financial burden on the public finance of the Czech Republic.**

Philip Morris is the world’s largest consumer packaged goods company operating in nearly 200 countries as a manufacturer of some of the world's top brands in food, beer and tobacco. Arthur D. Little is the world's oldest and one of the foremost management consulting firms, helping leading organizations world-wide create innovative strategies across the full spectrum of their activities.

Philip Morris CR a.s. asked Arthur D. Little to analyse the negative and positive effects of smoking on public finance in the Czech Republic for 1999. The results will indicate whether smoking imposes a financial burden on the public finance of the Czech Republic. Understanding the public finance implications of smoking is important in determining the fiscal and legislative policy applied to tobacco.

The study estimates only the public finance-related effects of smoking. These are effects that have traceable and significant impact on public finances. For the purpose of this study, public finance in the Czech Republic consists primarily of the national and municipal budgets and the budgets of health insurance companies. The study does not include private costs of smoking and thus does not consider all social effects of smoking. Therefore, the results of this study should not be interpreted as defining, and no judgement can be made as to whether smoking is good or bad from the standpoint of the individual or the society.

This study considers positive and negative effects of smoking on public finance, and includes both direct effects, for example, accrued taxes, and indirect effects, such as health care cost savings. Figure 2 illustrates the relationship among the effects taken into account in the study.

*Figure 2: The public finance balance of smoking comprises positive and negative effects with traceable and significant impact on public finance.*

### **Public Finance Balance of Smoking**

<b>Positive effects</b>		<b>Negative effects</b>
<b>Direct positive effects</b>	<b>Indirect positive effects</b>	
Excise tax	Health care cost savings	Increased health care costs
Value-added tax	Pensions savings	Lost income tax
Corporate income tax	Housing to elderly savings	Absenteeism related costs
Customs duty		Smoke-induced fire costs

The impact of smoking on public finance was assessed for 1999 only. The study thus provides a 1999 ‘snapshot’ and does not take into account the long-term dynamics of smoking phenomena, although we are aware that the time lag between smoking and its effects can be as long as 30 years, that the composition of cigarettes has changed; and that health care costs have increased significantly over the past decades.

In order to evaluate the balance, we took into account, on both the cost and benefit sides, only the portion of costs and benefits attributable to smoking. (Not all the health-care costs incurred by smokers are attributable to smoking and some of the smoking related tax income would be raised by comparable taxes on alternative forms of consumption.)

The overall result of the study is that negative financial effects of smoking are more than offset by direct and indirect (mainly direct) positive effects.

In the study we use the following assumptions:

1. Smoking poses a serious risk to the health of smokers.
2. Smoking can lead to a reduced life span of smokers.
3. Environmental tobacco smoke (second-hand smoking) may be harmful to the health of non-smokers.
4. Health-care in the Czech Republic is financed through a public, state-enforced health insurance system.
5. Taxes collected from tobacco producers and smokers (excise tax, VAT, corporate income tax, customs duties) contribute to the general-purpose government budget.
6. Average wage data is used in this study to calculate foregone income tax.

The remainder of the document is organized as follows. In Chapter 1 we describe the methodology applied in the study and present the results. In turn we quantify the positive direct and indirect effects and the negative effects. For each individual effect we provide a realistic estimate and a range. By realistic estimate we mean our best judgement, which we base on the most probable input data and on the most applicable calculation methods. The provided range, within which the estimate may vary, demonstrates the variability of opinion in the literature and the uncertainty and inaccuracy of the data. The lower and upper bounds of the range are the results of a combination of extreme opinions and values of contributing factors. We believe that it is very unlikely that any defensible approach could lead to a result outside this range. Chapter 2 discusses the reliability and robustness of our results by reviewing alternative approaches and verifying collected data by cross-checking.

## **1. Public finance balance of smoking in the Czech Republic – methodology and results**

**The realistic estimate of net effect of smoking on public finance in the Czech Republic in 1999 is +5,815 mil. CZK. The estimate can range between +1,347 mil. CZK and +13,650 mil. CZK. Tobacco related taxes and increased health-care costs are the most important**

### contributing factors.

In this chapter we describe and quantify the positive (direct and indirect) and negative effects of smoking on public finance and provide the methods of their quantification. Positive direct effects include excise tax, value-added tax, customs duties and corporate income tax; positive indirect effects are mortality-related health care, social and public housing costs savings. Negative effects are health-care costs attributable to smoking, health-care costs attributable to environmental tobacco smoke, early mortality-related lost income tax, absenteeism-related social benefits and costs of smoke-induced fires.

Figure 3: Budget income generated by smoking in the Czech Republic in 1999.

Effect description	Attributable to smoking-realistic climate	Attributable to smoking – minimum	Attributable to smoking - maximum (collected 1999)
Excise tax	15,647.9	15,647.9	15,647.9
Custom duties	354.4	354.4	354.4
VAT on excise tax and customs duties (22% of the above)	3,520.5	3,520.5	3,520.5
VAT on tobacco business activities	0.0	0.0	2,794.7
Corporate income tax	747.2	0.0	1,476.0
<b>Total budget income</b>	<b>20,269.9</b>	<b>19,522.7</b>	<b>23,793.4</b>

\*All values are in million CZK

Figure 4: Public finance balance of smoking in the Czech Republic in 1999.

Effect Description	Realistic estimate	Lower bound	Upper bound
Positive effects of smoking on public finance	21,462.6	20,465.4	24,986.1
<i>Budget income</i>	<i>20,269.9</i>	<i>19,522.7</i>	<i>23,793.4</i>
<i>Indirect positive effects</i>	<i>1,192.7</i>	<i>942.7</i>	<i>1,192.7</i>
Health care cost savings due to early mortality	968.4	775.3	968.4
Pension and social expense savings due to early mortality	196.3	146.5	196.3

Savings on housing for elderly	28.0	20.9	28.0
Negative effects of smoking on public finance	-15,647.2	-19,118.0	-11,335.7
<i>Health care costs attributable to smoking</i>	<i>-12,564.1</i>	<i>-13,820.5</i>	<i>-11,307.7</i>
Direct health care costs	-11,421.9	-12,564.1	-10,279.7
Health care costs due to ETS	-1,142.2	-1,256.4	-1,028.0
<i>Days out of work due to higher morbidity</i>	<i>-1,667.0</i>	<i>-2,420.4</i>	<i>0.0</i>
<i>Lost income tax due to early mortality</i>	<i>-1,367.0</i>	<i>-2,806.8</i>	<i>0.0</i>
<i>Fire induced costs</i>	<i>-49.1</i>	<i>-70.2</i>	<i>-28.0</i>
<b>Total balance of smoking in the Czech Repub. in 1999</b>	<b>5,815.4</b>	<b>1,347.4</b>	<b>13,650.4</b>

*\*All values are in million CZK*

The results presented above reflect our realistic estimate. The figure 5,815 mil CZK would be much higher if the taxes on tobacco products were fully included.

