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University of Economics, Prague
Faculty of Finance and Accounting
Department o Public Finance

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Prologue

On April 15 and 16, 2016 the Department of Public Finance organized already the 21th international conference "Theoretical and Practical Aspects of Public Finance" with over 100 participants from the Czech Republic, Slovakia, Russia, Poland and Spain.

The conference took place for the first time in March 1995 and since then it gained a significant position among similar events in both the Czech Republic and Slovakia. It is first of all a scientific conference, but it is relevant for practitioners and policy makers as well. A joint workshop with the OpenBudget.eu project on Open Budget Data took place in the framework of the conference.

The number of participants in the last years is stable even when the number of similar conferences organized by other Czech universities is growing. The conference tries to offer enough space for young scholars including graduate students. The day before the conference starts there is organized a students´ competition. Participation of students at the conference is highly encouraged so that 15 out of 60 papers included in this proceedings are authored or co-authored by graduate or doctoral students. It is about the same number as in the previous two years which means that a new generation of scholars grows and that it is going to bring new research questions and new approaches into our discipline.

The focus of the papers presented during the conference shows that after a few years when the center of attention were the challenges in the area of public finance caused by the European debt crisis and the continued slow economic recovery, we are back in lets say normal times when the papers deal with broad range of topics.

The contributions were presented in three sessions: A - Tax Policy, B - Public Expenditure and C – Public finance and finance. This volume includes 60 papers from the conference out of the total of 71 submitted papers. All contributions and conference details are available at the web site of the conference at *http://kvf.vse.cz/vyzkum/konference-tpavf/*.

A third of the papers deals with the tax policy or tax system. The importance of the tax topics is caused by the weight taxes play in the political discussion and the frequency of tax law changes in the recent years. The remaining papers deal with a great variety of topics: Nine papers deal with old-age pensions and social and health care systems and five papers deal with public procurement, especially with the competition effect and keep confirming that the number of bidders matters. The rest of the papers touches other important topics such as local government finance or higher education.

Regarding the applied methodological approaches, we can see a positive trend as the number of empirical papers which apply modern econometric methods grows. At the same time there are papers which present original primary data or have clearly interdisciplinary roots.

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PART A – TAX POLICY

Tax of estimates for the Czech Republic - modeling with short time series

Ondřej Bayer*

Abstract. The aim of this paper is to describe problems of modeling tax revenues with relatively small number of observations. For test the issue were used data for the Czech Republic from 1997 to 2003 for construction of economic models with small time series. Models were created for the total tax revenue, tax on personal income, corporate income tax and value added tax. The method used for the creation of econometric models was multiple regression analysis. The paper is focused on dedscribing linear multiple regression analysis methodology with emphasis on the issue of statistical tests and theirs treatments for the small number of observations. The first section deals with the graphical analysis of selected variables. The second part is dedicated to the methodical description of the multiple regression analysis and evaluation of current statistical tests of the length of the input time series. The last section is devoted to the evaluation of models and a brief conclusion.
Keywords: Forecasting, regression analysis, tax revenue .
JEL Classification: H20

1 Introduction

Recently is quite common to create econometric models from relatively small data samples., I decided to describe issues related to the interpretation of such econometric model in this paper. Specifically, the aim of this paper is to analyze the issue of tax revenues modeling using linear regression analysis with a small number of observations. Tax revenue estimates are designed only for the Czech Republic between zears 1998 to 2013 for the tax on personal income tax, corporate income tax, value added tax and the total tax revenue.

In the context of the problem were used several sources. From the econometric point of view was mainly used publication Arlt and Arltová (2009), which describes the statistical tests. For the design and construction of models is also used publication Doornik and Hendry (2013), who are given the theoretical background and detailed guidelines for statistical modeling in OxMetrics. Generally, the issue of modeling also describes Jenkins et. al (2000). To select the right variables was taken from Bezděk and Stiller (2000), Klazar (2003) and Urrutia et al. (2015), which creates custom predictive models. The modeling of tax revenues during heavy exogenous shocks deals Romer and Romer (2007) and McBride (2012).

Paper itself is divided into several chapters. The first chapter is devoted to describing and graphical analysis of the selected response and explanatory variables together with a description of the chosen methodology and statistical tests, with special regard to possible distortion due to the relatively small number of observations. Within the framework of statistical tests is discussed use of individual tests with regard to their information value with a small number of observations. The second chapter deals with the design and evaluation of various econometric models. The last chapter is devoted to the final conclusion.

2 Data and methodology

The actual data were obtained from the OECD database (2016). To capture the issues of shorter time series has been selected period 1998-2013, ie 15 observations. The data itself was adapted for expression in the values of the US dollar to maintain data consistency. The author used in writing this paper data that has already been prepared for his dissertation.

Selected as response variables were chosen four tax revenues: total tax revenue (TOTAL), revenue from personal income tax (PIT) revenue from corporate tax (CIT) and revenue of value added tax (VAT).

Development of dependent variables looks like this:

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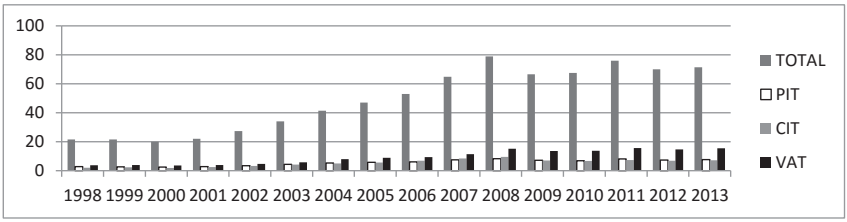
Figure 1: Tax revenues (bill. USD)



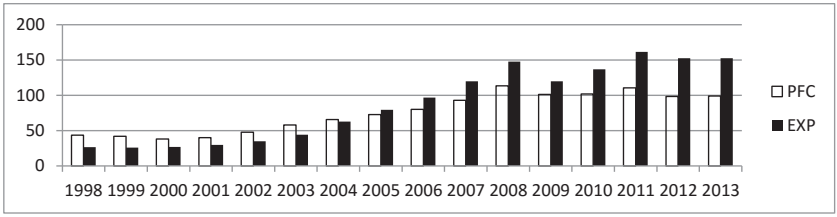
Source: Data OECD (2016) + own calculation

To save space, this chart was slightly modified. For all monitored taxes is a significant increase from 2001 to 2008. The arrival of economic crisis is indicated by a significant decrease of all monitored parameters in 2009. The consequences of the economic crisis are reflected in the following years with visible volatility. In terms of modeling, it is clear that due to the increased volatility in response variables will be difficult to construct high-quality predictive models.

As explanatory variables were chosen following indicators: final personal consumption (PFC), the volume of exports (EXP), total employment (TE) unemployment rate (UR), the proportion of self-employed (ROSE) and the average wage (AW). Although it is known that in the case of simple regression models is the best explanatory variable gross domestic product (GDP), so was rejected, because in case of multiple regression is very high risk of presence multicollinearity.

The volume of exports and final personal consumption should be sufficient compensation for the gross domestic product. Development itself is documented in the following graph:

Figure 2: Personal final consumption and volume of export (bill. USD)



Source: Data OECD (2016) + own calculation

These two explanatory variables also follow the similar trend as the response variable. In terms of their ability to inform on the progress of tax revenues is positive this development. On the other hand, increased volatility in the last five observations on the consequences of the crisis may indicate some problem of statistical significance. Private final consumption should be a good indicator for all monitored taxes, especially for the individual income tax and VAT. The volume of exports should be able to testify about the development of the corporate tax receipts.

The last groups of variables are variables that describe the labor market. Reason for this group is that the Czech Republic has relatively high labor taxation. Furthermore, these indicators tied to disposable income and thus might be able to describe and tax bases. Specific variable is the proportion of self-employed persons. This indicator should have the ability to describe possible tax evasion from independent activities. Indicator of the average salary is about the best possible indicator of disposable income.

Development itself is summarized in the following Table:

Table 1: Labor market variables

	TE	ROSE	UR	AW
1998	4.8233927	0.1391966	0.06495	4624.454
1999	4.7145579	0.1474582	0.0876	4571.7301
2000	4.6817131	0.1504577	0.0882	4375.935
2001	4.6852066	0.150495	0.08164	4750.3681
2002	4.7295008	0.1593403	0.07313	6023.7375
2003	4.7009583	0.1708162	0.07818	7524.922
2004	4.6916744	0.1653994	0.08321	8935.863
2005	4.7634991	0.1558308	0.07924	9979.7537
2006	4.828893	0.1563298	0.07142	11203.896
2007	4.9210837	0.1551081	0.05318	13220.76
2008	5.0006062	0.1518016	0.04393	16457.958
2009	4.9339965	0.1568708	0.06675	14849.291
2010	4.8839127	0.1649907	0.07275	15248.113
2011	4.8746215	0.1668437	0.06708	16884.733
2012	4.890741	0.1654759	0.06978	15519.961
2013	4.9374795	0.1590083	0.06949	15387.679

Source: Data OECD (2016) + own calculation

In the event of total employment (million inhabitants) are seen minor fluctuations around the positive trend from 2001 to 2008 and the subsequent fluctuations in the post-crisis period. The share of self-employed shows much higher volatility, when most people were self-employed in 2003 (17%). The unemployment rate follows slightly volatile trend in total employment. Average salary (USD per year) also proves its largest increase between 2007 and 2008 and the subsequent post-crisis development is also volatile.

All variables have fortunately relatively similar development, but due to fluctuations after the crisis could be quite considerable distortion in resulting models. For this distortion are two reasons. The first is the relatively short time series, which is a prerequisite for paper aim. The second problem is the high volatility in the recent sightings. Together the two factors probably will distort dynamic ex-ante prediction.

As the method for constructing predictive models were chosen method of multiple linear regression analysis. This method seeks to create a functional relationship between the response variable and explanatory variables. In the case of classic shape is following relationship:

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_n X_n + \varepsilon, \tag{1}$$

where Y is the response variable, α is the estimated constant βi are each estimated regression coefficients and Xi are each explanatory variable for $i = 1,2, \ldots, n$. The parameters of the regression model are usually estimated by the method of ordinary least squares (OLS).

When you perform a logarithmic transformation model regression coefficients become elasticity, because according to Jenkins et al. (2000) holds:

$$lnY = \alpha + \beta_1 lnX_1 + \beta_2 lnX_2 + \cdots + \beta_n lnX_n + \varepsilon, \tag{2}$$

where

$$\beta = \frac{\frac{\Delta y_t}{y_t}}{\frac{\Delta x_t}{x_t}} = \frac{\%y}{\%x} \tag{3}$$

The first problem with using a regression analysis is the possible occurrence of "apparent" regression. This phenomenon arises when using non-stationary time series, and leads to a total impairment model as a whole, because regression analysis is constructed on a stationary time series. We can use two methods for testing stationarity.

The first one is a qualitative method of evaluating the critical limits in the graphic expression of the residual autocorrelation function (ACF) and partial residual autocorrelation function (PAFC). In the case of non-stationary time series can be observed decreasing values of autocorrelation function simultaneously with the first partial autocorrelation function value close to one. The analysis autocorrelation function in this case is rather preliminary indication when experienced forecaster is able to base the modeling on these graphical analyzes.

A second approach to test stationarity is unit root test, which the most widely used test is adjusted Dickey-Fuller test (ADF). This test is based on testing autonomous lag in observed variable. Testing shows the first

insignificant delay within a time series. In case of non-stationary time series, this test could recommended the best possible delay for stationary time series.

Generally, most economic time series are either stationary I (0) or for to be statinary is required only first differences I (1). Stationarity itself is actually a replacement of variables in real terms bz increment values. Stacionarity problem in case of small observation is that the difference reduces the number of usable observations. Under certain circumstances, is possible work even with non-stationary data, but it is necessary to select the methodology of cointegration analysis*.

In the event that all of the selected variables are stationary, is possible to create specific model. This model, however, should be evaluated in terms of statistical testing.

To evaluate the model as a whole is used F-test, which tests the significance of the entire model. The second key indicator is the coefficient of determination R^2, which indicates what percentage of the variance observed variable model explains. In the case of the creation of models it is also useful to use information criteria.

Information criteria are based on observations of residues of individual models (Arlt and Arltová, 2009). The best model is the one that has the lowest value of the information criteria. Probably the most widespread is the Akaike information criterion (AIC), which has the form:

$$AIC(M) = ln\hat{\sigma}_a^2 + \frac{2M}{T}, \tag{4}$$

where M is the number of model parameters, $\hat{\sigma}_a^2$ is the residual variance and T is the number of observations, which is equal to the number of residue obtained under a given model (Arlt and Arltová, 2009).

The quality of the model can also be tested using dynamic ex-ante analysis. This method is based on shortening of the time series of one or more period and the subsequent prediction of these known values. The result of this test is to compare the estimation versus reality.

For model it is also important and standard deviation and significance of each sub-variables, which are tested by the t-test.

The problem of basic indicators of the model (F-test, t-test, R^2 and standard deviation) is distortion due to violation of Gauss-Mark's assumptions (GM). These assumptions, which form the basis for the estimation using OLS method, are:

1. $E(u) = 0$, random effects cancel each other out
2. $E(u\,u^T) = \sigma^2 I_n$, random component has a definite and constant variance and random components are uncorrelated
3. $E(X^T u) = 0$, where X^T is non-stochastic matrix, then it is all the randomness contained in a random component
4. Matrix X has full rank k, in matrix X are not linearly dependent columns.

In violation of GM's assumption of independence of random component occurs autocorrelations. The presence of autocorrelation is caused by dependence of residues with each other in time. Autocorrelation cause distortion in the F-test and also biased coefficient of determination.

The presence of autocorrelation can be deduced from the graphical analysis of ACF and PAFC where autocorrelation is indicated by statistically significant lag residues above the critical limit.

Another option for testing the presence of autocorrelation is test of goodness of fit (portmanteau test). Unfortunately, this test in the original shape is not suiTable for a small number of observations. Therefore it is appropriate with low number of observations to use modified portmanteau statistics (Arlt and Arltová, 2009) .It is however necessary to take into account that this test is based on a hypothesis testing shaped H1 : non H0, where H1 is the presence of autocorrelation. This test is rather suiTable for time series models based on generational process ARIMA.

The second most frequently used test is Durbin-Watson test (DW). This test is based on test squares of residues versus the selected dw-statistics:

$$dw = \frac{\sum_{t=2}^{T}(e_t - e_{t-1})^2}{\sum_{t=1}^{T} e_t^2}, \tag{5}$$

where e is the value of residues at time t to T. The actual statistics dw has a value (0; 4), when the value in the neighborhood of two points indicates the absence of autocorrelation. For accurate detection of critical limits of the presence of autocorrelation, or the ambiguity of the test, is advisable to use statistical Tables.

* For more details on this issue Arlt and Arltová (2009)

The disadvantage of DW test is that it is not able to indicate autocorrelations of higher order, and in the event of delayed variables in the model should be use modified DW statistics [*].

For a violation of GM's assumption of the rank of matrix X multicollinearity arises. This phenomenon causes distortion in t-test and standard deviation. Multicollinearity itself is relationship between the different explanatory variables. For simple indication can be used the correlation matrix of the explanatory variables, the values greater than 0.85 indicate a direct correlation and a value less than 0.85 indicates a correlation indirect.

Heteroscedasticity, which arises from a breach of the conditions of constant and final variance, is present in multivariate models, and therefore need not be addressed in this paper.

Assuming a normal distribution can be tested using the Jarque-Bera test, which is more suiTable for a larger number of observations or uses a modified asymptotic test (Arlt and Arltová, 2009). Both of these tests have testing hypotheses similar to goodness of fit. In the case of a very large number of observations (100 or more) is a general rule, that it is a normal distribution.

3 Observations and Results

The following chapter summarizes the key results of the statistical tests and evaluates models. Tests are analyzed by the typical problems associated with the number of observations.

The first very important test is a ADF test, which tests whether the variables are stationary. The following Table summarizes the estimated values of t-statistics for the ADF. Variable shape is after logarithmic difference:

Table 2: Unit-root test by augmented Dickey-Fuller test (ADF)

	ldTOTAL	ldPIT	ldCIT	ldVAT	ldPFC	ldEXP	ldTE	ldROSE	ldUR	ldAW
t-adf	-1.79	-1.902	-1.908	-1.888	-1.928	-1.694	-1.951	-2.279	-2.986	-1.651
critical value: 10% = - 1.6; 5% = -1.97; 1% = 2.8										

Source: Data OECD (2016) + own calculation

From the Table is clearly seen disadvantage of short time series, because in addition to the variables ROSE and UR all other variables are stationary only on weak confidence interval. Unfortunately, no other treatment besides increasing order differential reaches better results, so the assumption of stationarity proven only on the 10% significance level. Critical values of the ADF test were obtained from statistical Tables.

The second important test before the actual forecasting is testing multicollinearity between variables. To detect the presence of multicollinearity is just a simple correlation matrix enough:

Table 3: Correlation matrix

	ldTOTAL	ldPIT	ldCIT	ldVAT	ldPFC	ldEXP	ldTE	ldROSE	ldUR	ldAW
ldTOTAL	1.00	0.94	0.91	0.92	0.98	0.89	0.54	-0.11	-0.68	0.98
ldPIT	0.94	1.00	0.85	0.84	0.91	0.83	0.51	-0.05	-0.67	0.92
ldCIT	0.91	0.85	1.00	0.78	0.83	0.76	0.45	-0.04	-0.62	0.85
ldVAT	0.92	0.84	0.78	1.00	0.91	0.84	0.42	-0.21	-0.52	0.91
ldPFC	0.98	0.91	0.83	0.91	**1.00**	**0.85**	**0.56**	**-0.08**	**-0.64**	**0.99**
ldEXP	0.89	0.83	0.76	0.84	**0.85**	**1.00**	**0.47**	**-0.25**	**-0.64**	**0.86**
ldTE	0.54	0.51	0.45	0.42	**0.56**	**0.47**	**1.00**	**-0.64**	**-0.84**	**0.51**
ldROSE	-0.11	-0.05	-0.04	-0.21	**-0.08**	**-0.25**	**-0.64**	**1.00**	**0.40**	**-0.01**
ldUR	-0.68	-0.67	-0.62	-0.52	**-0.64**	**-0.64**	**-0.84**	**0.40**	**1.00**	**-0.63**
ldAW	0.98	0.92	0.85	0.91	**0.99**	**0.86**	**0.51**	**-0.01**	**-0.63**	**1.00**

Source: Data OECD (2016) + own calculation

From this matrix can be drawn several conclusions. The first part of the correlation matrix, where are the correlation of the response and explanatory variables, can help identify appropriate variables in the regression model. It should be remembered that the correlation relationship is not equal regression. It should take correlations between response and explanatory variables with certain reserve. The second part (indicated in bold) describes relations only between the explanatory variables (critical limit values are 0.85 and -0.85). From this section it is

[*] The extension d-statistics on a modified h-statistics is discussed in Arlt and Arltová (2009), pp. 213.

clear that using the average wage (AW) should be avoided in models together with a final personal consumption (PFC) and the volume of exports (EXP). Total employment (TE) has a possible correlation with the unemployment rate (UR).

After testing these two tests is another part devoted to the estimated models.

The total tax revenues are first constructed model. The results of this model summarized in the following Table:

Table 4: Total tax income model

	Coefficient	Std.Error	t-value	t-prob	Part.R^2
Constant	-0.015	0.017	-0.884	0.396	0.066
ldEXP	0.684	0.103	6.640	0**	0.800
ldTE	3.836	1.517	2.530	0.028*	0.368
ldROSE	1.061	0.433	2.450	0.032*	0.353
tests					
F	26.51[0.000]**		**AIC**	-5.831	
R^2	0.879		**Portmanteau $\chi 2(3)$**	2.743 [0.433]	
Sigma	0.048		**DW**	**2.435**	
			Normality test: $\chi 2(2)$	4.043 [0.132]	
dynamic ex-ante					
		forecast	actual	error	
		-0.038	0.020	0.058	
equation					
ldTOTAL = - 0.015 + 0.684*ldEXP + 3.836*ldTE + 1.061*ldROSE					

Source: Data OECD (2016) + own calculation

Model itself is relatively good. The value of statistical significance at constant can be neglected, because if we are estimating models without constant, it is quite difficult to determine the quality of the model. In the event that the model is without a constant we cannot determine the coefficient of determination and the quality of the model is assessed only by using information criteria and dynamic ex ante analysis. Dependence of total tax revenue, export volume, total employment and the share of self-employed is not so surprising. Taking into account that the Czech Republic is export-oriented the export importance is obvious. The share of total employment and the share of self-employed persons show a relatively high share of personal taxation in the overall tax mix.

The only diagnostic problem is relatively high value of the DW test. This value is in the interval between critical values therefore autocorrelation is not proved or disproved. Portmenteau statistics also does not prove autocorrelation; therefore it can be assumed that the autocorrelation does not occur. It should be noted that the two tests are sensitive to the number of observations.

Dynamic ex-ante approach, unfortunately, came out not very accurately, but estimating the last known period (2013) is quite difficult because the Czech economy is showing very high volatility since 2009, therefore, this test could be biased.