### **1.1. Positive effects on the balance of public finance**

**The realistic estimate of public finance gains is 21,463 mil. CZK, which can range from 20,465 mil. CZK to 24,986 mil. CZK. These gains consist of direct contribution of 20,270 mil. CZK from smoking related taxes and from savings through external effects of 1,193 mil. CZK.**

Direct income is generated by collecting value-added tax, excise tax and customs duties on tobacco products and corporate income tax collected from tobacco businesses. Indirect positive effects include savings in public health-care costs and state pensions due to early mortality of smokers, and savings on public costs related to the support of the elderly. Figure 5 shows the relative contribution in percentages of all (direct and indirect) positive effects.

*Figure 5: Excise and value-added taxes comprise the majority of smoking-related positive effects on public finance.*

Excise tax		72.9%	
VAT		16.4%	
Health care cost savings due to early mortality		4.5%	
Corporate income tax	<b>5,815.41,347.413,650.4</b>		3.5%
Custom duties		1.7%	
Pension and social expense savings due to early mortality		0.9%	

Savings on housing for elderly

0.1%

**Excise tax, value-added tax, customs duties and corporate income tax comprise direct public revenue from tobacco products.**

Based on information provided by the Ministry of Finance (Ministry of Finance, 2000), excise tax collected on tobacco products in the Czech Republic in 1999 was 15,648 mil. CZK. Data provided by the Customs Office of the Ministry of Finance (Customs Office, 2000) shows that customs duties collected on finished tobacco products and imported dried or pre-processed tobacco amounted in 1999 to 354 mil. CZK. Value-added tax

collected on tobacco products in 1999 amounted to 6,135 mil. CZK<sup>[1]</sup>. Of this amount we attribute 3,521 mil. to smoking. The remainder would, in the absence of cigarette smoking, be raised through VAT collection on alternative ways of consumption. Since VAT is calculated as a percentage of the value of goods including excise tax and customs duties, the difference – 22% of excise tax and customs duties collected on tobacco products – is our realistic estimate of tobacco contribution to VAT collected in 1999.

The estimated public finance contribution of attributable corporate income tax collected from tobacco businesses in the Czech Republic ranges between 0 and 1,476 mil. CZK, with our realistic estimate at 747 mil. CZK.

Tobacco businesses contributed 1,476 mil. CZK in corporate income taxes to the state budget in 1999 (calculation based on Philip Morris CR a.s. accounting data and market share). This is upper limit of our range of corporate income tax contribution. The lower bound of our range is put at zero, reflecting the hypothesis that the labour and capital, if employed in another industry, would generate a comparable level of profits and contribute comparable corporate taxes to the state budget. The tobacco industry in the Czech Republic in 1999 was one of the most profitable industries in the country and so paid more income tax than average business. We think that only the tax paid on above-normal profits should be included. We define above-normal profits as those that exceed the profits of the average company in the most profitable industry in the country other than tobacco. Tobacco companies in the Czech Republic in 1999 had an EBT/asset ratio of 35.42% compared to 18.21% for IT and office equipment. Nearly half, or 48.59%, of corporate tax paid by tobacco businesses thus comes from above-normal profits. Including this amount only, our realistic estimate of the public finance contribution of corporate income tax constitutes 747 mil. CZK.

Although the negative effects of consumption of tobacco purchased on the black market are included on the negative side of the balance (e.g. additional health care costs attributable to smoking) we do not consider the potential income from smuggled goods on the positive side because it does not directly relate to smoking but rather to the efficiency of tax collection.

**Public finance benefits from smoking indirectly, via mortality-related health care, pensions, and public housing costs savings.**

Mortality-related health-care costs savings range from 775 mil. CZK to 968 mil. CZK. The lower bound of this range reflects the average smoker's 4.30 years of lost life (as reported by Public

Expenditure Balance of Smoking in the Netherlands, 1997). The upper bound reflects 5.23 years lost by an average smoker based on data provided by (Lippiatt, B., 1990). This is also our realistic estimate.

Our calculations assumed average annual health care cost of 11,064 CZK per person (The Czech Statistical Office, 2000) and uniform distribution of deaths throughout the year. The present value of saved health-care cost per smoker is then calculated as half of the average yearly health-care costs for the first year, and present discounted value of further 4.73 years of average annual health care costs (reflecting 5.23 years of life lost for the average smoker). We increased health care costs by 10% each year to account for the general trend of ever increasing health care costs.

Mortality-related pensions savings range from 147 mil. CZK to 196 mil. CZK, with the realistic estimate at 196 mil. CZK.

This estimate is based on data obtained from the Czech Statistical Office and the Ministry of Labour and Social Affairs of the Czech Republic, as well as on the following assumptions:

- Average monthly old age pension of 5,724 CZK in the Czech Republic in 1999;
- Monthly insurance payments paid from the state budget for each pensioner of 419 CZK;
- 22,000 deaths due to tobacco smoking in the Czech Republic in 1999 (Peto, R., et al., 1994);
- 33% of smokers' deaths occurred during their productive ages; (this can be as high as 50% according to some sources)
- 3.1 of years of life are lost by smokers of pension age.

To compute the current value of future savings, we used a discount factor of 6.75%, which corresponds to the interest rate on state bonds that will mature in 2005. We calculated pension savings by multiplying the old age pension and insurance paid from the state budget per pensioner per year by the number of dead smokers of pension age in 1999. Assuming a uniform distribution of deaths of smokers throughout the year, we added 6 months of pension savings for the first year and the discounted value of the savings for the remaining of the 3.1 years [based on study (Lippiatt, B., 1990)].

The lower bound of the range uses the figure of 50% of smoker deaths occurring in the productive period (ages 20 to 64 for males and 20 to 59 for females) (Prabhat, J., Chaloupka, F.J., 1999). This figure is high compared with other sources (Public Expenditure Balance of Smoking in the Netherlands, 1997) where the figure of smokers deaths occurring in the productive age was 38%. The upper bound of the range is based on an estimate of 33% of smoker deaths in the productive period (Sachlova, 2000). This figure is also our realistic estimate.

Mortality-related elderly housing cost savings range from 21 mil. CZK to 28 mil. CZK, with the realistic estimate of 28 mil. CZK. The realistic estimate is based on data from the Czech Statistical Office, the Institute of Health Information and Statistics of the Czech Republic, and scientific literature. We assumed that in 1999, 1.7% of pensioners were in elderly housing; the annual subsidy per bed in elderly housing was 51,700 CZK; 22,000 deaths were due to tobacco



smoking; 33% of deaths were among people of productive ages; 3.1 years of life were lost by smokers of pension age; and we applied a discount factor of 6.75%. We calculated savings on housing for the elderly by multiplying cost per bed by number of deaths of pension-age smokers in 1999 by percentage of pensioners in old peoples' homes. This product was divided by 2 for the first year, to account for uniform distribution of deaths throughout the year. We then added the discounted value of the savings for the remaining of the 3.1 years. The lower bound uses the figure 50% of smokers in productive age (Prabhat, J., Chaloupka, F.J., 1999).

## 1.2. Negative effects of smoking on the public finance balance

**The realistic estimate of public finance losses attributable to smoking is 15,647 mil. CZK. Variety of expert opinion and input data put this estimate to the range of 11,336 mil. CZK to 19,118 mil. CZK. Increased health care cost, absenteeism-related social benefits, lost income tax and fire induced costs, all related to smoking, are the main contributing factors.**

The negative effects of smoking on public finance take the form of increased health care costs, the effects of early mortality, higher morbidity and smoking-related accidents. Health care costs attributable to smoking are the result of self-damage by (primary) smokers or damage caused to non-smokers (environmental tobacco smoke -- ETS). The former includes early mortality of smokers, worse state of health of smokers than non-smokers and fire damage caused by smokers' negligence. Fire-induced costs attributable to smoking are of small significance in the Czech Republic. Figure 6 shows the relative significance of the individual negative effects.

*Figure 6: Health care costs attributable to smoking and social benefits related to higher morbidity represent the majority of tobacco-related public finance costs*

Direct health care costs	73.0%
Social benefits related to higher morbidity	10.7%
Lost income tax due to early mortality	8.7%
Indirect health care costs	7.3%
Fire induced costs	0.3%

Health-care costs attributable to smoking – using the disease-based approach -- were 12,564 mil. CZK in 1999, consisting of direct health-care costs of 11,422 mil. CZK and indirect health care costs of 1,142 mil. CZK. Our realistic estimate of the impact of smoker absenteeism on public finance, derived from the data obtained from the Czech Statistical Office and the Institute of Health Information and Statistic of the Czech Republic, is 1,667 mil. CZK. Our realistic estimate of lost income tax due to the early mortality of smokers in CR in 1999 is 1,367 mil. CZK. Our realistic estimate of fire costs attributable to smoking is 49 mil. CZK.

### Health-care costs attributable to smoking

We distinguish between direct health-care costs -- damage to own health -- and indirect health-care costs -- damage caused by ETS. We used the disease-based approach to calculate direct health care costs. The estimate of the indirect health care costs is based on the comparison and

extrapolation of international data.

The disease-based approach, using detailed country-specific statistics of health care expenditure, has the potential to provide the most accurate estimate of the total health care expenditure attributable to smoking. The approach calculates the health care costs attributable to smoking by multiplying the total cost of treatment of each disease by the attributable risk factors that are, in turn estimated from relative risk factors. Relative risk factors quantify how much smoking affects the health of smokers relative to non-smokers. We do not take into account the fact that the costs of treatment of common diseases are higher in the case of smokers because of higher examination costs and longer treatment. We argue that these costs are not significant. This is supported by the fact that these costs were not quantified in earlier studies.

Since smoking risk factors for the Czech Republic were not available, we used those from western countries.

The disease-based approach, the method of choice in this context, was not applicable to the calculation of indirect health-care costs (the health-care costs related to ETS). We therefore estimated these costs by international comparisons and expert estimates.

The realistic estimate of direct health-care costs attributable to smoking in 1999, using the disease-based approach, is 11,422 mil. CZK, within the range of 10,280 mil. CZK to 12,564 mil. CZK. This range was obtained as +/- 10%, which is reasonable reflection of variance in reported values in the literature. Four subgroups of diseases were considered: neoplasm, cardiovascular diseases, respiratory diseases and diseases among children below 1 year of age. Within these categories, neoplasm of trachea, lung and bronchus; ischemic heart disease; pneumonia and influenza; and short gestation and low birth weight contributed the most to the total direct health-care costs of smoking.

The calculation of direct health care costs was based on the following formula. We used relative risks calculated for the US population from 1990 (JAMA 1993, 1994), as country specific data were not available for the Czech Republic. AR stands for attributable risk, P stands for proportion of the population by sex exposed to the risk factor, and RR stands for relative risk.

$$AR = \frac{P*(RR-1)}{P*(RR-1)+1}$$

This formula was also used in previous studies (Raynauld, A., Vidal, J.P., 1992). The attributable percentage was then multiplied by the total health care costs per disease, obtained from the General Health Insurance Company (VZP, 2000). While this total includes only data from VZP, it is representative since the VZP finances the treatment of 74% of the Czech population. In the following paragraphs the results are presented for the most important diseases.

The attributable percentages of the total costs of smoking-related diseases are listed in Figure 7.