Another model is about personal income tax revenue:

Table 5: Model for personal income tax revenue

	Coefficient	Std.Error	t-value	t-prob	Part.R^2
Constant	-0.016	0.016	-1.040	0.319	0.076
ldAW	1.011	0.116	8.700	0**	0.853
tests					
F	75.64 [0.000]**		**AIC**	-5.908	
R^2	0.853		**Portmanteau $\chi 2(3)$**	2.933 [0.402]	
Sigma	0.049		**DW**	2.008	
			Normality test: $\chi 2(2)$	1.619 [0.445]	
dynamic ex-ante					
		forecast	actual	error	
		-0.032	0.033	0.065	
equation					
ldPIT = - 0.016 + 1.011*ldAW					

Source: Data OECD (2016) + own calculation

Model of personal income tax also came out relatively well. For statistical verification there is no problem. Unfortunately, the model cannot describe well the volatility of the economy over the period 2009-2013, and is therefore a dynamic ex-ante predictions are very biased. The actual dependence of the average wage is somewhat not surprising, given that the average wage is quite ideal indicator. As significant came out several other variables, but in terms of the coefficient of determination and information criteria this model is clearly the best.

Another model is the estimate of the corporate tax revenues:

Table 6: Model for corporate income tax revenue

	Coefficient	**Std.Error**	**t-value**	**t-prob**	**Part.R^2**
Constant	-0.019	0.037	-0.518	0.613	0.020
ldEXP	0.871	0.205	4.240	0.001**	0.580
tests					
F	17.96 [0.001]**		**AIC**	-4.289	
R^2	0.580		**Portmanteau $\chi 2(3)$**	1.514 [0.679]	
Sigma	0.110		**DW**	1.742	
			Normality test: $\chi 2(2)$	0.967 [0.617]	
dynamic ex-ante					
		forecast	actual	error	
		-0.027	0.037	0.064	
equation					
ldCIT = - 0.019 + 0.871*EXP					

Source: Data OECD (2016) + own calculation

Also, this model is quite good. Again, there is no problem with econometric testing. DW test is still at the frontier, which rejects the presence of autocorrelation. Unfortunately, this model has very biased dynamic ex-ante prediction, because this model is not able to describe the shocks that hit the economy in 2009. The actual dependency of this tax revenue on exports is not surprising, because the Czech Republic is export-oriented. Even here, this model was chosen as the best in terms of the coefficient of determination and information criteria.

The last reporting tax revenue is revenue of value added tax:

Table 7: Model of value added tax revenue

	Coefficient	**Std.Error**	**t-value**	**t-prob**	**Part.R^2**
Constant	0.013	0.013	1.040	0.320	0.090
ldAW	1.284	0.118	10.900	0**	0.915
ldTE	-4.763	1.413	-3.370	0.006	0.508
ldROSE	-1.579	0.382	-4.130	0.002	0.609
tests					
F	49.27 [0.000]**		**AIC**	-6.318	
R^2	0.931		**Portmanteau $\chi 2(3)$**	2.334 [0.506]	
Sigma	0.038		**DW**	**1.655**	
			Normality test: $\chi 2(2)$	1.841 [0.398]	
dynamic ex-ante					
		forecast	actual	error	
		0.007	0.059	0.052	
equation					
ldVAT = + 0.013 + 1.284*ldAW - 4.763*TE - 1.579*ROSE					

Source: Data OECD (2016) + own calculation

. The value of DW test is indeed within the bounds of uncertainty, but there Portmonteau statistics showed no evidence of autocorrelation. Biased dynamic ex-ante is caused by volatility. In terms of the estimated explanatory variables is model very surprising. VAT dependence of the average wage is not surprising, because the average wage can express disposable income and consumption, but negative coefficients for the other variables are very surprising. Negative parameter in the shares of self-employed persons may be explained by tax evasions. But the negative coefficient in total employment may be caused by some unknown bias. The only rational explanation is possible to seek an increase in work for minimum wage, where the net wage is lower than social benefits.

4 Conclusion

Actual estimated models have demonstrated that it is possible to construct the relatively non-deflected predictions even with small number of observations. The disadvantage of selected models are stationary problems, where it is very difficult to add additional delay because the number of observations. In the case of this article, the author was forced to use relatively weak criterion of stationarity.

The actual models are unfortunately less explanatory power due to the volatility of monitored parameters in the period 2009 to 2013. The actual volatility would probably not be such a big deal if it be better distributed over time. Another problem with using a small number of observations is a certain distortion in autocorrelation tests where is necessary to calculate a critical value of Durbin-Watson test. Unfortunately, even the use of goodness of fit (Portmenteau) is not also entirely useful for the number of observations.

On the other hand, if it is possible to do better stationarity in short time series and these series not have high volatility, there is no problem to achieve relatively accurate model, if the autocorrelation is properly treated. The second option is to use a methodology of cointegration analysis, which is based on a non-stationary time series. Tertiary option is using panel regression analysis for more countries and for a lot more observation, but it is complicated to correctly discuss only one state from the panel.

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Remarks upon Estimating the Tax Gap of Individuals in the Czech Republic

Savina Finardi* – Ondřej Bayer**

Abstract. The paper is about estimation of tax gap of self-employed persons including personal income tax, social contributions and public health insurance in the Czech Republic. We used data from Eurostat national accounts database and compared indicators of output and intermediate consumption with some other similar countries to the Czech Republic – Slovakia, Sweden and Austria. Finally, we estimated the tax gap of self-employed persons in the Czech Republic in 2011 and 2012. In 2012, the tax gap was 8.3 billion CZK, which is quite high number.
Keywords: tax gap, personal income tax, social security contributions, tax evasion
JEL Classification: H26

1 Introduction

The article deals with the estimation of the size of the tax gap in the Czech Republic. For these estimates were used studies of other authors who are estimating the tax gap in the past. It is e.g. (Erard, 2005), (Giles, 2000), (Karlinsky, 2004), (Mackie-Mason, 1992), (Mazur, 2007), (McClellan, 2013), (McManus, 2006), (Mohamed, 2013), (Rice, 1992), (Taiebnia, 2008) and (Khwaja, 2014). In the Czech Republic, was recently published publication (Zídková, 2014), which deals with the estimation of the tax gap for value added tax.

To achieve concrete results for tax gap estimation we used methodology based on comparative analysis using national accounts. For better understanding of national accounts were publications (Hronová, 2009) and (Průša, 2008) used. The main goal of this paper is to estimate the tax gap for individuals in the Czech Republic.

The first part of this paper discusses the issue of revenues from dependent activity, total collection of PIT from tax returns and the number of self-employed taxpayers. This data are very important for the economic goal of this paper – "taxation gap" between employees and self-employed persons. The second part describes the methodological basis for calculating the tax gap. The last part describes the development of a specific tax gap for the Czech Republic in 2011-2012.

2 The issue of personal income tax and self-employment

The most important taxed income of individuals is income from dependent activity (wages and salaries) from the public finance point of view. To illustrate, Fig.1 shows the development of the absolute amount of the tax collection from personal income tax and the annual changes are mentioned as well. Figure 1 describes the real problem of total collection on PIT from tax returns and its decreasing development since 2003 till 2013. Nowadays the total collection is about 2.7 billion CZK. It should be mentioned that some employees have to submit the tax return because of some other incomes they reached during the tax period, but they still belong to the dependent activity category. There is no doubt that something has changed in the last 10 years and self-employed persons effectively cut their PIT payments. The question is what was the reason?

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Table 1: PIT collection and annual changes (2003-2013)

Year	PIT depen. activity (bil. CZK)	PIT from tax returns (bil. CZK)	PIT depen. activity (abs. diff, bil. CZK)	PIT from tax returns (abs. diff, bil. CZK)	PIT depen. activity (annual rel. diff.)	PIT from tax returns (annual rel. diff.))	PIT depen. activity (annual rel. diff.to 2003)	PIT from tax returns (annual rel. diff.to 2003)
2003	86.6	21.9	x	x	x	x	x	x
2004	94.7	22.1	8.1	0.2	9.35 %	0.91 %	9.35 %	0.91 %
2005	102.63	24.04	7.93	1.94	8.37 %	8.78 %	18.51 %	9.77 %
2006	110.66	26.58	8.03	2.54	7.82 %	10.57 %	27.78 %	21.37 %
2007	111.63	17.85	0.97	-8.73	0.88 %	-32.84 %	28.90 %	-18.49 %
2008	115.18	17.75	3.55	-0.1	3.18 %	-0.56 %	33.00 %	-18.95 %
2009	111.04	5.56	-4.14	-12.19	-3.59 %	-68.68 %	28.22 %	-74.61 %
2010	111.84	7.99	0.8	2.43	0.72 %	43.71 %	29.15 %	-63.52 %
2011	119.37	2.94	7.53	-5.05	6.73 %	-63.20 %	37.84 %	-86.58 %
2012	119.79	3.26	0.42	0.32	0.35 %	10.88 %	38.33 %	-85.11 %
2013	126.13	2.68	6.34	-0.58	5.29 %	-17.79 %	45.65 %	-87.76 %

Source: Authors, Data: ARAD.

In 2006, the Czech Republic introduced new model of tax credits instead of the standard deductions. Since 2005 a special tax allowance on depending child/children was introduced. Since 2008 the basic credit increased from 7,200 CZK to 24,840 CZK as well as the simple tax rate of 15 % was introduced. All these changes are probably reflected in the tax collection in the following years (2007 and 2009). Another relevant issue is lump-sum expenses, which can be applied by the self-employed persons and they can effectively reduce their partial tax base by this special expenses and not reflecting their real expenses, which can be significantly lower.

Table 2 shows the number of self-employed persons per 1 000 inhabitants in each selected country. We have chosen neighboring countries Austria and Slovakia and developed EU country Sweden with similar population as the Czech Republic has. In the Czech Republic the ratio is highest among selected countries, and in 2012 it was 86.4 for the self-employed per 1,000 people. Austria and Slovakia have this indicator very similar to the self-employed around 65 per 1,000 inhabitants. The lowest value is achieving Sweden, around 25 self-employed persons per 1,000 inhabitants.

Table 2: Development of number self-employed for 1,000 inhabitants

Year	CZ	AT	SK	SE
2003	84.7	62.3	43.8	26.8
2004	82.7	63.0	50.8	27.4
2005	79.8	63.4	53.3	27.2
2006	81.1	64.4	55.4	27.7
2007	82.0	64.6	58.6	28.0
2008	82.4	65.5	64.6	26.5
2009	83.1	65.4	67.9	26.6
2010	84.5	65.7	67.0	27.0
2011	84.6	65.5	65.6	25.7
2012	86.4	65.0	63.9	25.1

Source: EUROSTAT.

Despite the high proportion of self-employed persons in the Czech Republic, their contribution to the personal income tax is very low and has been falling in recent years. It can be assumed that the low tax collection from self-employment income is also involved in the devastation of the tax base, not only of income from independent activities. This fact can be attributed to a high level of lump sum expenses from independent activity. Another likely cause is the distortion of reported income. The annual differences are also influenced by changes in the rules for collecting the PIT.

3 Methodology and data used

The estimation of the tax gap is concentrated at the level of distortion of income and expenses for persons having income from independent activity. This methodology was used in [4]. Data were drawn from [3], which have the advantage that it is internationally comparable. Comparisons, data on output (P.1) with a pointer to intermediate consumption (P.2) and using these two indicators was created auxiliary cost ratio of the sector, which is in absolute terms, the gross added value.

$$Gross\ expensivness\ of\ sector\ in\ \% = \frac{intermediate\ consumption\ of\ sector\ (P.2)}{output\ of\ sector\ (P.1)} \quad (1)$$

The resulting gross cost of each sector was both examined from the perspective of a longer time series in the Czech Republic and also spatial comparison was conducted with selected EU countries. For the Czech Republic, data are available from 1993 to 2012 in the case of spatial comparison of selected EU countries have opted for a time series from 2000 to 2012.

An important Figure is also the number of self-employed persons. This information will be used to calculate the estimated tax gap in these sectors.

Subsequently, the comparison of the average gross expensiveness in all sectors and were selected only the largest absolute differences in average gross expense ratio between the Czech Republic and the rest of the countries surveyed (Table 3). The differences are such significant that it cannot be explained only by factor productivity, which is higher in Austria and Sweden. Significant differences can be observed in sectors F (construction), K (financial and insurance activities), L (real estate activities), M (professional, scientific and technical activities) and N (administrative and support service, etc.).

Table 6: Average gross costs by sector in selected countries (in % 2000-2012)

Sector	CZ	AT	SK	SE
A Agriculture, forestry and fishing	59.94	54.03	54.54	45.95
B Mining and quarrying	53.16	47.13	40.39	50.18
C Manufacturing	75.96	66.68	76.86	70.74
D Electricity, gas, steam and air conditioning supply	67.57	74.01	76.01	36.87
E Water supply; activities related to sewerage, waste management and remediation activities	61.61	51.29	48.74	59.37
F Construction	72.27	56.24	63.03	56.63
G Wholesale and retail trade; repair of motor vehicles	51.05	42.05	49.27	36.85
H Transportation and storage	57.46	51.49	62.56	61.57
I Accommodation and food service activities	55.51	38.68	46.13	59.70
J Information and communication	51.71	56.01	48.41	56.34
K Financial and insurance activities	54.57	44.79	46.80	36.60
L Real estate activities	51.86	31.92	27.37	44.38
M Professional, scientific and technical activities	62.06	53.13	50.39	50.36
N Administrative and support service activities Public administration and defence; compulsory social security	63.40	36.00	48.54	49.08
O Public administration and defence; compulsory social security	38.13	33.04	35.92	48.11
P Education	26.52	16.02	23.49	32.17
Q Human health and social care	39.02	36.61	39.06	27.59
R Arts, entertainment and recreation	56.82	35.11	43.96	53.35
S Other service activities	44.86	38.89	45.76	38.27

Source: Authors, Data: EUROSTAT.

In the calculation of partial tax base from independent activity was then included the largest absolute difference. The only exceptions were the A and B sectors, in which were chosen average value of all three countries, because of the specifics of these important sectors. We did not take into our following estimations sector D Production of electricity etc., which has its regional specifics and industry from the perspective of small entities undergoing tumultuous and development tax (solar equipment, etc.). For estimation of corrected partial tax bases from independent activity we used real data provided by the official Tax Authority in České Budějovice (South Bohemia region).

Differences in average gross expenses ratio to the CR are shown in Figure 4 (selected sectors only). The differences are thus not solely determined by labour productivity, but also national specificities of those countries should be taken into account.

Table 4: Differences of average gross costs to the Czech Republic (in p.p., total average for 2000-2012)

Sector	AT	SK	SE
F Construction	-16	-9	-16
I Accommodation and food service activities	-17	-9	4
K Financial and insurance activities	-10	-8	-18
L Real estate activities	-20	-24	-7
N Administrative and support service activities	-27	-15	-14
R Arts, entertainment and recreation	-22	-13	-3

Source: Authors, Data: ARAD.

$$Coefficient\ of\ sector = (AGC_{CZ} - AGC_{min}) + 1 \quad (2)$$

where AGC = average gross costs of sector.

$$PTB\ after\ correction\ of\ sector = PTB\ before\ correction * koeficient\ of\ sector \quad (3)$$

where PTB after correction of sector = partial tax base of independent activities after correction,
PTB before correction = partial tax base of independent activities given sector before correction
coefficient = coefficient of highest absolute difference in average gross cost given industry +1 .

After quantifying the tax base correction it was estimated a size of the tax gap. Personal income tax was considered a nominal rate of 15 % and it has been abstracted from any tax allowances that can be claimed only once.

$$PIT\ tax\ gap = \big((PTB\ after\ correction - PTB\ before\ correction) * 0{,}15\big) * number\ of\ persons \quad (4)$$

$$Insurance\ premium\ tax\ gap = ((real\ assesement\ base > min.AB) * rate) * number\ of\ persons \quad (5)$$

We have take into account the minimum assessment base for both systems of social and public insurance in 2011 and 2012. For the year 2012 we used basic extrapolation of time series using a linear trend for each of the relevant sectors, because we did not have any other relevant data about the partial tax base from independent activity according to economic sectors. If the real assessment base was higher than the minimum assessment base we have used the real one as a relevant base for our further calculations.

4 Results and Discussion

By using the above formulas we estimated the PIT gap for the Czech Republic. Figure 5 contains the results for all sectors except D), we also focused on the sector O), but self-employed persons are not observed here. The total PIT gap for 2011 is then estimated of 2.5 billion CZK. For the public health insurance it was less than 300 million CZK and for social security insurance it was 1.76 billion CZK. In 2012, the tax gap was due to PIT 2.7 billion CZK, for the public health insurance 326 millions CZK and social security insurance 5.1 billion CZK.

Table 5: Estimation of tax gap in 2011 (CZK)

Sector	PIT gap	PHI tax gap	SS tax gap
A Agriculture, forestry and fishing	84,904, 535	0	0
B Mining and quarrying	144,240	0	0
C Manufacturing	196,629,172	0	0
D Electricity, gas, steam and air conditioning supply	n.a.	n.a.	n.a.
E Water supply; activities related to sewerage, waste management and remediation activities	4,623,679	0	0
F Construction	481,948,790	0	12,428,354
G Wholesale and retail trade; repair of motor vehicles	459,147,133	0	851,519
H Transportation and storage	47,679,294	0	128,079,795
I Accommodation and food service activities	59,345,455	0	0
J Information and communication	17,724,062	0	78,990,884
K Financial and insurance activities	88,177,447	0	90,978,608
L Real estate activities	189,174,315	0	0
M Professional, scientific and technical activities	359,771,226	0	972,202,872
N Administrative and support service activities	99,049,997	0	21,321,975
O Public administration and defense; compulsory social security	n.a.	n.a.	n.a.
P Education	98,262,817	88,436,535	765,094,643
Q Human health and social care	233,924,508	210,532,057	1,706,062,492
R Arts, entertainment and recreation	68,095,710	0	33,629,858
S Other service activities	59,850,546	0	0
Total	**2,548,452,925**	**298,968,592**	**3,809,641,001**

Source: Authors

Note: SS – social security, PHI – public health insurance

Table 6: Estimation of tax gap in 2012 (CZK)

Sector	PIT gap	PHI tax gap	SS tax gap
A Agriculture, forestry and fishing	92,633,475	0	68,809,391
B Mining and quarrying	157,365	0	60,648
C Manufacturing	214,529,370	0	0
D Electricity, gas, steam and air conditioning supply	n.a.	n.a.	n.a.
E Water supply; activities related to sewerage, waste management and remediation activities	5,044,500	0	0
F Construction	525,807,240	0	266,695,601
G Wholesale and retail trade; repair of motor vehicles	500,931,540	0	269,808,993
H Transportation and storage	52,021,260	0	191,785,045
I Accommodation and food service activities	64,747,440	0	0
J Information and communication	19,337,580	0	120,551,850
K Financial and insurance activities	96,203,400	0	134,606,978
L Real estate activities	206,389,980	0	25,736,880
M Professional, scientific and technical activities	392,510,790	0	1,238,052,669
N Administrative and support service activities	108,064,350	0	55,205,783
O Public administration and defense; compulsory social security	n.a.	n.a.	n.a.
P Education	107,204,355	96 483,920	852,704,620
Q Human health and social care	255,209,895	229 688,906	1,899,712,084
R Arts, entertainment and recreation	74,292,660	0	61,987,162
S Other service activities	65,300,910	0	0
Total	**2,780,386,110**	**326,172,825**	**5,185,717,702**

Source: Authors

Note: SS – social security, PHI – public health insurance

The Czech Statistical Office published its own computations of underestimation of official incomes and revenues of selected companies in the Czech Republic in 2010 according to a revision of national accounts. These computations were made for private and non-financial small and medium enterprises and for non-financial enterprises under foreign control. Results showed that the rate of underestimation of incomes was about 10.75 % for all observed sectors of economy. Our estimations based on gross average costs are 10.88 p. p. for Austria, 3.13 p. p. for Slovakia and 10.2 p. p. for Sweden – year 2010.

Similar estimations were calculated and published in [4]. Authors found out some inaccuracy formulas, thus the total amount of social security tag gap has changed compared to the previous estimations.

It should be mentioned that our estimations are based on real data from Eurostat database; hence the real estimated tax gap should be more than we have estimated.

5 Conclusions

The aim of this paper was to estimate a size of tax gap in the Czech Republic in 2011 and 2012. According to our own methodology we estimated the total tax gap in the Czech Republic that was 6.7 billion CZK in 2011 and tax gap 8.3 billion CZK in 2012. These amounts are gross estimations of shadow economy in taxes of self-employed persons in the Czech Republic. The main limit of our computations is the fact, that national accounts database is based on official data, which are unfortunately distorted. Despite the fact of distortion, using national accounts is one of suiTable way, how to estimate the tax gap for self-employed persons.