*Figure 7: Much of the occurrence of diseases such as neoplasm of trachea, lung and bronchus, ischemic heart disease, pneumonia and influenza; and short gestation and low birth weight can be attributed to smoking*

	<b>Males %</b>	<b>Females %</b>
<b>Neoplasms</b>		
Lip, oral cavity, pharynx	91	52
Esophagus	72	69
Pancreas	30	23
Larynx	79	80
Trachea, lung, bronchus	89	2
Cervix uteri	--	21
Urinary bladder	43	27
Kidney, other urinary	44	9
<b>Cardiovascular diseases</b>		
Hypertensive diseases	26	14
Ischemic heart disease	42	32
Other heart diseases	26	14
Cerebrovascular diseases, aged 35-65	52	47
Cerebrovascular diseases, aged >66	26	11
Atherosclerosis	55	32
Aortic aneurysm	55	32
Other arterial diseases	55	32
<b>Respiratory diseases</b>		
Pneumonia and influenza	28	22
Bronchitis and emphysema	78	69
Chronic airways obstruction	78	69
Other respiratory diseases	28	22
<b>Diseases among infants (&lt;1 year of age)</b>		
Short gestation, low birth weight	16	16

Respiratory distress syndrome	16	16
Other respiratory conditions of newborn	16	16

*Based on: Cigarette Smoking - Attributable Mortality and Years of Potential Life Lost, USA 1990*

### **Neoplasm of trachea, lung and bronchus**

In 1999, 1,060 mil. CZK of the total 11,422 mil. CZK direct health care costs associated with the treatment of neoplasm could be attributed to smoking. The smoking-related costs of treatment of trachea, lung and bronchus amounted to 565 mil. CZK. Neoplasms are most closely associated with smoking, and smokers are 22.4 times more likely to suffer from them than non-smokers (Nelson, D.E., et al., 1994).

### **Ischemic heart disease**

The costs of treatment of cardiovascular diseases attributed to smoking were 7,854 mil. CZK in 1999. Of this total, ischemic heart disease costs were 5,027 mil. CZK. These were the highest smoking-related health care costs, mainly because ischemic heart disease is common in the Czech Republic, and the treatment is long (i.e. successful, improving greatly the survival rate of patients) and expensive (e.g. bypass operations). Smokers are only about 3 times more likely to suffer from this disease (Nelson, D.E., et al., 1994), which is not a big risk compared to the rate for the above mentioned cancer.

### **Pneumonia and influenza**

In 1999, 2,432 mil. CZK health care costs associated with respiratory diseases were attributable to smoking. This amount includes 553 mil. CZK for the treatment of pneumonia and influenza. These diseases are common among smokers and non-smokers alike, but usually do not require hospitalisation, and therefore the costs of treating them are not high. Smokers are only about 2 times more likely to suffer from these ailments, which is not a big risk compared to cancer (Nelson, D.E., et al., 1994). It also reflects the fact that there are other environmental factors that contribute to these diseases (car pollution, air pollution from burning coal, etc.).

### **Short gestation and low birth weight**

77 mil. CZK spent on diseases among children less than 1 year of age can be attributed to smoking. Short gestation and low birth weight associated with smoking cost 64 mil. CZK. While these costs are not significant compared to total direct health care costs, they must be accounted for due to the fact that smoking has an impact on children born to smoking mothers. The most obvious effect is low birth weight, which in serious cases leads to expensive treatment. (Nelson, D.E., et al., 1994).

### ***Indirect health-care costs attributable to smoking (ETS)***

Our estimate of health-care costs attributable to ETS in 1999, using international comparisons is 1,142 mil. CZK. We used an Australian study (Doran, Ch., Sanson-Fisher, R., 1996, and Rosa, J. J. 1996) in which ETS-related health care costs were 10% of direct smoking-related health care costs, and applied this percentage to our scenario. We provide a range of 1,028 mil. CZK to

1,256 mil. CZK, which reflects the spread in direct health care costs.

### **Days out of work due to higher morbidity of smokers**

The impact of absenteeism of smokers due to illness on public finance ranged between 0 and 2,420 mil. CZK in 1999, with realistic estimate of 1,667 mil. CZK. The lower bound reflects the findings of an earlier study (Raynauld, A., Vidal, J.P., 1992) and the fact that it has not been proven that smokers are more often out of work due to illness than are non-smokers. The higher bound is based on an estimated 6.5 days absent from work due to smoking (MacKenzie, T., et al., 1994), which was the highest outcome of the studies reviewed.

Our realistic calculation of 1,667 mil. CZK is based on data obtained from the Czech Statistical Office and the Institute of Health Information and Statistics of the Czech

Republic. This calculation used an average of 4.5 days out of work due to smoking (Ministry of Labour and Social Affairs, 2000); 2,237,000 smokers of productive age; a total of 19,118,553 days out of work due to illness in the Czech Republic in 1999; and total social benefits of 16,430 mil. CZK paid for illness in the Czech Republic in 1999.

We did not calculate any loss of corporate income tax because there is no consensus on whether smokers are less productive than non-smokers. It is also not clear whether such losses, if they exist, would be borne by the employer or whether they would also indirectly affect the public finance.

### **Lost income tax due to early mortality of smokers**

Our realistic estimate of lost income tax due to early mortality of smokers in the Czech Republic in 1999 is 1,367 mil. CZK. We provide the range of 0 to 2,807 mil. CZK, based on discounted effects of 1999 smoking-related deaths.

We calculated lost income tax by multiplying average yearly income tax and social and health payments of 86,800 CZK by 7,260 deaths of smokers in productive ages in 1999 and divided the total by two, based on our assumption of the uniform distribution of deaths of smokers throughout the year.

The lower bound of the range is based on the hypothesis that the vacant position would be filled immediately by an unemployed person. The 8.7% unemployment rate in 1999 (The Czech Statistical Office, 2000) supports this hypothesis. It could be argued that training will be necessary for the new employee, but in this circumstance, the state budget still saves money on social benefits paid to the unemployed. Therefore, it is reasonable to say that these effects cancel each other out, or that savings would exceed training costs.

We calculated the higher bound figure based on (Prabhat, J., Chaloupka, F.J., 1999), where 50% of deaths among smokers before pension age was mentioned and the loss of productive life was four years. The realistic estimate of lost income tax used 33% of deaths among smokers before pension (Sachlova, 2000) and estimated three years' average productive life lost.

### **Fire-induced costs**

The fire costs attributable to smoking range from 28 mil. CZK to 70 mil. CZK, with our realistic estimate at 49 mil. CZK. This estimate is based on data from the (Headquarters of the National Fire Fighting Service of the Ministry of Interior of the Czech Republic, 2000) on the causes of fires in the Czech Republic in 1999.

The range reflects the fact that 43% of all fire costs in 1999 were not assigned to a cause. The lower bound reflects only the direct costs of fires attributed to smoking, and the upper bound includes a share of costs from unassigned fires, based on the hypotheses that there would be double the incidence of smoking-related fires among non-assigned fires. The realistic estimate was made by taking share of costs of unassigned cases based on same incidence ratio of smoking related fires among all assigned cases of fires.

We do not take into account deaths and injuries caused by fires because the financial costs related to these were not material in the Czech Republic in 1999.

## **2. Reliability**

**The validity of the results is assured by critical review and assessment of all possible approaches and use of latest available data.**

The accuracy and reliability of an investigation of this type depends on the approach used for quantification and on the quality of input data. In this chapter we explain the logic behind our approach and describe our selection of methods of quantification. We also document the sources of the input data and discuss their accuracy.

Our approach is based on the following:

- Numerous contributing factors (phenomena with relevance to the subject of the study) were considered and those found to be most pertinent to the problem under consideration were taken into account and are discussed below.
- Alternative methods of quantification of these factors were analysed and their relevance and suitability to the Czech-specific situation were evaluated before selection was made.
- Input data for the calculations were collected from reliable sources and only the most up-to-date numbers were applied.
- Results were subjected to sanity checks and whenever possible alternative methods and international comparisons were used for cross-checking.

In this chapter, we first, in Section 2.1., explore in greater detail the selection of contributing factors and methods of their quantification, as used in this study. We document the development of our approach, discuss in detail contributing factors considered in the process and provide arguments for their inclusion or exclusion from the calculations. We also discuss alternative methods of quantification of some important factors, e.g. the health care costs attributable to smoking, justify our approach and illustrate the process of cross-checking of the results. In addition we provide an interpretation of the range within which the estimate may vary. In section 2. 2 we discuss the sources of input data.

## **2.1. Our approach, selection of contributing factors and quantification methods**

**Our approach is based on methodology widely used in the literature, which we further enhanced by careful consideration of additional contributing factors and more adequate methods of their quantification.**

We selected Public Expenditure Balance of Smoking in the Netherlands (1997), Raynauld and Vidal (1992), and Stoddart et al. (1986) as the most comprehensive of the relevant studies and used these as the basis of our approach to the quantification of the effects of smoking on public finance. All of these studies calculate health care costs using the same disease-based approach as is used in this report. The effects of smoking on the balance of public finance are in principle the same and independent of specific location. These studies therefore served as a basis for our approach. In addition, we endeavoured to make sure that the costs, as well as the revenues, were only included to the extent that they reflect a true comparison between a smoking and a non-smoking environment.

There are differences among the countries (tax system, system of social benefits, financing of health care, etc.), and the understanding of the health effects of smoking has developed over the recent years providing clearer and better quantifiable link between the habit and its effects. Some adaptation was necessary, therefore, to devise an approach applicable to the Czech Republic in 1999.

Raynauld and Vidal (1992) investigated the smoker's burden on society in Canada, taking into consideration external costs of smoking with emphasis on health care costs, costs of smokers' negligence, reductions in future health care costs and reduction in residential care facilities for the elderly. These external effects are more than outweighed by transfers in the form of taxes. This study is very comprehensive and discusses many possible implications of smoking on public finance. The conclusion of the study is that there was net transfer from smokers to non-smokers of 4.3 billion CAD in Canada in 1986.

Public Expenditure Balance of Smoking in the Netherlands (1997) analyses the public expenditure balance of smoking in the Netherlands. This study also provides a comprehensive review of methodologies employed in earlier studies. The main categories of costs and benefits for public finance are the same as in Raynauld, A., Vidal, J.P. (1992). This study also found the total net balance on public finance in the Netherlands was positive, 2,617 mil.NLG, based on high tax revenues from tobacco products.

Stoddart et al., (1986) estimates the publicly financed health care expenditure attributable to smoking for the Canadian province of Ontario in one year (1978) and compares this expenditure to the corresponding tobacco tax revenue. In the study health care expenditure is related to specific diseases or conditions attributable to smoking. A combination of epidemiological data and expenditures related to the treatment of these diseases is used to estimate total health care costs attributable to smoking.

Numerous studies focusing on particular problems (Carleton, R., et al., 1980), (Bell, C., 1996), (Nelson, D.E., et al., 1994), (Kozak, J.T., 1997), (Kukla, L., et al., 1999), (Zeise, L., et al., 1999), (Meltzer, E.O., 1994), (Skodova, Z., et al., 2000) related to the effects of smoking were reviewed, and their findings applied where appropriate. Field research and analysis of the Czech tobacco

industry, consumer behaviour, and other aspects led to further modifications.

When considering additional factors, or alternative methods of quantification, three criteria were applied to make the include/exclude decision:

- Relevance to the Czech-specific situation;
- Importance in terms of magnitude of contribution to the total balance or in terms of public perception;
- Method relies on most up-to-date or best quality/most reliable input data available for the Czech Republic.

In the following paragraphs we will discuss specific contribution factors and alternative methods of quantification, starting with those related to the quantification of positive direct and indirect effects and proceeding to those involved in the negative effects. This respects the order introduced in Chapter 1.

For each contribution factor under discussion we will clearly state whether it was included in the calculations and provide a logical argument supporting our decision. We do not limit ourselves to the discussion of the included factors as we seek to demonstrate that we have considered a variety of factors and went through a careful process of deciding which of them are appropriate and relevant for the subject under investigation.

Apart from the factors we will also discuss alternative methods of their quantification, which were considered for the use in our calculations. Again we will indicate the reasons for selecting any particular method. In some cases alternative methods were suitable for cross-checking of the results and this is also documented here.

On the positive side the contributions of the excise duty, value added tax and customs duties on tobacco were quantified based on the government statistics, which is believed to reflect the real situation relatively accurately. In the following paragraphs we discuss topics, which may affect the amount of income considered in the total balance and on which the opinion often differs.