These days the Ministry of Finance is introducing a new approach of better registration of sales in the Czech Republic. This is one of the ways which could decrease the size of a tax gap in personal income tax and other social contributions. Official evidence of sales will affect the total collection of valued added tax as well.

The topic of tax gap is still very important for better understanding of real economic problems and challenges in every economy. Current challenge is to maintain the level of public goods and services and thus we have to improve the system of tax collection and withdrawal. Otherwise we will face the dramatic reduction of public spending in every developed country including the Czech Republic.

Individuals (self-employed persons) in the Czech Republic can effectively hide their real incomes because of the lack of legislation. The question is whether the brand new legislation can fix the problem or whether this problem is more sophisticated and complicated.

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The influence of parliamentary elections on the tax structure in the EU countries

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Abstract. The paper deals with the political business cycle. Within the analysis, the influence of the term of parliamentary elections on the tax structure (direct versus indirect taxes) was examined. We used panel data regression analysis, namely fixed effects method with robust option and tested whether there is any relationship between tax structure and date of elections. The analysis involves panel data of tax revenues divided to GDP from all EU member States on timeline from 1996 to 2014. Our model contains 532 observations. Based on received results, the political business cycle has a slight effect on indirect and direct tax revenues. In election years we identified a decrease of direct tax revenues by 0.97%, in case of indirect tax revenues it is a decrease by 0.80%. Furthermore, we did not identify any influence of the timing of elections during calendar year, any post-election effects or any definite relationship between PBC and economic growth in observed timeline.
Keywords: tax structure, direct taxes, indirect taxes, parliamentary election
JEL Classification: D72, E62, H20

1 Introduction

The politicians are responsible for the implementation of tax policy. In the democratic societies people are tax payers and voters (Smatrakalev, 2006). Therefore, their behaviour and activities can be focused on implementation such measurements that may increase their popularity among voters in order to get higher chances of their re-election in a democratic electoral system. In this context we respect the statement of Sjahrir, Kis-Katos and Schulze (2013) who add that the existence of political business cycle can arise only in the systems of direct elections.

The fiscal policy in tax field could be deformed especially in election year or in a period prior and after the election year. Janků (2013) adds that due to the assumption of the irrational voters, all next intentional pre-election fiscal expansion must be successful. The assumption of irrational voters became the object of critique. Therefore Rogoff and Sibert (1988) introduced the model political business cycle which is based on the temporary information asymmetries between voters and political representatives. It is clear that the governments receive information about its competency more quickly than the voters can. Therefore the public sees the government's competency with a lag. As a consequence of that fact it is obvious that the incumbent party can have an incentive to lower taxes in election years to show their competency. The theory of political business cycle (PBC) predicts that politicians should manipulate fiscal policy just before elections by increasing public expenditures or decreasing tax burden of taxpayers. The post-election period should be according to Spěváček (2002) linked with fiscal restriction, especially by a decrease of public expenditures or an increase of tax burden of citizens.

Pre-election manipulation can be considered as the efforts to determine the growth of economy and employment or rather as the effort to improve the living standard of voters. For example Mamatzakis (2005) proved that the output growths when the tax mix is one that would give weight to indirect taxation. Kneller et al. (1999) also revealed that distortionary taxation reduces growth, whilst non-distortionary taxation does not. Only in case of using taxes as a source of financing an increase of unproductive government spending Drobiszova (2015) found out that both of direct and indirect taxes negatively affect the economic growth. Results of the analysis of Machová and Kotlán (2015) confirm the hypothesis that if productive spending is financed by indirect taxes, the effect on economic growth is positive, while if the spending is financed by direct taxes, the effect on growth is negative.

However, Rogoff (1990) states that there are some models predicting changes in the composition of expenditures rather than in total value of expenditures. The research of Drazen and Eslava (2010) found out that the political representatives can change only the structure of expenditures in behalf of those which are positively accepted by citizens which corresponds with conclusions of Morozumi, et al. (2014). The similar analysis was realized on the territory of the Czech Republic when Matějová et al. (2015) analyzed the structure of expenditure on municipal level. They found out that analyzed expenditure was influenced by PBC. Furthermore, Haselswerdt and Bartels (2015) employed a series of survey experiments to identify that the citizens react more favorably to tax breaks than to equivalent spending programs. From that reason there are many authors such as Foremmy and

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Riedel (2014), Ehrhart (2013), Mikesell (1978), Petterson-Lidbom (2003), Andrikopoulos et al. (2006) or Formanová et al. (2015) whose studies deal with the tax aspects in relation to political business cycle.

Above mentioned Ehrhart (2013) focuses on the revenue side of state budget. She points out to the issue that no significant changes in overall tax revenue may mask a considerable electoral manipulation in the tax policy determination. She states that the representatives of the legislative power can change the tax structure according to the citizens´ preferences. For testing she used OLS fixed-effect and GMM-system estimator. Furthermore she used the indicator of total tax collection and data of 56 developing countries in timeline 1980−2006. She revealed significant pre-electoral political budget cycle in the sense of composition of tax revenues (direct versus indirect taxes). Moreover Morozumi et al. (2014) included panel data from 107 countries over the 1975−2010 period in their research. They identified that there is a significant decrease in income taxes and an increase of consumption taxes in election years.

On the basis of Ehrhart (2013) methodology the main objective of this paper is to verify the existence and to analyse the changes in the tax structure in relation to the term of parliamentary election. Secondly, the partial aim is to identify the influence of PBC on the economic growth. According to our assumption, the term of parliamentary election can influence the tax structure in the EU member States. As a consequence of above described trends in behaviour of representatives of legislative power, we expect to observe the changes in the tax structure in the election year and in the post-election year on the timeline 1996−2014.

2 Methodology

Regression model tests the influence of elections on the tax structure. The model is based on Ehrhart (2013). Within the tax structure, we distinguish two types of taxes, direct and indirect. Both dependant proxies, Direct tax revenues (current taxes on income, wealth, etc., ESA2010 classification) and Indirect tax revenues (taxes on production and imports, ESA2010 classification), are divided to GDP in the manner of Brender and Drazen (2005), Ehrhart (2013), Katsimi and Sarantides (2012) and Prichard (2014). Ehrhart (2013) states six socio-economic indicators, the lagged dependent variable, GDP per capita, the degree of urbanization, the share of imports (indirect taxes), the rate of inflation and the share of population ages 14 and under. The proxies (GDP per capita, the degree of urbanization and the share of imports) are used in the same way. The proxy GDP per capita (current euro) is expressed in the logarithmic functional forms and represents the economic development, e.g. Brender and Drazen (2005), Ehrhart (2013), Katsimi and Sarantides (2012) and Prichard (2014). Whereas variable Urbanization (share of population living in urban areas) depicts the structure of the economy. The import (the share of imports to GDP), is an important component of indirect taxes. The remaining two indicators, Inflation and Population, are included in the models, but in the different forms. Compare to Ehrhart (2013), we do not use the logarithmic functional form for the Inflation with regard to the other proxies. The higher inflation (the annual change in the consumer price index) has negative effect on the real tax revenues (the Olivera-Tanzi effect). Ehrhart (2013) as an indicator of the demographic pressures in the developing countries used share of population under 14, but in the context of the EU member states we prefer share of population ages 15 to 64 (Population15-64).

For evaluation of the importance of parliamentary elections, we state four dummy proxies. The first, Election, is a variable coded 1 for year in which there is a legislative election. The other two dummy proxies take into the account of the parliamentary election timing, it means, if the elections are held in the first half of a year (Election1st) or in the second half of a year (Election2st). Last one, Post-election, represents "the Post-election effect", which follows the PBC theory introduced in the beginning of this paper.

We use data from Eurostat (Tax revenues, GDP per capita, Import), the World Bank Group (Urbanization, Inflation and Population15-64) and the International Foundation for Electoral Systems (proxies of Elections). We assume that all variables, with the exception of Inflation, are positively associated with the tax revenues. The regression model is following:

$$Tax\,\mathrm{Re}\,v_{it} = \beta_1 X_{it} + \beta_2 Elections_{it} + \mu_{it} \qquad (1)$$

Where i and t are country and year indicators, $TaxRev_{it}$ are tax revenues, direct or indirect to GDP, X_{it} are socio-economic proxies (log GDP per capita, Urbanization, Import, Inflation and Population15-64), μ_{it} is an unobserved error term.

For evaluation of the influence of elections on the tax structure, we use static panel data analysis. There are two basic methods in the static panel data, fixed and random effects. In accordance with Ehrhart (2013) we use OLS-Fixed Effects. Also LeSage and Dominguez (2012) stated that observations on government behaviour, voters, taxes, etc. can be analyzed using ordinary least-squares (OLS) methods, therefore it is considered as convenient tool for our analysis. We choose the Hausman test for the determination of a suiTable method (random effects are preferred under null hypothesis while preference for fixed effects is an alternative hypothesis). Econometric verification is verified, homoscedasticity is tested by the Wald test, the serial autocorrelation then by the Durbin–Watson test.

3 Results

For evaluation of the influence of term of parliamentary elections on the tax structure, we used static panel data analysis, namely fixed effects method on the basis of the Hausman test. The model contains 28 cross-sectional units and 19 time series units, the sum is 532 observations.

The model of fixed effects incorporates heteroscedasticity (the Wald test) and serial autocorrelation (the Durbin-Watson test). Therefore the models are supplemented by the robust variance estimator. The estimated regression coefficients remain the same and heteroscedasticity and serial autocorrelation also persist in the model, but standard errors are calculated to be robust. Regarding the other tests, the paper states the adjusted coefficient of determination (within), nevertheless, its values have limited information capability in the panel data regression.

Table 1: Elections and tax structure, OLS-Fixed effects, robust option

Proxies	Direct tax revenues				Indirect tax revenues			
	Election	Election 1st	Election 2nd	Post-election	Election	Election 1st	Election 2nd	Post-election
Const.	18.70 * (1.75)	18.72 * (1.75)	19.02 * (1.80)	18.72 * (1.74)	7.62 (0.52)	7.48 (0.51)	7.87 (0.54)	7.68 (0.53)
GDPpc (log)	-0.80 ** (-2.56)	-0.81 *** (-2.59)	-0.80 ** (0.01)	-0.81 *** (-2.59)	0.10 (0.28)	0.10 (0.27)	0.09 (0.27)	0.09 (0.26)
Urban	0.06 (0.86)	0.06 (0.85)	0.06 (0.87)	0.06 (0.85)	0.06 (0.99)	0.06 (0.98)	0.06 (0.99)	0.06 (0.99)
Import	-	-	-	-	-0.007 (-0.50)	-0.007 (-0.51)	-0.007 (-0.49)	-0.007 (-0.50)
Inflation	0.002 *** (2.85)	0.002 *** (2.87)	0.002 *** (2.76)	0.002 *** (2.73)	-0.004 *** (-6.54)	-0.004 *** (-6.58)	-0.005 *** (-6.64)	-0.005 *** (-6.76)
Population 15-64	-0.06 (-0.53)	-0.06 (-0.59)	-0.06 (-0.57)	-0.06 (-0.52)	0.01 (0.09)	-0.01 (0.10)	0.01 (0.07)	0.01 (0.09)
Elections	-0.11 * (-1.74)	-0.001 (-0.01)	-0.206 (-1.04)	-0.006 (-0.10)	-0.12 ** (2.13)	-0.09 (-1.13)	-0.14 (-1.30)	0.06 (-1.56)
R^2 (within)	0.09	0.09	0.09	0.09	0.08	0.08	0.08	0.07
Wald test	0.00 (514.34)	0.00 (500.15)	0.00 (486.56)	0.00 (498.50)	0.00 (5425.76)	0.00 (6213.58)	0.00 (6763.12)	0.00 (6928.79)
Durbin-Watson test	0.49	0.48	0.50	0.48	0.50	0.50	0.50	0.50

Source: Authors

Notes: (.) denotes t-statistic, */**/*** means a significance level at 10 %/5 %/1 %; R^2 means an adjusted (within) R-squared; the Wald test (p-value), the Durbin-Watson test (DW statistic value).

First of all, we start analysis with socio-economic factors. There are two statistical significant proxies, log GDP per capita and Inflation. In more detailed view on the tax structure, the log GDP per capita has a negative effect on the Direct Tax Revenues. If the GDP per capita increases by 1%, the direct tax revenues decrease by 0.8 GDP. The Inflation has a negative impact (the Olivera Tanzi effect) on the tax revenues of indirect taxes, whereas a positive impact on revenues of direct taxes. Nevertheless in both cases it is a minimal effect.

If we focus on the relationship between the term of parliamentary election and total revenues of taxes, the model indicates negative influence of political business cycle on the Direct and Indirect tax revenues as well. In years, in which there are parliamentary elections, the Direct tax revenues fall by 0.11 % GDP. It means if there are the average direct tax revenues circa 11.3 % GDP, then the direct tax revenues are lower by circa 0.97 %. In case of Indirect taxes, the revenues decrease by 0.12 GDP. Based on the fact that the indirect taxes created on average 13.6 % GPD, then in election year the indirect tax revenues fall by 0.80 %. With the respect to a reverse effect of changes in direct and indirect taxes (a decrease in both cases) in relation to the determination of economic growth, it is not possible to define the direction of determination of economic growth by electoral cycle.

Furthermore, we focused on the timing of parliamentary election. It means the parliamentary election in the first half of calendar year or in the second half of it. From the result of our analysis it is clear that there is no statistical significant impact of the date of parliamentary election. Finally, we tested whether there is evident so called Post-Election effect which was introduced in the beginning of this paper. We expected the post-election increase of tax revenues of both types of taxes. Based on the result of the model, we did not identify any Post-election effect during observed timeline.

4 Conclusions and discussion

The aim of this paper was to identify the effects of the term of parliamentary elections on the tax structure of all EU member States in time period from 1996 to 2014. We verified the political business cycle theory describing that the tax policy determination can be influenced by politicians´ behaviour which is based on using such economic instruments in order to maximize their chances of re-election in following parliamentary election. Those steps in tax policy determination are not desirable and subsequently they can distort the stated objectives of the economic policy. For the purpose of examination and evaluation of the influence of political business cycle on the tax structure in the EU member States we used the panel data regression analysis.

The results show that the term of parliamentary election has an effect on the Direct tax revenues and Indirect tax revenues as well. The influence of PBC on Direct tax revenues is about 0.11 % GDP, or we can say, the holding of parliamentary elections leads to a decrease of Direct tax revenues by 0.97 %. In case of Indirect tax revenues, we identified a fall of tax revenues by 0.12 % GDP, it is a decrease of the tax revenues by 0.88 %. In comparison with Ehrhart (2013) who analyzed the tax structure in developing countries, we identified different results. Her findings indicate the tax policy manipulation especially in case of indirect taxes. In our research we found out statistically significant decreases in both types of taxes. In our opinion the indefinite results can be caused by the diversity of the European Union countries. From that reason, as a possible extension, we propose an analysis of the tax structure of each member State individually with consequent comparison of the new EU member States with the old ones. Nevertheless, the received results correspond with the general findings, e.g. Janků (2013) and partially with the conclusions of Ehrhart (2013) in case of a decrease of indirect taxes, or of Morozumi et al. (2014) in direct taxes area. To sum up, we identified slight tax policy manipulation in observed timeline.

Moreover, we focused on the identification whether there is any significant effect of the timing of parliamentary election during calendar year. Based on received results we can state that there is no significant impact of the date of parliamentary election on the tax structure. Furthermore, we included the analysis of the post-election effects. In accordance with the political business theory we expected the post-election increase of tax revenues. However our assumption was not confirmed.

The way of determination of economic growth by tax policy is the area which is in the literature well-known, see e.g. Mamatzakis (2005), Drobiszova (2015) or Machová and Kotlán (2015). Based on our results and reverse effect of a slight decrease direct and indirect taxes in election year, it is not possible to define the direction of determination between PBC and economic growth.

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Analysis of the Dependence of Corporate Tax in Relation to the Tax Depreciation of Fixed Tangible Assets

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Abstract. The article deals with evaluation of dependence of corporate income tax rate to selected indicators of depreciation of fixed tangible assets in the Czech Republic and in the neighbouring countries. The examined indicators are the shortest possible period of tax depreciation and the price limit for classifying assets as the fixed assets.

The aim of this article is to determine by using selected method whether there is dependence among these indicators. In a transnational context between individual countries there exist the tax depreciation variations that cause differences in the construction of the tax base. The possible implementation of the Common Consolidated Corporate Tax Base (CCCTB) can eliminate these disparities, since the proposed CCCTB Directive deals, inter alia, with the possible rules and methods of tax depreciation. The authors used the methods of correlation analysis, analysis and comparison.

Keywords: depreciation, correlation analysis, corporate tax, tax rate, corporate income tax.

JEL Classification: C40, H25, M41

1 Introduction

The aim of this paper is, by using the selected method of correlation analysis, to assess interdependencies between corporate tax rate, period of tax depreciation and limit for classifying of assets as fixed assets from a tax perspective in the Czech Republic and in its neighbouring countries. The authors work with the research assumption that the countries with a higher tax rate of corporate income tax have "more favourable" conditions in terms of depreciation rules – i.e. the low amount of years of tax depreciation and high price limit for classification of tangible assets as the fixed assets. This analysis can also serve as the basis for the eventual introduction of CCCTB.

For business activities there are used short-term and current assets. Current assets are consumed in one-off mode and therefore costs arise at the moment of their use. For fixed assets the above mentioned shall not be applied because they are not consumed in one-off mode, but sequentially. Long-term assets are considered to be those whose period of application is longer than one year. Therefore, it is not possible to include their acquisition cost into costs in one-off mode. Expression of this gradual moral and physical amortization is the depreciation. Depreciation reduces the pricing of the asset and simultaneously enters into the costs.

The nature of assets´ amortization over time and a suggestion how to render this amortization was dealt by e.g. Hulteln and Vykoff (1980). By means of depreciation it is possible to reduce the tax base. Harumová (2002) states that enterprises create savings by amortization (depreciation) as a source of future investments. The tax base is one of the factors that affect the amount of tax. Conclusions published by Filatov (2014) state that the depreciation policy gives effect to the certain levers which affect the economy and the financial results. The choice of method of depreciation is one of the crucial elements of the accounting policy of an organization (Cohen, 1975). When designing the tax base, the depreciations have a significant influence. They constitute an expense and thus reduce the tax base. The analysis of depreciation as well as other factors affecting the tax base in case of possible introduction of the Common Consolidated Corporate Tax Base (CCCTB) was dealt by e.g. Nerudová et al. (2015) and Devereux and Lorets (2008).

2 Tax and accounting depreciation

There are accounting and tax depreciations. Accounting should be entered by the accounting depreciations which are adjusted by subjects so as to reflect the real assets amortization. Depreciation subject is the one who is entitled to depreciate the asset. The IFRS system defines depreciations as a systemic allocation of the depreciable amount of an asset over its life. The aspects of depreciation according to the IFRS are dealt by e.g. Elliot and Elliot (2013) or McKeith and Collins (2013). The IFRS are one of the tools of accounting harmonization. Barth (2008) states

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that the application of the IFRS is associated with a higher quality of accounting information and therefore it is rightful to consider the IFRS as global standards (Redmaye and Laswad, 2013).

Accounting depreciation does not affect the tax base of income taxes nor tax liability. There are various methods of depreciation dependent either on the performance of the asset or on time. The selected methods of accounting depreciation are elaborated in more details by Leiwy and Perks (2013) or Reimers (2008). In the balance sheet, the value of the original pricing is expressed in the column "gross". This amount is also the base for calculating of depreciations. Accounting depreciation according to Czech accounting regulations since 2010 allows to take into account the residual value or to use the method of component depreciation.

The nature of tax depreciation is to gradually in time transfer the entry price of assets into tax deductible costs and spendings, which affects the tax base. Due to the fact that the transfer is a gradual process, the tax base is being influenced for several years. Among the factors influencing the calculation of depreciation belongs life cycle of the asset, entry price and chosen method of depreciation (Wild, Larson and Chiappetta, 2008).

Fixed assets are, according to the Income Tax Act no. 586/1992 Coll., amended by later regulations applicable in the Czech Republic, depreciated from 3 to 50 years according to the assigned depreciation group. In total, there are 6 depreciation groups. For tax depreciation, it is possible to select progressive or linear method. In case of the progressive method of depreciation, the major part of the asset is depreciated in the early years of life cycle. The accounting depreciation and the tax depreciation should be calculated separately (Istrate, 2012). This results from the nature and diversity of accounting and tax depreciation.

While comparable rules for accounting depreciations in terms of global harmonization are regulated by the IFRS, or the US GAAP (more about the importance of the US GAAP e.g. Clor-Proell and Nelson. 2007), in the context of tax depreciation there exist the differences - different procedures in terms of the depreciation period, different number of depreciation groups or income tax rates are not often defined equally in all countries. Table 1 shows the items listed for the Czech Republic and its neighbouring countries for the year 2015.