In agreement with the literature (Public Expenditure Balance of Smoking in the Netherlands, 1997, Raynauld, A., Vidal, J.P., 1992, Stoddart, G., et al., 1986) we explore all significant effects, whether direct or indirect. For that reason we take into account also the indirect effects of the tobacco industry on public finance through the use of resources that could otherwise be employed by other industries. Similarly, we take into account the health care savings due to premature death of a smoker by quantifying only the health care costs in excess of the level typical for non-smokers, or the forgone income tax by quantifying the amount of tax a smoker would have paid should his life not be shortened because of smoking (this approach is the norm in the literature.) Applying this approach we need to consider that the labour and capital currently employed by tobacco industry could, if employed by other industries, produce returns taxed by VAT and corporate income tax. Or that the money currently spent on tobacco products would be taxed by VAT if spent on other goods.

Similarly, we did not include the income tax of employees of the tobacco industry as a public finance gain, based on the assumption that if not working within the tobacco industry, the same



workers would be employed elsewhere with comparable salaries, contributing similar amounts of income tax.

There are at least 600 substances other than tobacco included in the cigarette manufacturing process, for example, vanilla, menthol and sugar (Cervenkova, R., 2000). Although many of them are imported, the customs duties on cigarette additives were not included among the contributions. We argue that the amounts of those substances used by the tobacco industry and covered by customs or excise duties are so small that revenues are on an order of magnitude below the levels considered in the study.

All the components of the direct income of public finance are affected by smuggling of tobacco products. The potential income lost because of smuggling was not included in this study, however, as it does not directly relate to smoking but to the efficiency of tax collection. Even though we are aware of the fact that the negative effects of the consumption of smuggled cigarettes do affect the negative side of the balance, as increased health care costs and other effects.

Health care cost savings were calculated based on average health care costs in the Czech Republic in 1999. This is an approach similar to other studies on this subject, for example Doran, Ch., Sanson-Fisher, R., (1996), Public Expenditure Balance of Smoking in the Netherlands (1997), Rosa, J.J. (1994), Rosa, J.J. (1996). The health care cost savings are a result of premature death of smokers, based on the assumption that smokers would consume the same amount of health care as non-smokers in the years of life they lose because of smoking. In fact this is an underestimation as the typical health care costs of a smoker are higher than the average costs, as demonstrated in Section 1.2 in this study. In this respect it can also be argued that the savings are even higher as the shortening of life means a reduction of the number of old patients, whose treatment is more costly than average. We, however, did not quantify these additional savings because of the lack of demographic data related to mortality of smokers.

The values for the other variable involved in the quantification of the health care cost savings -- the number of years lost because of smoking -- varies in different studies Public Expenditure Balance of Smoking in the Netherlands (1997), Lippiatt, B. (1990), Barendregt, J.J., et al. (1997). These differences are due to country specifics and other factors mainly stemming from the selection of the population sample. Due to the unavailability of any research in the Czech Republic we used the estimates from study Lippiatt, B., (1990) and weighted them by population of the Czech Republic in the respective age groups, which we believe is the best customisation of the benchmark to the situation in the Czech Republic.

Savings on pensions and housing for elderly were calculated based on the same principles as used for savings on the health care costs. Inclusion of these indirect positive effects is supported by most studies in this area, including Public Expenditure Balance of Smoking in the Netherlands (1997), Raynauld, A., Vidal, J.P. (1992), Rosa, J.J. (1994), Rosa, J.J. (1996).

In calculating savings in pensions and housing for the elderly, we considered that the saving of a smoker dying prematurely arises in the year of death. However, this is only one part of the positive effect. The other constitutes the years the smoker would live had she/he not smoked. The smoker's life is shortened by several years, and the savings will therefore influence the public finance balance of smoking in future years. There are two alternative methods of quantification

of these savings. The first calculates the current year's savings as related to the deaths of smokers who died prematurely in the past and who would have lived in the current year had they not smoked. The second method takes into account all premature deaths that occurred in the current year and discounts the effect these premature deaths will have in the future.

We used the second method because of the availability of data and because the premature deaths are linked to the year in which they occur and this makes the calculation easier. However, would one decide to use the alternative method, the outcome should not significantly depart from our calculation since patterns of smoking and the health effects do not change significantly over a period of 4 to 6 years (typical period for which we discount future costs and future savings).

Saving on social benefits and compulsory health insurance contributions paid by the state to the health insurance system on behalf of those without regular income (pre-or post-productive age groups, i.e. children, youth, elderly, and unemployed) are part of the unemployment benefits or pensions. We did not include these two factors as these contributions are included in the pension and social savings due to early mortality of smokers, and therefore, their repeated inclusion would inflate the results of our calculations.

Also not included was all the public income for which the relationship to smoking is not direct. It comprises, among other factors: the taxes generated by tobacco advertising, the monetary benefits of tobacco retailing (such as corporate and income tax, additional employment), taxes on drugs used in the treatment of smoking-induced illnesses, monetary benefits of people quitting smoking, or the benefits related to the therapeutic use of tobacco.

Health care costs attributable to smoking are an important factor on the negative side of the balance. In the quantification of the health care expenditure we applied a disease-based approach, similar to (Stoddart, G., et al., 1986). We argue that this approach, using detailed country specific statistics of health care expenditure, has a potential to provide the most accurate estimate of the total health care expenditure attributable to smoking. Further given the fact that an alternative method of quantification, presented later in this chapter, provided comparable results we consider our estimate of the health care costs attributable to smoking as reasonable.

Quantification of health care costs using the disease-based approach depends on expert medical opinion and epidemiological data. We used our best judgement, based on extensive review of the relevant medical literature, and discussed the methods and the input data with experts in epidemiology, internal medicine and other medical sciences. In addition, we cross-checked the estimate of the health care costs attributable to smoking using an alternative top-down approach.

An alternative approach is based on the comparison between the total and smoking-attributable health care costs as reported in several countries (US, Canada, Netherlands). The results of this top-down approach yield a realistic estimate of the total health care cost attributable to smoking of 10,240 mil. CZK, within a range of 7,965 mil. CZK to 13,654 mil. CZK. The calculations are based on the results of 7 studies from the US (4), Canada (2) and the Netherlands (1), which give the fraction of the smoking attributable costs (relative to the total health care costs) in the range of 6% to 14%. We adjusted these results to the situation in the Czech Republic, taking into account differences in consumption levels of cigarettes, prevalence of smokers in Czech society, economic development of the Czech Republic compared to developed countries, and other factors that could have impact on differences between the data provided for other countries (US,

Canada, Netherlands) and the Czech Republic percentages on total health care costs.

We estimated the outcome for the Czech Republic at 9% of total health care costs based on the average of the benchmark studies of 9.8% lowered, to reflect the lower-cost health care system in the Czech Republic, and increased to factor in ETS impact, which was not accounted for in the studies used as a basis.

Health care expenditure also comprises the effects of passive smoking (ETS). Recent health research shows that there is a relationship between ETS and several diseases. The most recent and comprehensive study in this field (Bayard, S., et al., 1992) concluded, based on review of recent studies in the field of respiratory diseases, that ETS causes lung cancer, chronic airways obstruction, aggravation of asthma in asthmatic children and other respiratory diseases. The studies reviewed in this report showed however great differences in relative risks for individual diseases. The whole subject of ETS was also covered in (Environmental Health Perspectives Supplements 12/1999). We used an estimate to account for significant developments in this area based on (Doran, Ch., Sanson-Fisher, R., 1996 and Rosa, J.J., 1996). This study coped with the problem of increasing significance of ETS by using an estimated percentage of direct health care costs. As our expertise is not in medical field, we were not able to critically assess the relationship between ETS and specific diseases. Sufficient data for disease-based calculation of the effects of ETS on health care costs for the Czech Republic were also not available (e.g. prevalence of ETS).

Several recent studies (Penman, A., 1999), (Kopp, P., Fenoglio, P., 2000) argue that smoking-related productivity losses are an important factor on the negative side of the balance. These studies place an even higher value on productivity losses than on smoking-related health care costs. We did not include these losses in our calculations, however, for several reasons. First, even if there were such losses, these would be borne by employers, and these losses would affect public finance only indirectly. If such losses were significant, this would reflect in lower demand for smokers in the job market or in lower wage rates offered to smokers. As no such signs are evident in the Czech job market, we conclude that such losses are not significant.

Similar arguments, drawing similar conclusions, are presented in the literature (Raynauld, A., Vidal, J.P., 1992). We concede that productivity can be affected by frequent disruptions, but we hypothesise that smoking is in this context used by some people as an excuse for taking a break. The same people could easily substitute another excuse for a break, like having a coffee or a soft drink. Such productivity losses could not, therefore be attributed to smoking.

Many arguments are also found in the literature on the issue of lost income tax due to early mortality of smokers. Majority of studies in the field include the effect of lost income tax due to early mortality: (Doran, Ch., Sanson-Fisher, R., 1996), (Rosa, J.J., 1994), (Rosa, J.J., 1996). Lost income tax due to early mortality is not included in Raynauld, A., Vidal, J.P. (1992), based on the argument that smokers make an independent decision whether to smoke or not, and the loss of years of life is their personal loss. We included this factor in our calculations. We estimated the average years lost in productive age using data from the Czech Statistical Office and applying them to the research data from (Lippiatt, B., 1990). Our estimate is comparable to the values presented in other studies, e.g. Public Expenditure Balance of Smoking in the Netherlands (1997). We further introduce the argument of unemployed replacing those who die early. This leads to savings in social benefits paid to the unemployed and in costs of re-training. We argue

that these effects cancel each other out, and there is no loss of income tax due to early mortality of smokers.

Our review of materials distributed by anti-smoking organisations (Prabhat, J., Chaloupka, F. J., 1999) suggested that the additional cost of cleaning public places from cigarette pollution is perceived by the public as considerable. Nevertheless, we decided not to include this issue in the calculations. We argue that the majority of public places, such as public transport waiting areas, need to be cleaned regularly for reasons other than those related to smoking. It seems that the visibility of cigarette butts, rather than the other trash (which introduce higher hygiene risks than do the butts, e. g. dust) and strong anti-smoking feelings of the non-smoking public, which give the cleaning issue higher perceived importance. This view was confirmed in an interview with a representative of the Prague municipal authority, who stated that activities such as building work or of street kiosk vendors require far more attention and expense than the pollution caused by smokers. Further, the cleaning of a significant proportion of public areas, such as pavements adjacent to residential or office buildings, is the responsibility of private owners, who bear the related costs. This fact was confirmed in an interview with a representative of Prague City Council responsible for the city cleaning service. The conclusions that these costs are not real external costs are found in the literature (Raynauld, A., Vidal, J.P., 1992).

When considering fire-induced costs, we included in our calculations the damage related to fires registered in official statistics as caused by smokers and a proportional share of the fires without an established cause. We did not factor in the loss of life due to fires (19 deaths in 1999 [Headquarters of the National Fire Fighting Service of the Ministry of Interior of the Czech Republic, 2000]), as its effect on public finance, quantified similarly to losses attributed to higher mortality of smokers (loss of income tax etc.), is not significant. We also did not include any of the costs related to the maintenance of fire fighting force because its size is dictated by the need to cover territory rather than by the total number of fires. Also the capacity of the fire fighting force incorporates a certain redundancy mandated by the accidental nature of fires and the need to cope with all kinds of disasters.

We investigated several methods of quantifying the induced losses from smoking-related absenteeism. Only social security benefits were included in the final calculations. Loss of income tax was not included, as social security benefits are also subject to income tax. Although for many people social benefits are lower than their normal wage, and consequently the income tax they pay while on sick leave is lower, for other income groups, the benefits exceed their normal pay. The total balance is difficult to quantify, but it was assumed that the contradictory effects cancel out.

Deaths and material losses arising from car accidents caused by smoking were not included due to difficulties in attributing them directly to smoking. However, the negative effect of smokers' negligence while driving may be outweighed by accidents prevented from higher concentration induced by nicotine consumption. Doran, Ch. and Sanson-Fisher, R. (1996) also excluded these costs on grounds of distinct lack of empirical evidence in quantifying these costs.