Table 1: Income tax rate and depreciation of fixed tanglible assets

State	Rate (A) [%]	Min.period (B) [number of years]	Max. period (C) [number of years]	Price limit of fixed tangible assets (D) [EUR]
Czech Republic	19	3	50	1 480
Slovakia	22	4	40	1 700
Germany	15	4	50	150
Poland	19	4	40	810
Austria	25	4	50	400

Source: Schellekens, Ed., 2015

Table 1 illustrates differences in all analyzed countries. The lowest *nominal rate applicable to corporate income tax* (A) is in Germany, while the highest value is in Austria. Smaller differences arise with *the number of years of depreciation for assets located in depreciation group that is depreciated for the longest period* (C) and *the number of years of depreciation of tangible fixed assets which is located in the lowest depreciation group* (B). Different is also *the limit for classification of tangible asset as a long-term one in the tax perspective* (D).

One of the reasons of the differences which are demonstrated in Table 1 are the differences in national accounting systems and the consequent different methods for calculating income taxes. Harmonization of direct taxes, as stated by Wasserfallen (2014), proceeds largely only through the case-laws of the Court of Justice of the European Unionon Council Directive. The development trend of tax rates is in most countries declining (Slemrod 2004 or Devereux, Lockwood and Redoano, 2008) because the corporate tax rates affect, among other things, also the registered office of business.

3 Methodology

To achieve the objective of the paper authors used standard positivist economic methodology which also included the scientific methods of description, deduction, comparison, as well as study of legal sources and finally synthesizing methods. For specific analysis of dependency between the examined factors, the correlation analysis was used.

The mutual relation of various dependency rates is assessed by the correlation analysis (Newbold, Carlson and Thorne, 2013). One of the most commonly used indicators is the Pearson correlation coefficient r (1) which reflects the linearity degree of dependence,

$$r = \frac{\sum_{i=1}^{n}(x_i-\bar{x})(y_i-\bar{y})}{\sqrt{\sum_{i=1}^{n}(x_i-\bar{x})^2 \sum_{i=1}^{n}(y_i-\bar{y})^2}}, \quad (1)$$

where $\bar{x}$ = sample average
$\bar{y}$ = sample average

The relation (1) can be adjusted into (2),

$$r = \frac{\sum_{i=1}^{n} x_i y_i - n\bar{x}\bar{y}}{(n-1)s_x s_y}, \quad (2)$$

where s_x = Sample standard deviation
s_y = Sample standard deviation

If the value *r* is close to 0 the considered values are independent from each other. The more the value is closer to 1 the higher is the level of dependence. More about the correlation analysis e.g. Jacques (2013) or Barrow (1988).

Since the Pearson correlation coefficient is prone to outliers (Morris, 2012), the degree of dependence between the observed signs is also verified by using the Spearman correlation coefficient r_s (3),

$$r_s = 1 - \frac{6\sum_{i=1}^{n} d_i^2}{n(n^2-1)}, \quad (3)$$

where d = differences in the order of value x_i and y_i.

Interpretation of the coefficient value is the same as with the Pearson correlation coefficient.

4 Analysis and results

The input data for the analysis are shown in Table 1. The resulting values of the Pearson correlation coefficient for a selected pair of characters are demonstrated by the correlation matrix in Table 2. The calculation of the coefficient *r* was made by equation (1) and (2).

Table 2: Pearson correlation coefficient *r*

Indicator	**A**	**B**	**C**	**D**
A	1			
B	0.149403576	1		
C	-0.121987509	-0.40824829	1	
D	0.235278706	-0.477106868	-0.472643273	1

Source: own´s calculation

The strongest negative correlation is between the limit for classifying assets as long-term and the shortest possible time of tax depreciation of assets located in the first depreciation group. Similarly high degree of negative correlation was found between the limit for classifying assets as a long-term and the time of tax depreciation of assets located in the depreciation group where the assets are depreciated for the longest period. In both cases the average degree of negative correlation can be stated. It is true that one of the observed values increases and the second one decreases. A strong degree of correlation would be involved in case if the Pearson correlation coefficient acquired the value of 0.7 and higher (Buglear, 2012).

Medium degree of dependence exists also between the number of years of depreciation for assets belonging to the highest depreciation group and the number of years for assets occurring in depreciation group with the shortest depreciation period. In all other cases the coefficient results values are higher than 0.1 and lower than 0.4 which is a slight degree of positive or negative correlation.

In the case of assessing the tax rate dependence on other analyzed variables there was not detected dependence for the examined countries. Formulated authors´ research assumption mentioned in the introduction of the paper was not confirmed.

For verifying the dependence between two variables the Spearman correlation coefficient r_s determined by the relation (3) is also used. For detailed information about the calculation for verifying the dependence between the corporate income tax rate and the minimum depreciation period see Table 3.

Table 3: The Spearman correlation coefficient r_s

State	Order A (x_i)		Order B (y_i)	d_i	d_i^2
Czech Republic	2.5		1	1.5	2.25
Slovakia	4		3.5	0.5	0.25
Germany	1		3.5	-2.5	6.25
Poland	2.5		3.5	-1	1
Austria	5		3.5	1.5	2.25

Source: own´s calculation

By applying the value $\sum d_i^2$ into equation (3) the coefficient $r_s = 0{,}4$ is obtained. Between these two indicators there is a medium degree of correlation. The conclusion in this case is that the lower nominal income tax rate corresponds to a shorter period of tax depreciation of an asset classified in the lowest depreciation group.

Tables 4 and 5 show a similar analysis for assessing the number of years of assets depreciation in the highest depreciation group and limit for classifying asset as a long-term one.

Table 4: The Spearman correlation coefficient r_s

State	Order A (x_i)	Order C (y_i)	d_i	d_i^2
Czech Republic	2.5	4	-1.5	2.25
Slovakia	4	1.5	2.5	6.25
Germany	1	4	-3	9
Poland	2.5	1.5	1	1
Austria	5	4	1	1

Source: own´s calculation

Table 5: The Spearman correlation coefficient r_s

State	Order A (x_i)	Order D (y_i)	d_i	d_i^2
Czech Republic	2.5	2	1.25	1.5625
Slovakia	4	1	4	16
Germany	1	5	0.2	0.04
Poland	2.5	3	0.833333	0.694444
Austria	5	4	1.25	1.5625

Source: own´s calculation

Substituting the sum of the values d_i^2 from Table 4 into equation (3) gives r_s equal to 0.025, from Table 5 r_s becomes a value close to zero, namely 0.007. Values are close to zero and therefore these values are independent of each other.

5 Conclusion

The paper dealt with the analysis of dependencies of corporate income tax rates and selected indicators from the field of tax depreciation. These dependencies have been tested in accordance with the valid legislation of 2015 for the Czech Republic and its neighbouring countries, i.e. Slovakia, Germany, Poland and Austria. It was found that among these indicators there doesn´t exists very strong or strong correlation because the values of r and r_s did not acquire values higher than 0.9 and 0.7 in case of a strong correlation.

The highest level of dependence exists between the amount of the nominal tax rate and the shortest possible period of depreciation for assets that belong to the lowest depreciation group. An example of an asset with the shortest depreciation period is a computer. Similarly high – medium degree of dependence results from the relation of the tax rate and the shortest possible period of depreciation for assets that belong to the highest depreciation group. Example of such asset includes e.g. buildings. Research assumption defined in the introduction is therefore rejected and it can be stated that the analysed countries do not compensate the higher rate of corporate tax by "more favourable" company's depreciation policy.

There are differences in tax depreciation in all countries analyzed in this paper. Since depreciations as an expense reduce the tax base, it is appropriate to unify the way of the tax base determination. One of the ways may be the implementation of the concept of the CCCTB directive which deals with the unification of depreciation in the Chapter VI, Article 32-34 (Eur-lex, 2011). The unification of the approach would subsequently lead to the comparability of the nominal corporate income tax rate and strengthening of its informative ability and also to the

possible reduction of the differences between nominal and effective corporate income tax rate. Another effect may be the strengthening of competitiveness and cooperation in a transnational context.

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CCCTB formula apportionment: The evidence from different economic sectors

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Abstract. The allocation formula for the distribution of Common Consolidated Corporate Tax Base (CCCTB) contains three equally weighted factors, which are considered as the most accurate to reflect the profit generation process. The question in the stake is the suitability of this allocation formula for individual economic sectors. The paper analyses the ability of the allocation formula to assign the same proportion of the profit to individual economic sector in the CCCTB system as allocated under the current system of separate accounting from the perspective of the Czech Republic. Based on the performed analysis the formula apportion seems to be adequate measurement of profit generation for 7 of 19 considered economic sectors, while for 4 of them do not. The remaining economic sector suffer slight change in the assigned share on overall tax base under the CCCTB system.

Keywords: Common Consolidated Corporate Tax Base, Formula Apportionment, Distribution, And Economic Sector.
JEL Classification: F23, H25, K34

1 Introduction

After the huge political debate the European Commission launched the proposal for Common Consolidated Corporate Tax Base (hereinafter as "CCCTB") on 16 March 2011. The CCCTB system was introduced as the tool for the harmonization of corporate income tax system within the European Union (hereinafter as "EU") and it is especially addressed to multinational companies to simplify the taxation of their cross-country business activity. This simplification should be mainly based on the common definition of tax base and on common requirements of tax administration. In addition to the primary goal of the CCCTB the European Commission presented in course of its re-launch from 17 June 2015 that the CCCTB may constitute an important instrument to combat tax avoidance, especially by elimination of shortcomings of the current corporate tax system allowing the aggressive tax planning.

The idea of the CCCTB system is based on the common definition of tax base and its consolidation on the level of parent company and its further distribution to individual group members with the application of allocation formula, i.e. formula apportionment, (hereinafter as "FA"). Both the FA system as well as the design of FA were subject of comprehensive analysis of many researches, considering the main pros and cons of formulary methods as well as searching for the most effective FA for the European Union. The idea of FA system supposes that to each member group a share of consolidated tax base will be assigned. The assigned share will be derived from the share of individual member group on overall business activity of the group settled by the allocation formula factors.

According to Weiner (1999) has formula apportionment three key economic components: apportionable income (the tax base), the composition of formula and the definition of formula factors. She indicates that the exact definition of FA is unimportant, because it does not have a great revenue impact for a state. In later study Weiner (2005) proposes that formula must be internally consistent, which requires that no more than 100 percent of taxpayer's business activity is taxed, if each jurisdiction adopt a particular formula. However, the consistency requirement does not say anything about how exactly formula reflects the economic activity. This assumption is supported also by Tan (2010) stating that the most appropriate formula may not actually be the one that is most economically efficient, but that one which is the most politically feasible. As a good example of uniformity of FA system may be mentioned formulary system applied in Canada, which according to Mintz and Weiner (2003) provides a good model for the European Union, controversially the system applied by the United States shall be rather avoided by the EU.

FA system is often subject of many critics, for example Hines (2008) states that under FA the firms has incentives to manipulate their operations through mergers or divestitures. Similarly Gordon and Wilson (1986) indicate that FA creates the incentives for cross-hauling of output. On the other hand, from the beginning FA is considered as pragmatic compromise to the current system of separate accounting, which avoids the detailed examination of characteristic of particular transactions under arm's length principle and restricts the possibilities for profit shifting with the aim of tax optimization (Bird and Brean, 1986). Correspondingly, Tan (2010) concludes that the most advantage of FA is the avoidance of a great direct profit shifting and of transfer pricing problems

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with neutralizing of most transfers pricing strategies in inter-group transactions. He also terminates that actual distortion generated by FA depends heavily on the choice of formula factors. With respect to the right choice of formula factors McLure (1980) argues that is better to use immobile factors (labour), which are considered to be low tax sensitive rather than more tax sensitive mobile factors (capital) in allocation formula.

The European Union's choice for three-factor formula is supported by the experiences of Massachusetts formula commonly used in the United States. As stated by Tan (2010) the states have not chosen this formula, since it is considered to be the "right" one in all cases, but only because it is a simple formula that fairly reflects a very large share of the value-generating activity while retaining a simplicity that is lacking in formulas that attempt to measure income more precisely. The structure of the proposed allocation formula by the CCCTB Draft Directive is presented below by equation:

$$ShareX = \left(\frac{1}{3} \frac{Sales^{X}}{Sales^{group}} + \frac{1}{3} \left(\frac{1}{2} \frac{Payroll^{X}}{Payroll^{group}} + \frac{1}{2} \frac{No\_of\_employees^{X}}{No\_of\_empolyees^{group}} \right) + \frac{1}{3} \frac{Assets^{X}}{Assets^{group}} \right) * Con'd\_Tax\_Base \quad (1)$$

where a share of group company member X on the common consolidated corporate tax base is determined as its share on the overall volume of sales, tangible fixed assets and labour, derived from the combination of payroll costs and number of employees.

The assets factors will be computed on the average amount of tangible fixed assets, which is owned or leased by a group member, respectively by company group. The tangible fixed assets will be assigned to its economic owner; the leased assets will be assign to both - lessor and lessee. The labour factor is constituted as the combination of payroll costs and number of employees working for a respective group member. The definition of employee will derived from the definition of employee of a Member State on which territory a respective employee performs her/his activity. Payroll costs will consist of all payments that are deductible as expense, including employees' benefits and social contributions. The sales factor will set as the sum of revenues from sales of goods and services decreased by warranty claims and rebates, where the revenues will be attributed to the state of dispatch or transport of goods, i.e. under application of destination principle, in case of services to the state on which territory the services are carried out.

The CCCTB allocation formula differs from Massachusetts formula in splitting of the labour factor in other two equally weighted factors. This deviation should reflect the different wage levels in western and eastern EU countries and at same time reflect the costs on employees in their relation to exact number of employees. According to Petutchnig (2010) the core of application these two + two apportionment factors is that these are able to reflect all stages of profit-making process of the company group. The sales factor represent the demand side of this process while the factors labour and assets represent the supply side. These two phases are also observable in the determination of pre-consolidation income of a group member as the results of difference of revenues and expenditures.

The aim of the paper is to analyze the design of the CCCTB allocation formula from the perspective of the Czech Republic under the sense of its explanatory power with special focus on the examination of the effect of introduction of the CCCTB system and its allocation formula in different economic sectors.

2 Data and methodology

With regard to the objective of the paper to analyze the effect of the introduction of the CCCTB system from the perspective of the Czech Republic only the data of group companies, with any relation to the Czech Republic were considered. All data referred to calendar year 2013 and were taken over from the Amadeus database, namely version no. 2442 from 22 January 2015.

Only the data of group companies fulfilling the two-tier eligibility test set by the CCCTB Draft Directive, namely by Article no. 54, were employed. The two-tier test is based on the criterion of ownership with a threshold of higher than 75% share on capital, criterion of control with requirement of higher than 50% proportion on voting rights and higher than 75% share on rights giving the entitlement to profit. The considered group companies were parent companies resident in the Czech Republic and their subsidiaries settled in EU. Further, the data of EU resident parent companies having at least one subsidiary settled in the Czech Republic were included in the data sample.

The primary dataset contained the information about profit/loss before taxation of individual companies, which was considered as a proxy of the tax base, information about the scope of their economic activity indicated by the NACE classification, the information about the volume of operating turnover, which was considered as a proxy for the sales factor. Further, the details about number of employees and related payroll costs and information about the volume of tangible fixed assets were accessed. All financial data were converted in thousands EUR. Lastly the information about ownership structure of group companies, their tax residency and Bureau van Dijk Identification number were also obtained.

The necessary requirement on the primary dataset was that each company needs to have available information about volume of tangible fixed assets and NACE code. The fulfilling of this criterion was necessary for further calculation of missing values in the primary dataset, which of structure is observable in Table 1.

In addition to above mentioned primary dataset also the supporting dataset containing the data of group companies eligible for the application of the CCCTB system in the whole EU was obtained. The data in the supporting dataset also referred to calendar year 2013 and contained the same information about each individual company as required for primary dataset (see above). The supporting dataset was used for the imputation of the missing values in the primary dataset. The supporting dataset contained the values of 153,012 companies resident in the EU, from which 48,101 companies were parent companies and 104,911 were their subsidiaries. Missing values of operating turnover, i.e. sales factor, were computed on the basis of 142,031 available values in the supporting dataset. For computation of assets factor were accessible 152,363 values. Labour factor were calculated based on 106,213 available values of costs on employees and 93,583 values of number of employees.

Table 1: Structure of the primary dataset

Country code	Country name	Number of parent companies	Number of subsidiary companies	Total number of companies
AT	Austria	48	255	303
BE	Belgium	31	504	535
BG	Bulgaria	1	0	1
CY	Cyprus	1	1	2
CZ	Czech Republic	1,097	2,442	3,539
DE	Germany	86	278	364
DK	Denmark	15	132	147
EE	Estonia	0	71	71
ES	Spain	13	554	567
FI	Finland	18	215	233
FR	France	46	1,213	1,259
UK	United Kingdom	68	1,287	1,355
GR	Greece	1	82	83
HR	Croatia	2	0	2
HU	Hungary	3	285	288
IE	Ireland	5	41	46
IT	Italy	41	749	790
LT	Latvia	0	20	20
LU	Luxembourg	0	21	21
LV	Lithuania	1	69	70
MT	Malta	1	1	2
NL	Netherlands	57	367	424
PL	Poland	21	319	340
PT	Portugal	1	132	133
RO	Romania	1	0	1
SE	Sweden	32	318	350
SI	Slovenia	7	79	86
SK	Slovakia	44	398	442
Total		**1,641**	**9,833**	**11,474**

Source: Amadeus database, version 2442, 15 January 2015, adjusted

The methodology for missing data imputation was applied similarly as by Cline et al (2010) and by Nerudová et al (2015) According to the them the missing values are counted based on the predefined relationships of the factor variables included in the CCCTB allocation formula (1).

Firstly the supporting dataset was into two sub-datasets according to residency country of a company. The first sub-dataset covered companies resident in first fifteen founding EU Member States[*] and the second contained companies resident in remaining thirteen states[†]. The supporting dataset was further divided according to the sector of economic activity of a respective company.

The imputation coefficients were calculated according to below stated equations.

$$OPT\_imputation\_coefficient = \frac{average\_OPT}{average\_TFA} \tag{2}$$

$$NoE\_imputation\_coefficient = \frac{average\_NoE}{average\_TFA} \tag{3}$$

[*] Austria, Belgium, Germany, Denmark, Spain, Finland, France, United Kingdom, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Sweden.

[†] Bulgaria, Cyprus, Czech Republic, Estonia, Croatia, Hungary, Latvia, Lithuania, Malta, Poland, Romania, Slovenia, Slovakia.

$$CoE\_imputation\_coefficient = \frac{average\_CoE}{average\_NoE} \quad (4)$$

The imputation coefficients for sales factor (2) were calculated as the ratio of average value of operating turnover (OPT) to average value of tangible fixed assets (TFA) of companies with both published values. Imputation coefficients for number of employees (3) were calculated as the ratio of average number of employees (NoE) to average value of tangible fixed assets (TFA) of all companies with both published values. And similarly, the imputation coefficients for costs on employees (4) were calculated as the ratio of average costs on employees (CoE) to average number of employees (NoE). The computation of imputation coefficient for assets factor was not necessary, since there was no missing value in primary dataset. The missing values were further computed according to relations stated in equations (5), (6) and (7).

$$MISSING\_OPT = OPT\_imputation\_coefficient * known\_TFA \quad (5)$$

$$MISSING\_NoE = NoE\_imputation\_coefficient * known\_TFA \quad (6)$$

$$MISSING\_CoE = CoE\_imputation\_coefficient * known\_NoE \quad (7)$$

In line with the objective of paper the overall tax base were calculated and further allocated among the individual EU Member States under the current system, i.e. according to the rules for calculation of the tax base of group companies applicable in 2013, and in the CCCTB system, where the total tax base of a respective group company was distributed among individual member with the application of allocation formula as stated above (1).

With respect to the allocation of the group tax bases in current system it is possible to distinguish between three groups of states: Firstly there is the group of states in which any group consolidation scheme is applicable, these are: Belgium Bulgaria, Czech Republic, Croatia, Estonia, Finland, Greece, Hungary, Slovakia, Slovenian and Romania. Further, the second group of states where the tax loss offsetting scheme may be applied for group companies these are: Ireland, Latvia, Sweden and United Kingdom. And lastly the group of states in which tax consolidation scheme is applicable may be identified, these states are: Austria, Denmark, France, Germany, Italy, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal and Spain.

In accordance with the objective of the paper, the analysis of the explanatory power of allocation formula (1) in separate economic sectors were also performed. The analysis of the explanatory power was based on the comparison of coefficients of determination, indicating the proportion of explained variability, of arranged regression models as previously analyzed by Roggeman et al (2010), Krchnivá, Nerudová (2015) or Krchnivá (2015). The data set previously applied for the computation of missing values was used for the analysis of the explanatory power of formula factors However, necessary adjustments of this dataset needed to be done. Firstly, only the companies with the available information of all formula factors were selected. Secondly, extreme values under of 1% and above of 99% percentile were eliminated. The final dataset were further divided in to sub-datasets according to sector of economic activity classified by NACE codes at the first stage. The structure of the dataset for the analysis of explanatory power can be seen in Table 2.

As was already mentioned above, the analysis of the explanatory power was preformed based on the comparison of coefficients of determination of estimated restricted and unrestricted multivariate linear regression models. The proposed multivariate regression model was as follows:

$$PL_n = \beta_0 + \beta_1 CoE_n + \beta_2 NoE_n + \beta_3 TFA_n + \beta_4 OPT_n \quad (8)$$

where the PL_n considers profit/loss before taxes as the dependent variable which is explained by four independent variables, i.e. payroll costs (CoE), volume of tangible fixed assets (TFA) and operating turnover (OPT) or number of employees (NoE).

The restricted regression model supposes that the explanatory power of the independent variables in the model is equally weighted and therefore this model shall accurately reflect the structure of the CCCTB allocation formula. The parameters of the proposed multivariate regression models were estimated by Ordinary Last Squares method. All considered regression models were tested by F-test analyzing the statistical significance of the proposed regression model. All observed regression models were statistically significant on the 1 % significance level. Further all obtained adjusted coefficient of determination were tested for the statistical significance; these were also statistically significant on 1 % significance level.

Table 2: Structure of dataset for analysis of formula factors explanatory power

Code	Description	Details (first two digits)	Number of subjects	% proportion
A	AGRICULTURE, FORESTRY AND FISHING	01-03	896	1.14
B	MINING AND QUARRYING	05-09	534	0.68
C	MANUFACTURING	10-33	17,963	22.87
D	ELECTRICITY, GAS, STEAM AND AIR CONDITIONING SUPPLY	35	758	0.96
E	WATER SUPPLY; SEWERAGE, WASTE MANAGEMENT AND REMEDIATION ACTIVITIES	36-39	783	1.00
F	CONSTRUCTION	41-43	5,779	7.36
G	WHOLESALE AND RETAIL TRADE; REPAIR OF MOTOR VEHICLES AND MOTORCYCLES	45-47	17,358	22.10
H	TRANSPORTATION AND STORAGE	49-53	3,770	4.80
I	ACCOMMODATION AND FOOD SERVICE ACTIVITIES	55-56	2,590	3.30
J	INFORMATION AND COMMUNICATION	58-63	4,786	6.09
K	FINANCIAL AND INSURANCE ACTIVITIES	64-66	4,049	5.15
L	REAL ESTATE ACTIVITIES	68	2,830	3.60
M	PROFESSIONAL, SCIENTIFIC AND TECHNICAL ACTIVITIES	69-75	8,043	10.24
N	ADMINISTRATIVE AND SUPPORT SERVICE ACTIVITIES	77-82	4,583	5.83
O	PUBLIC ADMINISTRATION AND DEFENCE; COMPULSORY SOCIAL SECURITY	84	34	0.04
P	EDUCATION	85	471	0.60
Q	HUMAN HEALTH AND SOCIAL WORK ACTIVITIES	86-88	1,693	2.16
R	ARTS, ENTERTAINMENT AND RECREATION	90-93	902	1.15
S	OTHER SERVICE ACTIVITIES	94-96	727	0.93
T	ACTIVITIES OF HOUSEHOLDS AS EMPLOYERS; U0NDIFFERENTIATED GOODS- AND SERVICES-PRODUCING ACTIVITIES OF HOUSEHOLDS FOR OWN USE	97-98	4	0.01
U	ACTIVITIES OF EXTRATERRITORIAL ORGANISATIONS AND BODIES	99	6	0.01
			78,559	**100.00**

Source: Amadeus database, version 2442, 15 January 2015, adjusted

The obtained results indicating the explanatory power of formula factor in each economic sector were further used for the analysis of the effect of introduction of the CCCTB system with special focus on the change of the distributed share of the overall tax base to different economic sectors, which may provide the evidence about the suitability of the allocation formula in practice.

3 Results and discussion

The paper analyzes the distribution of group tax base in the CCCTB system from the perspective of the Czech Republic with special focus on the analysis of the change in distributed share on overall tax base to single economic sectors searching for the evidence of suiTable design of the CCCTB allocation formula. This analysis is further accompanied by the analysis of explanatory power of formula factors based on the comparison of adjusted coefficients of determination of multivariate regression models. The considered multivariate regression models assumed that the dependent variable profit/loss of a respective company is explained by four independent variables, i.e. by volume of operating turnover, volume of tangible fixed assets, number of employees and related costs on employees. As mentioned before, linear links between dependent and independent variables were considered. Except of the unrestricted regression model, where the weight of independent variables is not defined, the restricted regression model was also applied. The restricted regression model assumes that the independent variables are equally weighted in the model, which may better reflect the structure of the CCCTB allocation formula. The results of the analysis of explanatory power of allocation formula for the whole data sample as well as for individual economic sectors are observable in Table 3.

As is obvious from Table 3 no analysis were performed for economic sectors T a U, since extent of the sub-data samples was not sufficient. The explanatory power of allocation formula regardless the economic sector amounts to 28 % in case of unrestricted regression model, while in case of restricted regression models amounts to 26 %. The obtained results are lower in comparison with Krchnivá and Nerudová (2015). The difference is caused by the extent of the analyzed data sample as well as by the character of company's data, since the data of independent companies were applied in their analysis.

The largest proportion of variability is explained by the allocation formula in NACE sector O in case of unrestricted regression model, namely by 94 %, however this outcome is questionable by obtained result for restricted regression model where the proportion of explained variability amounts only to 39 %. The results may be distorted by the extent of the sub-data sample. The highest proportion of variability is explained in NACE sector Q, P and S, while the lowest proportion of variability is explained in NACE sector I, K and R.

Table 3: Explanatory power of formula factors in economic sectors

Economic sector	Number of observation	Unrestricted regression model		Restricted regression model	
		adj R2	F-statistics	adj R2	F-statistics
All NACES	78,559	0.2788	7,591.87	0.2632	28,057.11
A	896	0.3418	117.20	0.3253	432.52
B	534	0.3457	71.41	0.3742	284.43
C	17,963	**0.4096**	3,116.57	**0.3990**	11,927.74
D	758	0.2313	57.93	**0.1367**	120.92
E	783	0.3906	126.32	0.3829	486.14
F	5,779	0.3698	848.78	0.3516	3,134.57
G	17,358	0.2956	1,821.82	0.2614	6,142.51
H	3,770	0.2614	334.48	0.2599	1,324.84
I	2,590	**0.0616**	43.47	**0.0523**	143.83
J	4,786	0.2511	402.00	0.2488	1,585.94
K	4,049	**0.1813**	225.11	**0.1373**	645.50
L	2,830	0.2526	240.08	0.1992	704.88
M	8,043	0.2114	539.81	0.2015	2,030.38
N	4,583	0.2149	314.61	0.2104	1,222.08
O	34	**0.9405**	131.48	**0.3918**	22.26
P	471	**0.4944**	115.90	**0.4575**	397.42
Q	1,693	**0.6254**	707.21	**0.5557**	2,116.94
R	902	**0.1222**	32.36	**0.0802**	79.52
S	727	**0.4679**	160.63	**0.4647**	631.13
T	4	-	-	-	-
U	6	-	-	-	-

Source: own adaption in STATA

The obtained results about the proportion of explained variability were further analyzed in context of distributed proportion of the overall tax based to individual economics sectors. The analysis was performed under the hypothesis that the sufficient explanatory power of allocation formula is indicated by insignificant change in distributed share on overall tax base. This hypothesis was verified for each economic sector with the aim to prove suiTable disposition of the allocation formula for this sector.

The analysis was performed for the data sample of group companies which are eligible for the CCCTB system and have any link to the Czech Republic, i.e. these are Czech resident parent company or Czech resident subsidiary of an EU parent or Czech parent company. The details about assigned proportion on the overall tax base in current system and in the CCCTB system can be seen in Table 4. Since the paper focuses on the comparison of aggregated share of the tax base to individual economic sectors, the details about distributed proportion among individual EU Member States are the subject of further research.

Based on the comparison amount of overall tax base in current system and CCCTB system in Table 4, it can be seen that the amount of overall tax base in the CCCTB system slightly decreased (by 3.89 %) in considered dataset. This reduction is caused by the application of the loss-offsetting scheme in the CCCTB system. However, our model is based on the assumption that in all economic sectors loss-making companies are operating and therefore the reduction of the tax base assigned to each economic sectors is uniform.

Under this assumption it can be concluded that in NACE sector O, P and Q there is no change in the proportion of distributed tax base when CCCTB would be implemented. While the results for NACE sectors P and Q are consistent with the outcome of previous analysis step, in case of NACE sector O the obtained results are questionable due to extent of the sub-data sample. Further, very slightly, less than 0.05 %, change in the assigned proportion of the tax base was obtained for NACE sectors A, E, F, L and R. While in NASE SECTORS A, E, F the gained results may be supported by the outcomes of the first analysis step, i.e. by the evidence of explanatory power of allocation formula higher than 30 % for both unrestricted and well as restricted models, the results for NACE sectors L and R are inconsistent with conclusion of the first research stage, since in case of NACE sectors L the proportion of explained variability amounts to 19.92 %, while in NACE sector R just to 8.02 %. This inconsistency maybe be caused by the character of economic sector, in which the generated profit may be more affected by the demand of consumers than by amount of assets or number of employees.

On the other hand, the most significant change in the distributed proportion of the tax base was indicated in NACE sectors C, M and B. The outcomes for NACE sector M may be supported by the results of the analysis of explanatory power indicating the explained proportion of variability amounting to 20.15 %. The proportion of explained variability in NACE sector C and B ranges to 39.90 %, respectively to 37.42 %. These inconsistency is caused by the fact, that even if the allocation formula is able to explain high percentage of variability the continuing manufacturing and mechanization process of industries, it may require inclusion of a higher weight to assets factor in allocation formula.

Table 4: The comparison of distributed share on overall tax base in current and CCCTB system

	Number of subjects	Current system		CCCTB system		Change CCCTB vs. CS
ALL NACES	11,474	385,427,895.48	100.00%	370,438,497.37	100.00%	0.00%
A	118	647,307.62	0.17%	666,755.17	0.18%	0.01%
B	143	33,305,546.72	8.64%	42,583,923.63	11.50%	2.85%
C	2,388	88,703,849.01	23.01%	154,253,900.22	41.64%	18.63%
D	370	4,983,691.11	1.29%	3,562,331.50	0.96%	-0.33%
E	139	170,844.77	0.04%	319,453.65	0.09%	0.04%
F	531	5,279,413.08	1.37%	5,231,892.36	1.41%	0.04%
G	2,581	17,717,643.62	4.60%	34,704,870.06	9.37%	4.77%
H	414	4,210,453.99	1.09%	6,662,832.08	1.80%	0.71%
I	249	868,936.50	0.23%	1,086,620.71	0.29%	0.07%
J	517	21,291,187.83	5.52%	19,956,812.93	5.39%	-0.14%
K	755	46,806,581.29	12.14%	13,631,804.90	3.68%	-8.46%
L	879	1,155,066.15	0.30%	1,135,339.97	0.31%	0.01%
M	1,476	149,780,255.88	38.86%	81,227,942.99	21.93%	-16.93%
N	671	9,588,267.88	2.49%	4,773,379.83	1.29%	-1.20%
O	3	472.87	0.00%	107.24	0.00%	0.00%
P	63	2,198.78	0.00%	9,492.57	0.00%	0.00%
Q	68	348,632.29	0.09%	320,161.17	0.09%	0.00%
R	42	6,418.75	0.00%	52,906.56	0.01%	0.01%
S	66	536,294.58	0.14%	245,537.92	0.07%	-0.07%
T	1	24,832.76	0.01%	12,431.91	0.00%	0.00%

Source: own adaption in STATA

According to the CCCTB Draft Directive the special definition of formula factors will be applied for some specific economic sectors, for example for financial and insurance institutions, for oil and gas extraction and marine transport. The arrangement of the special definition of formula factors for financial and insurance institutions may be supported by the obtained results for NACE sectors K since the distributed share on the overall tax base in the CCCTB system decreased by 8.46 % as is clearly visible from Table 4. The special definition of formula for oil and gas extraction and marine transport is not justifiable by performed analysis, since the detailed examination of NACE sectors B and H would be necessary.

4 Conclusion

The aim of paper was to analyze the suitability of the CCCTB allocation formula for the distribution of the group tax bases in separate economic sectors. The analysis was performed from the perspective of the Czech Republic and provides the evidence of suitability of allocation formula to explain and therefore minimize the change in the assigned share of the tax bases to separated economic sectors in the CCCTB system. While results of explanatory power of allocation formula are supported by the outcomes of the comparison of distributed share on the tax base to NACE sectors Q, P, E, F, A, M and K, the results for NACE sectors R, L, C and B are not in the line with each other. This discrepancy may be explained by specific characteristic of these sectors, which are for example human element, customer's demand in case of NACE sectors R and L or a higher level of mechanization in NACE sectors C and B. The research performed above revealed the necessity of further research in the area the analysis of the different setting of allocation formula and its impact on distributed proportion of the tax base to separate economic sectors.

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Classification of Tax Systems of European Union Countries according to Tax Mix in 2012

Květa Kubátová* – Martin Štefanský†

Abstract The paper deals with the typology – classification – of tax systems of 28 member countries of the EU in 2012 by applying variables of the tax quota and tax mix (shares of particular taxes in GDP). It is the first article of this kind because other similar typologies focused either on the OECD countries or on the Eurozone. The Eurostat data about 10 variables of shares of tax revenues in GDP is used and after applying the cluster analysis, 5 typical tax structures were found out. Nevertheless, the general opinion that 15 original EU countries have a different tax structure than new member countries (post-communist countries) was not confirmed.

Key words: tax systems in EU, classification of tax systems, tax mix in EU countries, tax clusters

Jel Classification: H20

1 Introduction

The common tax policy (later the tax policy of the European Union) has interfered with the unwillingness of member countries to adjust own tax systems to the common model since the European Community was founded. The effort to harmonize taxes in this area has completely no effect as regards direct taxes and results of indirect taxes are unconvincing. Tax bases and ways of tax collecting are harmonized in case of these taxes but tax rates differ often significantly in member countries.

The common EU market is represented by various tax systems whereas some are more similar than the other ones. If it is possible to find some typical tax systems – clusters – within the EU, this knowledge may be used for more effective mutual convergence of such clusters. Even intergroup differences are a big obstacle to general convergence.

The presented paper follows up on results of the bachelor thesis (Štefanský, 2016) where the typical clusters of the EU tax systems were created by the method of a cluster analysis. The paper finds more accurate specifications of found clusters.

The paper is organized as follows. The overview of present literature concerning the typology of tax systems in the EU by means of the cluster analysis is followed by the description of data and applied methodology. This is followed by results of the analysis and their evaluation.

2 Literature Review

The literature concerning the typology of tax systems by means of the cluster analysis dates back to 1991 when the work of Guy Peters (Peters, 1991) was published. However, only a few studies dealing with this issue have been published since that time. We can mention the work of Kubátová, (2012), Delgado (2009), Lazăr (2014) from the recent time.

Delgado (2009) clustered together the OECD countries according to five tax variables, including the share of income taxes, taxes from goods and services and from social security contributions in the total tax revenue in 1965 and 2005. The biggest seven-member group is a group of continental countries with the dominant social security contribution, the remaining seven countries are divided into other four groups of 1 up to 3 countries. The summary of results is again slightly problematic due to the fragmentation into very small clusters.

Kubátová (2012) clustered together 34 OECD countries according to the variable tax quota and other six variables of the tax mix according to the structure of OECD statistics. Typical groups are created in this typology of the OECD countries as in case of Peters (1991).

Lazăr (2014) has made the cluster analysis for the Eurozone countries recently. However, it has limited the research to a smaller number of countries, more or less unfounded. Taxes in particular countries are the result of economic-political and culture-historical factors. It has not been possible yet to find proofs of tax specifications in the Eurozone in literature. The before mentioned cluster analysis also do not denote to the fact that the Eurozone would be a specific area of taxation.

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Lazăr (2014) analysed the data of the Eurozone countries and Romania concerning the total revenue, direct taxation, indirect taxation and social security contribution during 2000 – 2011 in the above cited article. In 2011, she created the following six groups:

- C1: Austria, Belgium, Italy, France
- C2: Cyprus, Malta, Estonia, Luxemburg
- C3: Finland
- C4: Germany, Netherlands
- C5: Ireland, Greece, Slovenia, Portugal
- C6: Romania, Slovakia, Spain

Six typical groups were confirmed also in previous years of the analysis. However, there have been some slight reorganizations in the course of time.

The above quoted mentioned authors concentrated also on the stability of clusters in time (it was the main goal of some authors' analyses). Clusters of countries according to particular types of tax systems seem to be quite sTable in time. The mentioned analyses confirm that there are several types of tax systems in the EU, in the OECD as well as in the Eurozone. These groups are very sTable if the stability of typology in time is also reviewed. There are only sporadic transfers of countries from one group to another one.

3 Data and Methodology

The cluster analysis made in this text is based on the Eurostat data published annually in the report *Taxation trends in the European Union* (Eurostat, 2014). The applied data concerns 28 member countries in 2012 (including Croatia as the last accepted member since 1st July 2013). For the purpose of the cluster analysis, variables were selected based on the categorization of taxes according to ESA95.

The Chart No. 1 contains descriptive statistics. All indexes are expressed as a share of tax revenues in GDP in %.

Table 1: Descriptive statistics – tax revenues as percentage of GDP in 28 EU member states in 2012*

Summary statistics:

Variable	Observations	Obs. with missing data	Obs. without missing data	Minimum	Maximum	Mean	Std. deviation
VAT	28	0	28	5,5	12,3	7,9	1,4
ED&CT	28	0	28	2,1	5,1	3,2	0,8
OToP (ID incl.)	28	0	28	0,3	4,2	1,2	0,9
OTP	28	0	28	0,3	6,2	1,6	1,4
PIT	28	0	28	2,6	24,5	7,8	4,7
CIT	28	0	28	1,1	6,3	2,6	1,3
OIT&CT	28	0	28	0,0	3,1	0,9	0,7
PT	28	0	28	0,3	4,1	1,4	1,0
SSC	28	0	28	0,9	17,0	11,1	3,9
TQ (SSC incl.)	28	0	28	27,2	48,1	36,3	6,2

Source: Eurostat (2014), self-processed in XLSTAT, k-means clustering

Note: * VAT- value added tax; ED&CT- excises and other consumption taxes; OToP (ID incl.)- taxes on products, except VAT and import duties, excluding excise duties; OTP- Other taxes on production; PIT- personal income tax; CIT- corporation income tax; OIT&CT- other income and capital taxes; PT- property taxes; SSC- social security contributions; TQ (SSC incl.)- tax quota including SSC.

The cluster analysis is defined as a non-parametric method which classifies objects into various groups or clusters so that intragroup variabilities are minimum and intergroup variabilities are maximum ones.

The cluster analysis in this paper was made by a non-hierarchical method when applying the hard clustering, so-called *k-means clustering*. XLSTAT, a software package of statistical and analytical functions in the add-in form for the Microsoft Excel*, was chosen as an instrument.

4 Results of Cluster Analysis

The Table 2 contains final clusters with marked central objects.

* You can find more details on the procedure of clusters´ specifications in Štefanský (2016)

Table 2: Results of cluster analysis

Results by class:					
Class	1	2	3	4	5
Objects	5	6	9	6	2
Sum of weights	5	6	9	6	2
Within-class variance	14,168	18,860	21,628	16,294	85,366
Minimum distance to centroid	2,461	1,265	1,856	2,357	6,533
Average distance to centroid	3,258	3,470	4,187	3,545	6,533
Maximum distance to centroid	4,392	6,954	6,024	4,735	6,533
	Austria	Bulgaria	Croatia	Czech Republic	Denmark
	Belgium	Ireland	Cyprus	Germany	Sweden
	Finland	Latvia	Estonia	Hungary	
	France	Lithuania	Greece	Luxembourg	
	Italy	Romania	Malta	Netherlands	
		Slovakia	Poland	Slovenia	
			Portugal		
			Spain		
			United Kingdom		

Zdroj: Eurostat (2014), self-processed in XLSTAT, k-means clustering

Based on the Chart No. 2 we may characterize clusters 1 – 5 as follows:

- Cluster 1: Advanced countries of the continental Europe. Countries in this cluster belong to the original 15 EU countries, they are very advanced countries. They are distinguished by a relatively high total tax burden; mainly direct taxes, especially property and income taxes and also social security contributions, are very high.
- Cluster 2: Former socialist republics and Ireland. They are distinguished by the lowest tax burden as compared to other groups. The burden is oriented to the most significant revenue-related types of indirect taxes (VAT and consumption taxes) and focused on social security contributions.
- Cluster 3: Varied community. It is a relatively disparate group of countries of the Iberian Peninsula, Mediterranean countries, countries onshore of the Baltic Sea and United Kingdom. Generally, the focus on indirect taxes (VAT and consumption taxes) may be confirmed in this cluster. Nevertheless, the diversity of tax policies of these countries determines the values of other variables as average ones, i.e. without any extremes which would specify the identification.
- Cluster 4: Bismarck heritage. This cluster includes former socialist countries, Benelux countries and Germany, with huge systems of social security (chancellor Bismarck introduced first mandatory social security contributions in Prussia at the end of 19th century). These countries are distinguished by the emphasis on social security. The indirect taxation is also high but direct taxes and the total tax quota are average.
- Cluster 5: Northern Welfare States. Countries in this group are subject to the highest total taxation, high income taxes which represent very joint social security.