Cost of anti-smoking campaigns is not included on the negative side as the majority of anti-smoking advertising (legally required warnings on billboards or cigarette packs) is financed by the tobacco producers rather than the state. The cost of other campaigns is immaterial in the

Czech Republic.

Loss of quality of life was not considered in our report, as it is out of scope of the study. Some studies provided methods for valuation of such losses (Jeanrenaud, C., et al., 1997).

Also not included were all factors for which the causal link to smoking is not direct. One such factor is the loss of purchasing power due to spending on cigarettes.

The results are provided in the form of a range, within which the estimate may vary if different input expert opinion and data from other sources were considered. The range demonstrates the variability of opinion in the literature and the uncertainty and inaccuracy of the data. The lower and upper bounds of the range are the results of a combination of extreme opinions and values of contributing factors. We believe that it is very unlikely that any defensible approach could lead to a result outside this range. The data accounts for 4,998 mil. CZK of the width of the provided range. By assuming that hypotheses used to compute realistic estimate are valid, the range reduces to 2,095 mil. CZK to 7,093 mil. CZK. This range stems mainly from the uncertainty of the estimate of the direct health care costs attributable to smoking and the uncertainty of the estimated value of lost income tax due to early mortality of smokers. These are in turn related to the uncertainty of the values of attributable risks of specific diseases and percentage of smokers who die in productive age.

## 2.2. Data

**The input data used in the calculations come from reliable sources and whenever possible they were verified through comparison or sanity checks.**

We collected data from respected scientific journals; from reports of international and national institutions; official Czech statistics; and from interviews with local experts. Our extensive literature search focused on the economic and medical consequences of smoking.

Articles in prominent medical journals, such as *The Lancet*, *Journal of American Medical Association*, *The New England Journal of Medicine*, *Canadian Medical Association Journal*, served as an important source of information. This was complemented by articles in the local medical journals and international magazines such as *The Economist*. In addition we also worked with specialised reports on the impact of smoking on human health published by international and national institutions like the World Health Organisation or the US Surgeon General. The use of such sources guarantees high standard of data applied in the calculations.

We used extensively demographic and epidemiological data from the official publications of the Czech Statistical Office, the Institute of Health Information and Statistics of the Czech Republic. In addition these institutions provided some more detailed data on our request. Quantification of the health care costs relies heavily on the information obtained on request from the General Insurance Company (Všeobecná zdravotní pojišťovna), whose records provides the most comprehensive picture of the health care expenses in the country. Specific information was also obtained directly from governmental bodies such as the Ministry of Finance or the Ministry of Interior.

We conducted seven face-to-face and over ten telephone interviews with experts. These were primarily medical professionals specialising in specific smoking-related diseases and

epidemiologists. This included epidemiologists from Charles University in Prague and Hradec Kralove, Masaryk University in Brno, National Institute of Public Health in Prague, internal medicine specialists from leading Czech hospitals, a toxicology specialist on drug abuse and its prevention, and a psychiatrist specialising in addiction related diseases. We also interviewed economists with extensive experience in health care economics and the role of the governmental bodies in the management of the resources dedicated to the health care system. Among these there was a former Minister of the Czech government, an economics professor specialising in problems of externalities, and a number of public officials. These interviews ensured a good understanding of the general situation, the overall effects of smoking, clarified local specifics and provided necessary expert opinion. Discussions with medical specialists confirmed the trends we researched in the literature and approved the similarity of findings between the Czech Republic and other countries.

Whenever possible the data were verified by comparing inputs from independent sources. For example: data on excise tax, VAT, customs duties obtained from the government statistics were compared with the data provided from accounting records held by Philip Morris CR a.s.; international benchmarks were used to verify Czech- specific input data applied in the quantification of the health care costs attributable to smoking.

Where data were not available, informed estimates were made based on thorough investigation of the literature, international benchmarks and on our professional judgement.

## **Glossary**

**Attributable risk** – portion of health risk attributable to smoking. It expresses quantitative relationship between smoking and health risk, given other factors influencing the occurrence of the disease are the same for smokers and non-smokers.

**Realistic estimate** – for the purposes of this report we define realistic estimate as an outcome of calculations performed by the authors using the most probable set of data and the most suitable methodology as created or adhered to by the authors.

**Discount factor** – discount factor introduces the time preference of money, 1 CZK obtained today is more valuable than 1 CZK obtained in future. The discount factor usually varies between 3 and 10% and represents the time preference of society. We use the discount factor of 6.75% in our study, which represents coupon rate of state bond maturing in 2005. We use this rate because the effects of smoking we consider usually do not last longer than 5 years into the future. This rate also falls in the generally used interval.

**ETS** – Environmental Tobacco Smoke – exposure to the tobacco smoke by non- smokers, mainly in family, public places such as restaurants and in the workplace. Although environmental tobacco smoke is diluted compared to that inhaled by active smokers, it is chemically similar, containing many of the same toxic agents, including carcinogens.

**External costs** – costs imposed by the smokers on third parties (e.g. part of the health care costs that fall on the whole society through the public health care system, environmental tobacco smoke related costs etc.).

**Internal costs** – private costs (see below).

**Morbidity** – a measure of how often a person is ill. Morbidity is different for smokers and non-smokers and is generally higher for smokers.

**Mortality** – states the number of deaths per certain cause of death. The mortality differs for non-smokers and smokers and is generally higher for smokers.

**Private costs** – costs borne by a smoker (price of cigarettes/tobacco, private losses caused by health problems related to smoking, including the loss of quality of life or suffering attributable to smoking).

**Public expenditure** – is used in this report interchangeably with the term ‘public finance.’

**Public finance** – all financial transfers enforced by the state, in particular the government budget, municipal budgets, and budgets of health insurance companies.

**Relative risk** – health risk of smokers relative to the health risk of non-smokers. This quantifies how much smoking affects the state of health of smokers relative to non-smokers due to their smoking habit. It excludes all other differences in behaviour or inherent factors that can lead to a certain disease besides smoking.

**Social costs of smoking** – total cost of smoking to the whole of society. Comprises private costs and external costs.

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[1] This is calculated as 22% (standard VAT rate) of total tobacco revenues (12,703 mil. CZK); excise tax (15,648 mil. CZK); and customs duties (354 mil. CZK).