5 Summary

The paper concentrates on the classification of tax systems of the EU countries in 2012 by means of the cluster analysis. It is the first cluster analysis concerning exclusively member countries of the EU. The analysis was made based on the Eurostat data for 28 member countries. 10 variables with shares of selected taxes in GDP were chosen based on the tax categorization according to ESA95.

The calculation was made by the non-hierarchical method of cluster analysis when applying the hard clustering, so-called *k-means clustering*.

The results show that we may define 5 clusters of countries with similar tax systems in the European Union, which differ sufficiently from other clusters. Except for the first and fifth cluster (the first cluster contains countries with high taxes, mainly direct ones, and the fifth cluster contains rich northern countries with a joint system), clusters contain always countries of the original EU-15 as well as new member countries. This indicates that the traditional diversification of tax systems of the EU countries in original and new member countries is at least simplification.

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Administrative costs of local fees. Case study of the South Moravian Region

Lenka Matějová*

Abstract. Local fees represent independent agenda of municipalities in which they have so called revenue autonomy. They decide on fees, rates, and taxpayers, ideally while respecting criteria of efficiency, effectiveness and responsiveness. It can be difficult in small municipalities (up to 1 000 inhabitants) in the Czech Republic. They do not have the possibility to collect local fees as municipalities up to 5000 inhabitants (number of taxpayer, culture and accommodation facilities etc.). But, as analysis has showed, the costs of this agenda are very similar to the costs of larger municipalities. The aim of this paper is to determine the relative costs of collecting local fees in municipalities of the South Moravian Region and to discuss factors which can influence the results of analysis. Relative costs are the ratio between administrative costs to collection of local fees and revenue of local fees. Their amount is significant influenced by operation (fixed) costs of municipal office (authority), fee rate, number of taxpayers and real time that employees spend with this agenda.

Keywords: municipality, administrative costs, local fees, economies of scale, South Moravian Region, Czech Republic
JEL Classification: H71, H72

1 Introduction

In the Czech Republic, the municipalities are the lowest level of the government. Their main issues are territorial development and public services provision according the principle of subsidiarity (Nemec, 2010). The degree of decentralized service provision requires similar degree of revenue autonomy. The Czech municipalities are funding through "own" revenues and transfers. Transfers are primarily used for exercise of delegated powers. "Own" revenues of municipalities are mainly tax revenue (about 60 percent of total revenue), non-tax, capital and other revenues. Tax revenues include a share of income of national taxes, income of property tax and municipal and administrative fees. The municipalities do not have an opportunity to influence their share on national tax revenue. They can only modify coefficients of property tax. Local fees are only income for which the Czech municipalities have revenue autonomy.

However, local fees have minimal revenue potential (Binek et al. 2008) and moreover, revenues from local fees should be further reduced by costs necessary to collection of the fees. For this reason municipalities should try to follow criteria of efficiency, effectiveness and responsiveness in collection of the fees to obtain maximum income from them. It can be a problem, especially at the level of the smallest municipalities (up to 1 000 inhabitants), which are 77.5 percent of all municipalities in the Czech Republic. In these municipalities the costs of collecting and administration of local taxes can exceed revenue because the local governments only collect two or three local fees, and (or) they do not have culture, accommodation facilities or have small number of taxpayers. They have to pay salaries to employees who dealing with agenda of local fees and fixed costs of the municipal offices. Thus total costs of the smallest municipalities are very similar as in larger municipalities (up to 5 000 inhabitants). This situation can create mismatch between the amount that the municipality collects and the amount that can be used for public interest by municipality (Prud'homme, 1995).

This paper aims to identify the relative administrative costs of local fees, specifically for municipalities up to 5 000 inhabitants in the South Moravian Region. The results show one of the ways how to measure the effectiveness of collecting of local fees. Based on the results the paper discusses what factors influence administrative costs.

Costs associated with the existence of local taxes can be divided into two groups – administrative costs and induced costs. Administrative costs are mainly incurred by municipalities (legislative activity, collecting and management of local fees and recovery of arrears) but also by central government (legislative activity, financial control, etc.). Induced costs are incurred by payers of local fees (time, bank transfer, etc.). This analysis focuses only on administrative costs of municipalities, namely costs arising from collecting and administration of local fess. Study abstracts from the costs arising on the part of central government and costs related to recovery of arrears. They are not regular and only represent a departure from the normal state.

List of local fees, rules for collection and upper and lower limits of rates of local fees are regulated by Act No. 565/1990 Coll., on local fees. The municipalities are responsible for assessment, collection, enforcement,

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inspection and first level appeals for these fees. (Kubátová et al., 2000). The municipalities can levy dog fees, fee for municipal waste disposal, resort and recreation fees on visitors, tax on use of public space, fees on entry tickets, fees on recreational units, motor vehicle entry fees, and fee for the improving of building land on the basis of municipal ordinance. Until 2012 municipalities levied fee for a gambling machine.

Czech and other studies mainly deal with administrative costs of national taxes (Kubátová et al., 2000; Pudil et al, 2004; Mikesell, 2007; Andrlík, 2010; Andrlík, 2013). An analysis of the administrative costs of local taxes was conducted in 2004. Pudil et all. (2004) found that administrative costs of local fees exceed revenues in small municipalities (up to 400 inhabitants). However, the analysis suffered from a lack of detailed data and small sample of the municipalities.

2 Material and Methods

Analysis method is based on study of Pudil et al. (2004) and uses the coefficient of labor utilization *(K)*. *K* determines the percentage of working time of employee that employee spends with agenda of local fees. It is used as a conversion factor for total costs incurred on the agenda of local fees at the municipal office (authority). Data are collected for the year 2014, research was conducted in 2015. Information about local fees revenues were obtained from information portal MONITOR of Ministry of Finance of the Czech Republic. Data that cannot be obtained from a public database were obtained by internet based survey. There are the number of employees dealing with agenda of local fees and other agendas and activities at the municipal office (authority), their average salary, and the coefficient of labor utilization.

Total administrative costs *(TCA)* contain labour costs *(N_m)* and operating costs *(N_o)* of the municipal office (authority):

$$TCA = N_m + N_o \quad (1)$$

Labour costs include super-gross salaries of employees dealing with the agenda of local fees, employees dealing with other agendas in delegated and independent power and carrying out supportive activities for first group of employees; and the salaries of overhead employees of municipal office (authority). Their activities have nothing to do with local fees. Labor costs were adjusted according to number of employees in individual agendas and were recalculated by coefficient *K*.

Operating costs consist non-investment costs of municipal office (authority). After consultation with accountants and employees of selected municipalities following items of municipal budget were included among operating costs: 5137 – small tangible fixed assets; 5151 – 5155 - water, heat, electricity, solid fuels; 5157 – domestic hot water; 5161 – postal services; 5162 – telecommunication and radio-communication services; 5163 – services of financial institutions; 5168 – data processing and services related to information and communication technologies; 5172 – software. The sum of operating costs was divided among all employees of the municipal office and recalculated by coefficient *K*.

Total administrative costs of the municipality are compared with their revenues from local fees and relative costs are calculated for each municipality in analysis.

The South Moravian Region had 673 municipalities in 2014. Internet based survey was completed by 79 municipalities. It is 11.7 percent of all municipalities in region. 75 municipalities up to 5 000 inhabitants are involved into research. It is 11.1 percent of the total number of municipalities in this size category in the South Moravian Region. Table 1 shows the size structure of the municipalities by population in the South Moravian Region and municipalities that engage in research.

Table 1: Size structure of municipalities by population in the South Moravian Region (in 2014) and municipalities involved in research

Size category of municipalities (population)	Number of municipalities in category	% from total number of municipalities	Number of municipalities involved in research	% from total number of municipalities in size category	Share answers of size groups to all answers
1 - 199	111	16.50	9	8.1	11.4
200 - 499	191	28.4	24	12.6	30.4
500 - 999	182	27.1	20	11.0	25.4
1 000 – 1 999	104	15.5	11	10.6	13.9
2 000 - 4 999	62	9.2	11	17.7	13.9
5 000 - 9 999	13	1.9	3	23.0	3.8
10 000 – 1 9999	4	0.6	0	0	0
20 000 – 49 999	5	0.7	1	20.0	1.2
More than 50 000	1	0.1	0	0	0
Total	673	100.0	79	11.7	100.0

Source: Author based on Czech Statistical Office (2016)

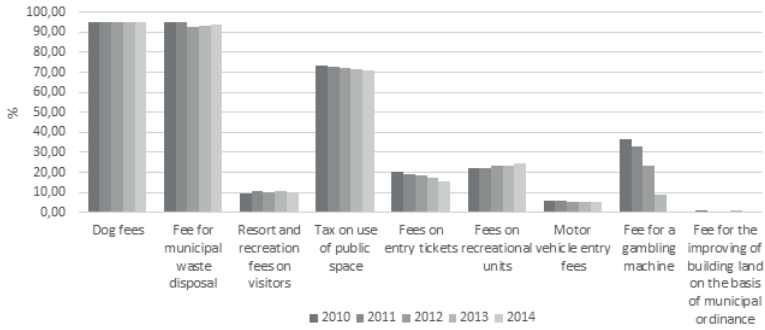
While respecting confidence level 95% statistical error 10.65 must be taken into account for answers from the municipalities up to 5 000 inhabitants. For condition statistical error 5.0 at least 242 responses would be necessary get for this size category. It is limit of internet based survey. But currently some of data cannot be obtained from public database and the number of answers is dependent on willingness of respondents. Closely related to this problem the evidence of costs on delegated and independent power is. The costs cannot be clearly categorized to one of the powers of the municipality.

3 Results and Discussion

Local fees have fiscal and regulatory functions which are fulfilled in varying degrees. In the South Moravian Region both functions are very restricted, moreover, revenue potential of municipal fees is low. The total revenue of local fees accounts only about 2.5 percent of all revenues of municipalities in 2014 (MONITOR, 2016).

Mikesell (2007) found that over 90 percent of Czech municipalities levy at least one of the fees. Most often the municipalities collect dog fee (but it represent only 3 percent of revenue of local fees in 2014), fee for municipal waste disposal and fee for use of public space (Binek et al., 2008). This trend is also true in the South Moravian Region as Figure 1 shows. Most of the municipalities collect dog fee and fee for municipal waste disposal in 2010-2014. Three-quarters of municipalities levied fee for use of public space and fifth of them fee on entry tickets and on recreational units. Less than 10 percent of total municipalities levy resort and recreation fee on visitors. The last three fees are very dependent on the public facilities of the municipality, its position in the region and nearby interesting places for visitors. Municipalities up to 500 inhabitants do not almost levy them.

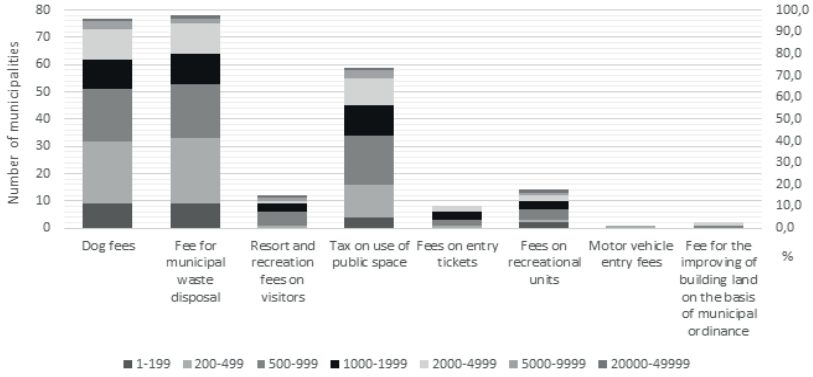
Figure 1: Share of municipalities collecting the local fees in the South Moravian Region in 2010-2014



Source: Author based on MONITOR (2016)

Result of the analysis showed the larger the municipality is (in number of inhabitants) thereby the number of local fees and their revenue increase. It is most often resort and recreation fees on visitors and fees on entry tickets (see Figure 2).

Figure 2: Local fees in the municipalities involved in the research by size categories, in 2014

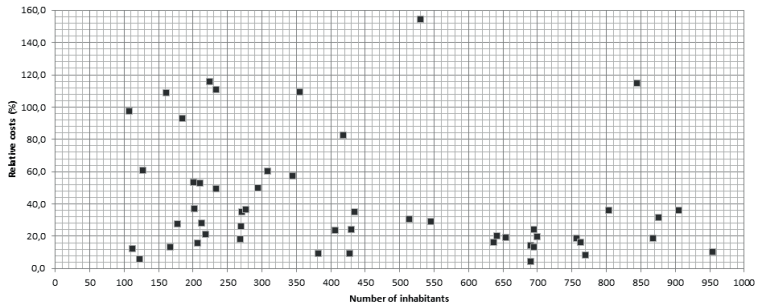


Source: Author

In all size categories the municipalities levy three fees on the average. And due to this fact, there is only one employee dealing with agenda of local fees in municipalities with population less than 800 inhabitants. In municipalities with more than 800 inhabitants there are two or three employees. And it applies that they engaged in agenda of local fees only part of their working time, usually 10 to 30 percent of their working time. Only one municipality, with more then 20 000 inhabitants, has four employees only for agenda of local fees. Some of the smallest and smaller municipalities (up to 5 000 inhabitants) employ their employees only on a part-time basis. So despite expectations, in such municipalities the operating costs exceeded labor costs per employee in agenda of local fees. This is primarily due to two factors. In the current system of evidence of costs there is not clearly specify that costs are actually related to collection of local fees. Operating costs are overstated. At the same time, the municipality could do the extraordinary one-time non-capital expenditure in the analyzed year, which significantly distorts the results of the analysis. And second, the analysis uses a subjective estimate of the municipal authorities about their workload with agenda of local fees.

One of the situation described above may have occurred in two municipalities in the size category of 5 000 to 9 999 inhabitants. The first municipality has relative costs 1 200 percent and the second 620 percent. The third and last municipality in this size category has relative costs 30 percent. For the only municipality in the size category with over 20 000 inhabitants the relative costs are 43.5 percent. The relative costs of local fees in municipalities up to 999 inhabitants and in municipalities with 1000 to 4999 inhabitants are presented in Figure 3 and Figure 4.

Figure 3: Relative costs of local fees in municipalities up to 999 inhabitants (in 2014)

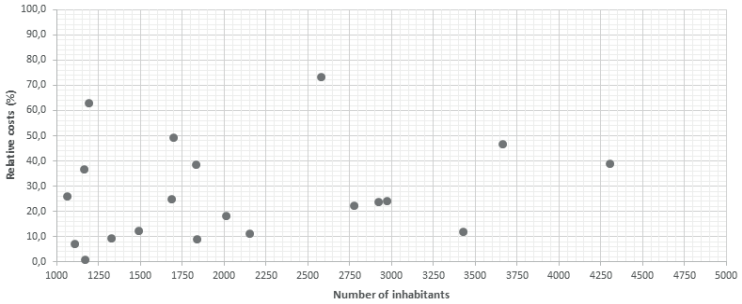


Source: Author

In these size groups relative costs have significantly regressive course. For some municipalities up to 500 inhabitants, they even exceed revenues. In one case, this municipality levies four local fees. Quarter of municipalities up to 500 inhabitants have administrative costs close to revenue of local fees, the second quarter between 50 – 60 percent of revenue. This first group of municipalities mostly levies a dog fee and a fee for municipal waste disposal. Other municipalities up to 500 inhabitants and municipalities between 500 to 999 inhabitants have relative costs less than 40 percent. Spread of the individual results is reduced. Reducing relative costs and the spread of results, which can be seen for municipalities up to 800 inhabitants, may indicate the existence of economies of scale under the follow circumstances: Municipalities levy three fees (dog fee, fee for municipal waste disposal and a fee for use of public space) and there is one employee dealing with local fees agenda only part of his time.

Addition to the above, the results can be influenced the number of taxpayers and the rates of individual fees. Especially the rate of dog fee reaches only 3 – 10 percent maximum rate which is fixed by law (1 500 CZK) in analyzed municipalities.

Figure 4: Relative costs of local fees in municipalities with 1 000 to 4 999 inhabitants (in 2014)



Source: Author

As Figure 4 shows, relative costs have less spread than in the first size group, but do not hold downward or constant trend. In neither case there is found that administrative costs exceed the revenue of local fees. There can be consider the factors negatively influenced the relative costs for municipalities up to 1 000 inhabitants contribute to better results in this size groups. Numbers of taxpayers increase and municipalities have more option for collection of local fees. From results of the analysis for this size group the existence of economies of scale is not clear indicative. This result can be little bit surprising but at this moment the limits of internet based survey and problems with data evidence of municipalities in the Czech Republic are shown. More accurate measurements would be necessary to make more precise results.

Table 2 shows average relative costs for each size category of municipalities up to 5 000 inhabitants. The results confirm the above conclusions. Results also confirm conclusion analysis of Pudil et all. (2004).

Table 2: Average relative costs for municipalities up to 5 000 inhabitants.

Size category of municipalities (population)	Average relative costs for size category (%)
1 - 199	61.56
200 - 499	42.81
500 - 999	25.03
1 000 – 1 999	23.51
2 000 - 4 999	32.40

Source: Author

The analysis suffers from the problems of identifying the exact costs and the using of subjective estimates of responsible employees of municipalities. But the results suggest that agenda of local fees is also area where municipalities can cooperate to achieve better efficiency of performance of local administration, particularly in municipalities up to 1 000 inhabitants. This cooperation is now allowed between two municipalities. Responses from municipalities have shown that this means of cooperation is not substantially used. It is thus appropriate to search tools to promote such cooperation.

4 Conclusions

Decentralized local governments provide advantages of small scale, freedom to innovate or nearness to inhabitants. Their disadvantages may be non-effectiveness of performance of local administration, lack of knowledge, lack of expertise and (or) opportunities for residents and local government itself. Quality performance of independent competences requires at least partial revenue autonomy. Czech municipalities have it only in local fees. The municipalities are responsible for assessment, collection, enforcement and inspection of payment. Revenues of local fees as income of municipalities should be further reduced by costs necessary to collection of the fees. These adjusted revenues from local fees can actually be used for public service.

As analysis for municipalities of the South Moravian Region has shown, in the current conditions it is difficult to measure administrative and relative costs of local fess. The analysis suffers from many problems. There is not clearly defining costs of municipal office which is only related to collection of local fees. It is difficult to determine what percentage of work time employees of municipal office devote only agenda of local fees.

The results show that the smallest municipalities (up to 1 000 inhabitants) should be encouraged to cooperate in collection of local fees and that in area of local fees economies of scale can exist. But more accurate measurements are necessary to make more precise results.

Acknowledgements

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Alternative Models of Tax Assignment to Municipal Level

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Abstract. The paper identifies the factors which influence tax sharing in the Czech Republic. The determinants of tax sharing are described. We simulate the alternative models of tax sharing in the Czech Republic using the full sample of Czech municipalities between years 2010-2014. The impact of alternative parametrisation is evaluated using the Gini coefficients. The key determinants are population size, the number and size classes of municipalities and coefficient that adjusts multiple gradual transitions. We compare the different models of tax sharing and conclude that the main change in year 2013 (which came into force) contributes to equality of tax revenue sharing per capita.

Keywords: tax sharing, tax revenues, local government, Gini coefficient
JEL Classification: H71, H77, R51

1 Introduction

Even though tax sharing is the main source of sub-national revenue for the majority of countries around the world, there are relatively few studies that deal with tax sharing specially as is mentioned OECD/KIPF (2015). However, it can be found some studies that address the problem of tax sharing (e. g., McLure (2001), Boadway (2001), Wildasin (2004), Blöchliger and Petzold (2009), Blöchliger and Nettley (2015). In the conditions of Czech Republic there are studies about tax sharing rare. Despite this fact there exist studies which analyze system of tax sharing in the Czech Republic (e.g. extensive report for Ministry of Finance - VŠE, (2009), Provazníková and Petr (2010) or Kotatkova Stranska (2012).

Tax Assignment to sub-national government level for municipalities and regions is a stormy discussed topic in the Czech Republic. There are several players which struggle for the changing system in their favour - the Association of Regions in the Czech Republic, the Union of Towns and Villages and the Association of Local Administrations. Besides these main associations there exist other stakeholders like the Association for Rural Renewal of the Czech Republic, local initiatives, the academics etc. The Ministry of Finance of the Czech Republic is responsible for system settings and performs relatively frequent changes according to the need and interests pushed through. Last main change was provided at the end of year 2015, when the increase was in the percentage of shared taxes for both regions and municipalities. This change means, according to preliminary calculations, increasing tax revenue to both regions and municipalities in coming years. The objective of this paper is to show the changes in various alternative models of tax assignment from the perspective of changing parameters – factors which influence tax assignment.

The paper is structured as follows: Firstly, the paper provides a brief overview of the tax assignment to sub-national government level (municipalities especially) in the Czech Republic. Secondly, individual scenarios are defined together with the description of the relevant data sources and the method applied. Thirdly, the paper presents obtained results and compares these scenarios in depth.

2 Tax Assignment to Municipal Level

The tax sharing legislation – Act on Tax assignment of selected taxes yields to subnational independent administrations and to certain state funds (Act 243/2000), has been in effect since year 2001. This Act sets the rules for redistribution of tax yields among the state, regions and municipalities (Provazníková and Petr (2010). During the period of its validity the Act was several times updated, the last update was done in year 2015, and it was published as Act No. 391/2015 Coll. effective from January 1, 2016.

According to the valid existing legislation municipalities get the following shared taxes revenues (Act 243/2000):

- 20,83% of the national tax collection from the value added tax (VAT);
- 23.58 % of the natural person income tax from dependent activities collection;
- 1.5 % of the natural person income tax from dependent activities collection (according number of employees in the municipality);
- 23.58 % of the national legal entities tax collection (excluding taxes paid by municipalities themselves);

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- 23.58% of the national natural person income tax collected by reduction tax;
- 23.58% of the national natural person income tax from independent business activities tax collection (only 60% of this national tax collection is redistributed).

Municipalities receive 30% of the yield according to the natural person place of residence. This tax revenue is linked to the municipality and it is serving as a motivation element towards promoting business activities in municipalities. (Provazníková and Petr, 2010). Because of its "setting up to fail" (leaving aside the reasons why this tool did not work), it will be cancelled from next year. There exists also grand debate about setting of motivations factors (these 30 % of the yield according to the natural person place of residence and 1.5 % of the natural person income tax from dependent activities collection by number of employees in the municipality) for municipalities. The remaining 10% of the national yield of this tax belongs to the state and lasting 60% of the tax yield is assigned to be redistributed among the national, regional and municipal budgets. (Provazníková and Petr, 2010). Furthermore, these shared taxes municipalities obtain 100 % tax revenues – real estate tax and the legal entity tax paid by municipalities.

The specific amount from the national gross shared taxes yield (excluding 1,5 % of the natural person income tax from dependent activities collection) is redistributed to each municipality based on four main criteria (Act 243/2000): cadastral area of the municipality, simple number of inhabitants, modified number of inhabitants according to gradual transition coefficients which take into account municipality size and recently added criterion – the number of pupils. The cadastral area of the municipality is defined as the share of municipality area in the total Czech Republic municipalities´ area. Weight of this criterion is 3 %. The reason for introducing this criterion was to compensate lower population density (Provazníková and Petr, 2010). Simple number of inhabitants represents the share of the municipality inhabitants in the total number of Czech Republic population. Weight of this criterion is 10 %. Modified number of inhabitants according to gradual transition coefficients is very important criterion which prevents abrupt changes in the amount of tax revenue as a result of population changes in municipality (Provazníková and Petr, 2010). Its essence lies in the gradual increase of tax revenues by coefficients that reflect the population increase in each category of municipality size (see Table 1). The only exception from this criterion are Praha, Brno, Ostrava a Plzeň. These four municipalities have their own coefficients. The weight of this criterion is 80 %. The last criterion is the number of pupils in each municipality. This criterion has weight 7 %. These criteria have their own historical development. Over time there were changes not only in the number of classes (gradually it fell from 14 to 4), but also in the size classes of municipalities (reduction in the first category from 300 to 50, in the second category from 5000 to 2000) and also in the amount of gradual transitions coefficients (especially in the last category of large cities).

Table 1 Gradual transition coefficients and multiples of gradual transitions in year 2013-2015

Municipalities with number of inhabitants from - to	Gradual transitions coefficients	Gradual transitions multiple
0 – 50	1.0000	1.0000 x number of inhabitants in municipality
51 – 2 000	1.0700	50 + 1.0700 x number of inhabitants in a municipality that are above the number 50
2001 – 30 000	1.1523	2136.5 + 1.1523 + x number of inhabitants in a municipality that are above the number 2 000
30 001 and more	1.3663	34 400.9 +1.3663 x number of inhabitants in a municipality that are above the number 30000

Source: (Act 243/2000)

3 Data and methods

To evaluate the impact of changes in the legislative framework for redistribution of the national gross shared taxes yield, we use the data for all municipalities that are available as an appendix to (Act 243/2000) from 2010 to 2014. We use share indicators of the national gross shared taxes yield (the sum of all major taxes – VAT, national natural income person tax (excluding 1.5 % of the natural person income tax from dependent activities collection) and national legal entities tax according four main criteria - cadastral area of the municipality, simple number of inhabitants, modified number of inhabitants according to gradual transition coefficients which take into account municipality size and the number of pupils. Our computations are based on following scenarios that should take into account the real tax sharing, hypothetical changes in parameters that were used in particular years, and the possible influence of the number of pupils as a new variable influencing the tax sharing in the last years:

A Original (baseline) scenario where tax shares of municipalities are computed for all years using the system parameters valid in these years (i.e. one set of parameter for the years 2010, 2012 and 2013 and the second set of parameters for the years 2013 and 2014).

B A scenario where parameters of the tax sharing system from the year 2014 are applied. In this case, the number of pupils from the 2012 is used for the years 2010 and 2011 due to lack of data for these years.

C A scenario where parameters of the tax sharing system from the year 2014 are applied without the criterion of the number of pupils. The weights for the remaining criterions are defined by the weights valid in 2010 (3% for the number of inhabitants, 3% for the cadastral area, and 94% for the criterion based on gradual transition coefficients).

D A scenario where parameters of the tax sharing system from the year 2010 are applied.

E A scenario where parameters of the tax sharing system from the year 2010 are applied and a new criterion of the number of pupils is added. In this case, the number of pupils from the 2012 is used for the years 2010 and 2011 due to lack of data for these years. The weights for the criterions corresponds to those valid in the year 2014.

For all scenarios mentioned above, the shares of all municipalities on the national gross shared taxes yield are simulated and compared with the original ones. In case of the original scenario (scenario A), the results are compared with the values valid for the year 2010. We are focusing on the following statistics:

1. Weighted Gini coefficients that express the inequality in distribution of shared taxes. The Gini coefficient (as defined by Dorfman, 1979) is computed using the weights representing the share of municipality inhabitants in the total number of Czech Republic population. This measure represents the inequality among them municipalities better than the unweighted Gini coefficients that would treat the municipalities as the basic units that would lead to unreliable high values of inequality due to existence of a large number of low populated municipalities sharing only a small part of taxes and small number of highly populated cities (e.g. Praha) sharing an important part of shared taxes.
2. Average relative change in the share of individual municipalities on gross shared taxes and the standard deviation (as a measure of volatility of these changes). The means and standard deviations are computed as weighted statistics where weights remain the same as in case of computation of Gini coefficient. The average values greater than one mean that in average more municipalities (inhabitants of these municipalities) would share more taxes in case of the simulated scenario than in the original scenario. We compute the mean changes for all municipalities and mean changes in corresponding deciles defined by the number of inhabitants (it means that the first decile represents the 10% of the population of the Czech Republic).

4 Results and discussion

The results of our simulations are presented in the Table 2 and Table 3. Table 2 shows the changes in the inequality of the tax redistribution. The baseline scenario (scenario A) proves that the changes in the parametrization of the tax sharing lowered considerably the inequality of tax distribution among the municipalities (considering the number of inhabitants in the municipalities). This results may be in contradiction with the intentions to have a tax sharing system that takes into account the size of public services provided by the municipalities (that might be approximated e.g. by the size of municipalities). One important factor standing behind this decrease was the implementing of the number of pupils into the system of tax sharing. As the scenario D suggests, a significant decrease in inequality could be achieved by implementing this criterion into the framework defined by the parameters of the 2010 as well. Second decisive factor of equalizing the tax shares among the municipalities was the change in the gradual transition coefficients for the municipalities with more than 30 000 inhabitants (a decrease from 1.7629 to 1.3663).

A better look on the size of changes in the tax shares distribution offers the Table 3. Implementing the parametrization of the year 2014 to the years 2010-2012 could have led to average increase in the shared tax revenues by 6% (see column B of mean change). To be more precise, 6213 of 6245 municipalities (covering 63,8% of the population) would have increased revenues in the year 2010. On the other hand, implementing the system of the year 2010 within the conditions of the year 2014 (scenario D) would have increased the revenues of 32 (most populated) municipalities that cover 35.7% of the Czech population.

Table 2 Weighted Gini coefficients and tax sharing scenarios

Year	Scenario A	Scenario B	Scenario C	Scenario D	Scenario E
2010	0.2808	0.2096	0.2473	0.2808	0.2381
2011	0.2809	0.2100	0.2475	0.2809	0.2384
2012	0.2802	0.2097	0.2468	0.2802	0.2381
2013	0.2100	0.2100	0.2470	0.2803	0.2384
2014	0.2100	0.2100	0.2467	0.2800	0.2384

Source: Authors calculations

Table 3 Comparison of changes in tax sharing among the municipalities

Year	Mean change (std. deviation)					Tax sharing increase – number of municipalities (population share)				
	A	*B*	*C*	*D*	*E*	*A*	*B*	*C*	*D*	*E*
2010	1.000	1.060	1.019	1.000	1.043	6245	6213	6129	6245	3301
	(0.000)	(0.132)	(0.086)	(0.000)	(0.081)	(1.000)	(0.638)	(0.487)	(1.000)	(0.736)
2011	1.000	1.060	1.019	1.000	1.043	3578	6214	6130	6246	3302
	(0.016)	(0.132)	(0.086)	(0.000)	(0.081)	(0.426)	(0.639)	(0.489)	(1.000)	(0.736)
2012	1.003	1.060	1.019	1.000	1.043	4276	6214	6129	6246	3302
	(0.036)	(0.131)	(0.086)	(0.000)	(0.081)	(0.420)	(0.642)	(0.491)	(1.000)	(0.735)
2013	1.063	1.000	0.969	0.959	0.992	6004	6248	2978	32	117
	(0.151)	(0.000)	(0.071)	(0.119)	(0.069)	(0.605)	(1.000)	(0.269)	(0.358)	(0.507)
2014	1.06	1.000	0.969	0.959	0.992	5975	6248	2959	32	118
	(0.156)	(0.000)	(0.070)	(0.118)	(0.069)	(0.599)	(1.000)	(0.268)	(0.357)	(0.507)

Source: Authors calculations

A detailed view on the distribution of simulated changes among the municipalities may be found in the Appendix A. The Table in the Appendix A shows the average increases (and standard deviations in parenthesis) of tax sharing for the municipalities among the deciles defined by the number of inhabitants of the Czech Republic. It is clear that only the scenario A and the scenario B increase the revenues for the small cities and villages. This increase is considerably large in case of the actual tax sharing framework. Scenario C proves that omitting the criterion of number of pupils would have increased the revenues for the 5 biggest cities (the 9th and the 10th decile) in the years 2013 and 2014 (by 5% and 10% respectively) while the revenues of the smallest cities (the 1st decile) would have remained the same. The same results may be obtained considering the number of cities with increased tax share induced by the simulated scenario or the share of inhabitants (in the corresponding decile) with increased tax share.

5 Conclusions

This paper is concerned with municipal financing in particular. The objective of this paper was to show the changes in various parameters of tax assignment to municipal level. The baseline scenario (scenario A) proved that the changes in the parametrization of the tax sharing lowered considerably the inequality of tax distribution among the municipalities (considering the number of inhabitants in the municipalities) from the point of municipal tax revenues. One key factor standing behind this shift was the implementing of the number of pupils into the system of tax sharing. This is one of key arguments which Ministry of Finance use when advocate the changes in tax sharing (like last change in year 2013). But this must be considered in context of entire municipal financing – introduction of this criterion caused decrease in subsidies per pupil generally. The municipalities are financed not only by tax sharing revenues but also by other revenues – non-tax revenues, subsidies etc. From this perspective our results do not prove equalization. Our intention was not to show that the changes in the system of tax sharing should contribute to equalization, we only prove that particular change (introducing of new criteria) assists to lowering the inequality of tax distribution from one point of view. In this sense, the objective of the paper was met. For overall picture of the municipality finances it can be take into account not only tax revenues but also municipalities expenditures what analyzed our colleagues from University of Economics and summarized in they report (VŠE, 2009).

Discussion about factors which influence tax sharing is always ambiguous. Nowadays, it is being speculate about a next criterion into the system of tax sharing - population over 65 years. This might be subject to further research. Other interesting point could be analysis of 1,5 % of the natural person income tax from dependent activities collection because it is considered as motivation element for municipalities. From this view is further analysis needed.

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Appendix A: Comparison of mean changes (standard deviations) in tax sharing

Deciles	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
					Scenario A					
2010	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
2011	1.008	1.007	1.006	1.000	0.998	0.996	0.991	0.995	0.994	1.004
	(0.029)	(0.021)	(0.019)	(0.014)	(0.011)	(0.008)	(0.012)	(0.008)	(0.004)	(0.000)
2012	1.025	1.023	1.017	1.007	1.000	0.998	0.983	0.984	0.999	0.996
	(0.070)	(0.044)	(0.039)	(0.031)	(0.025)	(0.019)	(0.018)	(0.018)	(0.019)	(0.000)
2013	1.155	1.208	1.225	1.234	1.134	1.041	0.964	0.907	0.881	0.891
	(0.131)	(0.092)	(0.077)	(0.061)	(0.061)	(0.033)	(0.037)	(0.023)	(0.021)	(0.000)
2014	1.161	1.216	1.231	1.237	1.134	1.040	0.961	0.904	0.880	0.890
	(0.121)	(0.104)	(0.089)	(0.072)	(0.068)	(0.038)	(0.039)	(0.027)	(0.023)	(0.000)
					Scenario B					
2010	1.125	1.179	1.206	1.228	1.133	1.048	0.985	0.924	0.883	0.892
	(0.071)	(0.072)	(0.052)	(0.032)	(0.042)	(0.021)	(0.028)	(0.013)	(0.010)	(0.000)
2011	1.124	1.178	1.204	1.227	1.136	1.049	0.987	0.924	0.884	0.892
	(0.071)	(0.071)	(0.052)	(0.031)	(0.043)	(0.021)	(0.029)	(0.014)	(0.010)	(0.000)
2012	1.122	1.174	1.200	1.225	1.138	1.050	0.988	0.924	0.883	0.892
	(0.070)	(0.071)	(0.053)	(0.031)	(0.044)	(0.020)	(0.028)	(0.013)	(0.010)	(0.000)
2013	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
2014	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
					Scenario C					
2010	1.114	1.103	1.101	1.128	1.040	0.968	0.925	0.884	0.926	0.989
	(0.015)	(0.007)	(0.007)	(0.010)	(0.033)	(0.012)	(0.018)	(0.007)	(0.017)	(0.000)
2011	1.114	1.102	1.100	1.127	1.042	0.969	0.926	0.884	0.926	0.989
	(0.015)	(0.007)	(0.007)	(0.010)	(0.033)	(0.012)	(0.019)	(0.008)	(0.018)	(0.000)
2012	1.113	1.102	1.099	1.126	1.045	0.969	0.926	0.883	0.926	0.989
	(0.014)	(0.007)	(0.007)	(0.010)	(0.034)	(0.012)	(0.019)	(0.008)	(0.018)	(0.000)
2013	0.995	0.942	0.918	0.921	0.919	0.923	0.937	0.956	1.049	1.109
	(0.049)	(0.053)	(0.039)	(0.023)	(0.016)	(0.012)	(0.011)	(0.006)	(0.031)	(0.000)
2014	0.995	0.942	0.918	0.921	0.920	0.924	0.937	0.956	1.049	1.108
	(0.049)	(0.052)	(0.039)	(0.023)	(0.016)	(0.012)	(0.011)	(0.006)	(0.031)	(0.000)
					Scenario D					
2010	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
2011	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
2012	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
2013	0.894	0.855	0.836	0.818	0.879	0.952	1.012	1.083	1.132	1.121
	(0.046)	(0.048)	(0.036)	(0.021)	(0.035)	(0.019)	(0.029)	(0.015)	(0.012)	(0.000)
2014	0.895	0.856	0.837	0.818	0.879	0.953	1.012	1.083	1.133	1.121
	(0.045)	(0.047)	(0.036)	(0.021)	(0.035)	(0.020)	(0.029)	(0.014)	(0.012)	(0.000)
					Scenario E					
2010	1.028	1.092	1.121	1.119	1.098	1.075	1.048	1.022	0.946	0.901
	(0.070)	(0.071)	(0.051)	(0.030)	(0.022)	(0.015)	(0.014)	(0.008)	(0.025)	(0.000)
2011	1.027	1.090	1.119	1.119	1.100	1.076	1.050	1.023	0.947	0.901
	(0.069)	(0.071)	(0.051)	(0.030)	(0.023)	(0.014)	(0.015)	(0.008)	(0.025)	(0.000)
2012	1.026	1.088	1.117	1.118	1.100	1.076	1.051	1.023	0.946	0.901
	(0.068)	(0.071)	(0.052)	(0.029)	(0.023)	(0.014)	(0.014)	(0.007)	(0.025)	(0.000)
2013	0.915	0.927	0.931	0.913	0.966	1.025	1.064	1.108	1.071	1.010
	(0.011)	(0.007)	(0.005)	(0.007)	(0.024)	(0.011)	(0.018)	(0.008)	(0.016)	(0.000)
2014	0.915	0.927	0.931	0.913	0.965	1.025	1.064	1.108	1.071	1.010
	(0.011)	(0.007)	(0.005)	(0.007)	(0.025)	(0.011)	(0.018)	(0.008)	(0.016)	(0.000)

Source: Authors calculations

Step by Step CCCTB Implementation in EU28: The Impact of the First Stage on the Tax Bases in the Czech Republic and Slovak Republic

Danuše Nerudová[*] – Veronika Solilová [**]

Abstract. The European Commission decided to re-launch the CCCTB for the consolidation aspect of the CCCTB was the most difficult part for the negotiation. Therefore, the European Commission changed the implementation strategy of the CCCTB. Firstly, by June 2016 the Commission would like to implement a mandatory Common Corporate Tax Base (hereinafter as CCTB) for EU 28 and then as the second stage the CCCTB. The mandatory CCTB would replace the consolidation regime by temporary cross-border loss offset regime. The aim of the paper is to compare the impacts of the first implementation stage of the mandatory CCTB implementation in case of Czech Republic and Slovak Republic – i.e. how the tax bases of both selected countries change after the implementation of the temporary cross-border loss offsetting regime. The results show that in comparison with current situation (when applying separate entity approach) the introduction of temporary possibility for cross-border loss offsetting would have negligible affect for the Czech Republic, but significant effect for the Slovak Republic.

Keywords: CCCTB, CCTB, loss offsetting, cross-border, EU
JEL Classification: H25, K22

1 Introduction

The directive proposal on the introduction of Common Consolidated Corporate Tax Base (hereinafter as CCCTB) was published by the European Commission on 16th March, 2011. The system offered unified set of rules that cross-border companies could use for calculation of their taxable profit. Moreover, it proposed "one-stop-shop" for filling the tax return and consolidation profit and losses within the EU. The uniqueness of the project lied in the fact that on one hand it represented unified rules for the construction of the tax base, on the other hand it did not breach the national sovereignty of EU Member States to apply independently the tax rate.

However, this most ambitious project in the area of corporate taxation during the last few decades had to be re-launched with different implementation strategy. As the element of consolidation comprised in the proposal turned to be the most difficult part for the negotiation. On 17th June 2015 the European Commission introduced Action Plan on re-launching of CCCTB, i.e. the move form CCCTB towards common corporate tax base (hereinafter as CCTB). In the first step, the implementation of the mandatory CCTB for EU28 should be introduced by June 2016, with the exemption of small and medium sized enterprises or enterprises with no cross-border activities. Then as the second step, the consolidation regime should be introduced.

Based on the CCTB, all EU Member States would apply unified set of rules for calculation of taxable profits of companies with cross-border activities, which should eliminate loopholes between national corporate taxation systems. During the interim period between mandatory CCTB implementation and full CCCTB implementation, the temporary cross-border loss offset regime should be introduced as a compensation for the lack of consolidation regime in the short-term.

The aim of the paper is to compare the impacts of the first implementation stage of the mandatory CCTB implementation in case of Czech Republic and Slovak Republic – i.e. how the tax bases of both selected countries change after the implementation of the temporary cross-border loss offsetting regime. The empirical analysis is based on the data available from the Amadeus database.

2 Theoretical background

The key element of the CCTB is the temporary cross-border loss offsetting regime. Based on theory, two basic models of loss relieves can be identified. The first model includes loss offsetting within one company (i.e. losses

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incurred by a branch or permanent establishment). The second model comprises loss offsetting within a group of companies (parent and subsidiary). Further, both models can be distinguished into the domestic loss relief and cross-border loss relief according to the way of loss offsetting.

As European Commission (2006) mentions, in respect of the first model – *within one company*, majority of the EU Member States allow both ways of loss offsetting i.e. domestic and cross-border. In case of the second model – within a group of companies, domestic loss relief is available under specific rules in most EU Member States. However, the second way of the loss offsetting i.e. cross-border loss relief is very rarely implemented in the EU, particularly in Denmark, France, Italy and Austria. The situation is displayed in Table 1 below.

Table 1: The Application of Domestic and Cross Border Loss Relief

	Domestic loss relief	Cross-border loss relief
Within one company ("permanent establishment")	Automatically available in all 25 member states	Available in most cases Belgium, Czech Republic, Netherlands, Austria, Portugal, Slovenia, Slovakia, Finland, Sweden, United Kingdom, Spain, Ireland, Italy, Cyprus, Latvia, Lithuania, Malta
Within a group of companies ("parent and subsidiary")	Available under specific rules in most member states Denmark, Germany, Spain, France, Ireland, Italy, Cyprus, Malta, Latvia, Luxembourg, Netherlands, Austria, Poland, Slovenia, Finland, Sweden, United Kingdom	In principle not available, with very few exceptions Denmark, France, Italy, Austria

Source: COM (2006) 824 final

As is obvious from the above stated Table, cross-border offset of losses within a group of companies is possible only in four EU Member States. This situation causes an obstacle in cross border business on the Internal Market of the EU, for in contrast to domestic losses, foreign losses cannot be offset against the profit of the parent in 24 EU member states. Moreover, when the subsidiary incurs losses and the parent in different EU Member State runs profit, those losses cannot be offset as well. The first stage of CCCTB implementation in the form of the CCTB should address the above stated issue.

In respect of the method of cross-border loss relief, European Commission (2006) mentions, that Denmark, Italy and France apply the method based on the system of consolidated profits in contrast to Austria which is applying the method of deduction (reintegration). The system of consolidated profits is designed as a comprehensive scheme, for it includes all group members and the economic result of the group is taxed in the country, where the parent company is resident. However, that system is connected with higher compliance costs of taxation. The method of deduction is proposed by the European Commission as the temporary solution of cross-border loss offsetting. Under that method, losses incurred by the subsidiary situated in another EU Member State, which were deducted from the result of the parent company, are subsequently recaptured when the subsidiary starts to be profiTable. That system is relatively easy to operate. The losses are deducted at first and later, when the subsidiary returns to the profit, the previous deducted loss is recaptured through a corresponding additional tax burden on the level of the parent company. In this respect, Niemann and Treisch (2005) researched the impact of the method of deduction on MNEs' investment decisions in Austria and they found out that real investment in the foreign subsidiary is in general favored by loss offsets, unless the parent in Austria have enough profit to absorb foreign losses.

3 Methodology

The empirical analysis is based on the company-level data from the Amadeus database which is provided by Bureau van Dijk. These data were taken from update 255 (December 2015) of the database including standardized financial information of more than 18 million public and private companies in 43 European countries.

In order to quantify the difference between current tax bases of both selected countries (Czech Republic and Slovak Republic) and the tax bases after the implementation of the temporary cross-border loss relief, there were selected companies resident in both countries, possessing the subsidiary company in the EU 28. Those groups of companies were further subjected to the two-tier test confirming the eligibility for consolidation (group membership). This test consists of two layers: a) control, which is assumed if the controlling company holds at least 50.01% in the controlled company and b) ownership, which is assumed if the ownership rights amount to more than 75 % of the company's capital. Further, only the companies providing the information on the amount of profit or loss were selected. Based on those selection criteria, we have received the sample of 1,587 parent companies resident in the Czech Republic and its 2,427 subsidiary companies in EU 28, and 451 parent companies resident in the Slovak Republic and its 812 subsidiary companies in EU 28. In the next step the gained sample of companies was researched in order to identify total current tax bases of subsidiary companies according to the NACE classification.

Further, based on the indicated CCTB implementation with temporary measure for cross-border loss off-setting, we identified EU subsidiaries of Czech and Slovak parent companies running losses and we off-set those losses with the tax bases of the parent companies. Then, we determined tax bases of subsidiaries of Czech and Slovak parent companies according to the NACE classification. However, we did not consider the group of EU parent subsidiaries resident in the Czech Republic and Slovak Republic, for even in current situation and after the CCTB implementation, if they are running loss, their recorder tax base equals zero.

Finally, the comparative analysis of the current tax bases and tax bases after the implementation of the CCTB with temporary cross-border loss-offsetting was performed. Based on the results of the comparative analysis, the differences were identified and quantified.

It is necessary to mention, that the performed research is based on the similar assumption as Devereux and Loretz (2007) that corporations do not change their behavior in response to the tax reform, which provides a useful benchmark for the analysis. Moreover, the paper also follows the approach of Devereux and Loretz (2008), Fuest et al. (2006) or Clien, et al. (2010).

4 Results and discussion

As European Commission indicated that the possible off-set losses might be recaptured on the level of the parent company once the subsidiary returns to profitability, we expected in our research the application of the system of temporary loss transfer and comparing it with current situation.

Table 2: Current Situation

NACE	Czech Republic - CZ Parents and EU Subs. according to NACE of Czech Parent in ths. EUR				Slovak Republic - SK Parents and EU Subs. according to NACE of Slovak Parent in ths. EUR			
	No. of Parents	No. of Subs	Sum of TB		No. of Parents	No. of Subs	Sum of TB	
			%	ths. EUR			%	ths. EUR
A	39	42	0,12	1, 663	6	6	0.51	204
B	5	6	0.58	7,836	0	0	-	-
C	232	307	9.81	131,190	42	63	15.21	6,138
D	19	33	18.34	245,378	1	3	0.22	89
E	16	29	0.97	13,006	0	0	-	-
F	131	171	0.64	8,565	22	28	0.50	200
G	407	550	29.38	393,012	109	168	20.32	8,199
H	36	51	1.58	21,084	15	26	6.38	2,575
I	30	55	0.13	1,813	11	16	0.71	287
J	53	66	3.33	44,575	25	30	2.12	854
K	15	121	17.24	230,609	3	4	0.02	9
L	224	359	4.03	53, 965	47	84	2.68	1,083
M	283	495	7.02	93, 968	110	291	37.51	15,134
N	41	51	0,30	4,005	36	64	10.74	4,334
O	2	8	5.51	73,767	4	5	0.04	14
P	22	35	0.04	557	6	8	1.79	723
Q	16	22	0.18	2,376	10	10	0.15	60
R	11	19	0.77	10,347	3	5	1.09	440
S	5	7	0.00	25	1	1	0	0
Total	1,587	2,427	100%	1,337,740	451	812	100%	40,345

Source: own calculations

Above stated Table 2 presents the sum of total tax bases of all subsidiary companies meeting CCCTB criteria of the Czech and Slovak parent companies according to the NACE classification. Under the current conditions – i.e. the situation when CCCTB rules are not applied and companies are taxing their tax bases according to their domestic taxation rules – the total sum of tax bases of subsidiaries of the Czech parent companies represent EUR 1 337 740 ths. and subsidiaries of the Slovak parent companies EUR 40 345 ths.

Table 3: Situation after CCTB Implementation with Temporary Possibility of Cross-border Loss Off-setting

NACE	Czech Republic - CZ Parents and EU Subs. according to NACE of Czech Parent in ths. EUR				Slovak Republic - SK Parents and EU Subs. according to NACE of Czech Parent in ths. EUR			
	No. of Parents	No. of Subs	Sum of TB		No. of Parents	No. of Subs	Sum of TB	
			%	ths. EUR			%	ths. EUR
A	39	42	0.0013	1,663	6	6	0.58	204
B	5	6	0.0057	7,505	0	0	-	-
C	232	307	0.0982	130,206	42	63	17.34	6,110
D	19	33	0.1845	244,699	1	3	0.26	93
E	16	29	0.0098	13,006	0	0	-	-
F	131	171	0.0064	8,484	22	28	0.52	182
G	407	550	0.2959	392,361	109	168	19.58	6,897
H	36	51	0.0159	21,080	15	26	6.36	2,241
I	30	55	0.0014	1,813	11	16	-5.05	-1,780
J	53	66	0.0336	44, 575	25	30	2.01	707
K	15	121	0.1683	223,189	3	4	0.01	3
L	224	359	0.0407	53,965	47	84	3.05	1,073
M	283	495	0.0709	93,968	110	291	42.10	14,829
N	41	51	0.0030	4,005	36	64	11.45	4,033
O	2	8	0.0556	73,767	4	5	0.04	14
P	22	35	0.0004	557	6	8	1.46	513
Q	16	22	0.0018	2,376	10	10	0.17	60
R	11	19	0.0078	10,347	3	5	0.14	49
S	5	7	0.0000	25	1	1	0	0
Total	1,597	2,476	100%	1,325,930	451	812	100%	35,227

Source: own calculations

The situation, when the CCTB with temporary possibility of cross-border loss off setting would be implemented is shown in Table 3 above. Under that situation, Czech and Slovak parent companies would be allowed to off-set the losses of their EU subsidiaries. As is obvious from the Table, in case of the Czech Republic, it would lead to the decrease in the total corporate taxable income from EUR 1,337,740 ths. on EUR 1,325,940 ths., and in case of the Slovak Republic, from EUR 40,345 th. on EUR 35,227 th. The largest decrease would be reported in NACE K (Financial and insurance activities) for the Czech Republic and in NACE G (Wholesale and retail trade; repair of motor vehicles and motorcycles) and NACE I (Accommodation and food service activities) for the Slovak Republic (for more details see Table 3).

Based on the research it can be concluded, that after the implementation of the temporary cross-border loss offsetting regime, the total tax base of the subsidiaries of the Czech parent companies would decrease by EUR 11,810 ths., i.e. by 0.88% and in case of the Slovak Republic by EUR 5,118 ths., i.e. by 12.68% (see Table below).

Table 4: Summary of results

Country	Sum of TB in ths. EUR - current	Sum of TB in ths. EUR - CCTB	Differences in ths. EUR	Differences in %
Czech Republic	1,337,740	1,325,930	11,810	0.88
Slovak Republic	40,345	35,227	5,118	12.68

Source: own calculations

5 Conclusions

European Commission came on 17th June 2015 with the Action Plan to improve corporate taxation in the European Union with aim to tax profits of companies in the place (country), where they generate profits. Moreover, taxation should be more growth-friendly and should not be compromised by tax competition in the area of mobile tax bases, thus there should not be the space to shift the profit outside the EU. One of the proposed solutions represents re-launching of the Common Consolidated Corporate Tax Base through step-by-step approach, i.e. the implementation of the CCCTB in two steps. Firstly, as CCTB – i.e. just as unified rules for corporate taxation together with temporary possibility of cross-border loss offsetting in order to replace missing consolidation element in the first step. Then the full CCCTB system should be implemented – i.e. including consolidation regime and tax sharing mechanism.

The aim of the paper was to compare the impacts of the first implementation stage of the mandatory CCTB implementation in case of Czech Republic and Slovak Republic – i.e. how the tax bases of both selected countries change after the implementation of the temporary cross-border loss offsetting regime. The results show that in comparison with current situation (when applying separate entity approach) the introduction of temporary possibility for cross-border loss offsetting would have negligible affect for the Czech Republic, but significant affect for the Slovak Republic. In case of the Czech Republic, the introduction of temporary possibility for cross-border loss offsetting would result into the decrease of total corporate tax base of the subsidiaries of the Czech parent companies by 0.88% i.e. by EUR 11,810 ths. However, in case of the Slovak Republic, the introduction of temporary possibility for cross-border loss offsetting would result into the decrease of total corporate tax base of the subsidiaries of the Slovak parent companies by 12.68% i.e. by EUR 5,118 ths.

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Local taxes as a tool of local economic development

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Abstract. The purpose of submitted paper is to evaluate economic dimension of local taxes and local taxation. The paper discusses the relation of economic and tax policy of municipality. It also contains a short legal analysis of local taxes as a tool of the municipal economic policy in the legal system of Slovak Republic. The most important part of the paper is a proposition of methodology for quantification the stabilizing function of the local taxes and its application in district towns of Slovak Republic. The results show that the stabilizing function implementation tax loss in case of the real estate tax in Slovak district towns is relatively non-significant and its volume is not influenced by a development of the current budget.
Keywords: local economic development, local taxes, municipalities, real estate tax, tax policy, stabilizing policy.
JEL Classification: H25, H71, H72

1 Introduction

Economy is a very structured and complex phenomenon. It is important to study it not just on central or regional level, like mainstream economists do, but also on level of municipalities. It might be said that with fiscal decentralization efforts that have been implemented for last decades the role of local economies increases. This fact has been realized also by municipalities themselves. This knowledge leads them to develop local economy. Local economic development (LED) may be defined as the process through which partners from the public, business and non-governmental sectors work together on creating better conditions for the economic growth and employment creation. The objective is to improve quality of life for everybody (The World Bank, 2003, 1). Trousdale (2005, 8) in the context of LED emphasizes the participation of all subjects in the territory and he demands from the public sector primarily "a stimulation of local business activities". It is questionable whether municipalities should or should not intervene into economy.

Interventions of the public sector into local economy in order to support the entrepreneurial subjects are recommended primarily by the institutional theories, the Learning regions theory, the Cluster theory, the Theory of the Regional innovation systems and so on (e.g. Blažek – Uhlíř, 2011; Buček – Rehák – Tvrdoň, 2010; Výrostová, 2010; Maier – Todtling, 1997, 1998).

Since 1991 Slovak and Czech municipalities are legally able to influence their development. The role of Slovak municipalities in local development is derived from the provision of section 1(2) of Slovak Act Nr.369/1990 Coll. On Municipalities as amended. Slovak municipalities are obliged to care of a "comprehensive development of its territory and of its inhabitants". It also includes a support of local economy. For this purpose may municipalities implement various tools. Žárska (2008) says that there are a) financial, b) administrative, c) legislative, d) planning and e) informational tools of the municipal development. As Ježek – Ježková (2011, 120–121) stated, the most important are financial tools. Their research shows that:

1. Financial tools of local development in the last decades are the most important form of the public territorial support.
2. The use of these tools is basically not socially effective for two reasons: a) there is a disproportion between the number of candidates for support (businesses) and regions in which this support should be allocated, b) public costs to acquire a private investments in the territory (businesses) are often much higher than received social benefits from the capital allocation in the territory.
3. Recently the object of financial support is primarily the innovations implementation in businesses in order to support the innovation and competition abilities of businesses in particular region.
4. In addition to the businesses may be the recipients of financial support also individuals (common people, not just individuals – self-employed) as well as municipalities. An important thing is however the existence of supranational, national and regional supportive programs, which may be able to support the projects adequate to the territorial needs.

Žárska (2008, 49) says that the most important financial tool of local development in conditions of municipalities are local taxes and local taxation. In order to implement an objectives of LED use municipalities their own stabilizing policies. In comparison with the economic policy of state these have a little influence on the territory, but in specific conditions of municipalities they may help local producers and then inhabitants and

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municipality as well. The role of municipalities in support respectively in stabilization of local economy is analyzed in Ježková – Ježek (2011) as well as Toth et al. (2014). Local taxes also fulfil a stabilizing function but it has not as big influence on economy as the state taxes. Preliminary results on the situation in the area of local taxes use in order to local economy support in condition of Slovak municipalities have been published in Poliak (2014, 2015a). These publications contain only descriptive analysis with no quantification of impact on revenues[*].

2 Data and methods

The objective of submitted text is to evaluate the use of local taxes as a tool of local economic development in specific conditions of Slovak municipalities as well as an application of a simple model of local tax loss in order to use local taxes as a tool of local social and economic development. The research question is whether there is a relation between the real estate tax stabilizing function implementation and current deficits or not. The main reason is to find out whether municipalities in order to gain more revenue when the gap between current revenue and expenditure increases (in a negative sense), restrict the use of real estate tax to support the local economy. There will be used data of 2008-2013 current deficits, because according to this research question there is a need to compute a relation with a one year gap.

The research sample is assembled from Slovak district and regional towns except of town Košice and Bratislava (because of their two-levelled government). The sample selection was determined by the accessibility of data. The material for the research was provided by generally binding regulations of analyzed municipalities and statements on real estate tax for year 2009–2014. This season has been chosen due to the fact that in season 2005–2008 have Slovak municipalities practically no effort to change their tax policies (in 2009 they had felt the first impacts of economic crisis).

The used model is same as in Poliak (2015b). A tax loss in this case is a volume of income which is abandoned by the municipality due to implementation of selected sectoral policy into its tax policy. It is influenced by interference of municipality primarily in area of:

- Tax rate
- Subject of local tax
- Registered tax arrears

It is a sum between a potential income and real income of analyzed tax. A problematic institute is local tax arrears. Municipalities can solve this problem by:

- Implementation of officiality principle – the municipal council may write off a part of arrears.
- Implementation of dispositive principle – according to the tax debtor initiative may municipality at the request pardon a registered arrear.

According to the form of register and reporting of municipalities it is very hard to find out the purpose of dealing with tax arrears. In accordance of a scientific objectivity it is better to abstract from the institute of tax arrears.

$$\text{Potential income} = \text{Real income} + \text{Tax loss} \tag{1}$$

A real income from particular local tax is a sum of paid tax (while abstracting from the existence of tax arrears) at various tax regimes.

$$\text{Real income} = ((\text{NTb} * \text{BR}) + \sum(\text{NTi} * \text{Ri})) \tag{2}$$

When:
NTb – Number of tax subjects taxed by a basic tax rate
BR – Basic tax rate
NTi – Number of tax subjects taxed by a different tax rates (each)
Ri – a tax rate (rates) different of a basic tax rate

In case of a special tax regime we may quantify a tax loss as a multiple of number of tax subjects taxed by a specific tax regime and a difference between a basic tax rate and a specific tax rate.

$$\text{Tax loss} = (\sum(\text{NTi} * (\text{BR} - \text{Ri})) + (\text{NTe} * \text{BR})) \tag{3}$$

When:
NTe – Number of subjects exempted of taxation

[*] More about stabilizing function of local taxes e.g. Alm – Buschman - Sjoquist (2011); Alm – Buschman - Sjoquist (2014); Baskaran (2014); Bondonio – Greenbaum (2007); Braid (2013); Fisher (1996); Gruber (2010); Janeba - Osterloh (2013); Lynch (2004); Lyytikäinen (2012); McCluskey - Bevc (2007); McCluskey - Franzsen (2005); Presbitero - Sacchi – Zazzaro (2014); Ulbrich (2011).

In case of a total exemption of taxation (zero tax rate) creates a tax loss whole potential income of these tax subjects.

According to the fact that the tax loss will be quantified in terms of the real estate tax, it is necessary to edit formula (2) and (3) as follows.

$$\text{Real income} = ((\text{Ab} * \text{BR}) + \sum(\text{Ai} * \text{Ri})) \tag{4}$$

When:
Ab – Area taxed by a basic tax rate
BR – Basic tax rate
Ai – Area taxed by a different tax rates (each)
Ri – A tax rate (rates) different of a basic tax rate

Lands in Slovakia are taxed based on the value. Therefore it is necessary to apply for the real estate tax this modified procedure.

$$\text{Tax loss} = (\sum(\text{Ai} * (\text{BR} - \text{Ri})) + (\text{Ae} * \text{BR})) \tag{5}$$

When:
Ae – Area exempted of taxation

In submitted text will be quantified a stabilizing function of the real estate tax. According to the fact that Statements of real estate tax do not contain sufficient information about housing tax, it will be considered as the object of an implementation of redistribution function of this tax. Of building tax will be into calculation of stabilizing function included these types of buildings: (1) buildings for agricultural production, (2) industrial buildings and (3) buildings for other entrepreneurship, storage and administration are the object of a stabilizing function of the real estate tax. The other buildings* are the object of the redistribution function quantification. Of tax land will be for the purpose of stabilizing function quantification taken into account (1) arable lands, (2) forest lands and (3) fish ponds and the other economically used areas. It is due to their potential of generating the revenue. These types of lands are used by a person who has ownership, rent or user rights to these types of lands, for economic activities that generate a direct or indirect kind of benefit. Due to the municipal regulation of tax regime in case of permanent grasslands, gardens, built-up areas and courtyards, construction sites and other areas, these will be taken into account in case of redistribution function quantification.

The actual quantification of redistribution and stabilizing function is based on the formulas (3), (4) and (5). Both functions are quantified in proportion to the total potential income from the real estate tax.

$$Redistribution/stabilising\ function = \frac{\text{Loss of specified components of real estate tax}}{\text{Potential income of real estate tax}} \tag{6}$$

The relation between the stabilizing function and current deficit will be computed by IBM SPSS Statistics software.

3 Results and discussion

Legal construction of local taxes in Slovakia allows to municipalities to use a wide spectrum of supporting their local economies. From the analysis of generally binding regulations of district towns it is clear that the use of local taxes as a tool of local economic development is not as enhanced as their use as a tool of local social policy.

According to the actual law status since the 1st of January 2005 Slovak municipalities are according to the Act Nr.582/2004 Coll. On Local Taxes as amended authorized to levy (1) Real estate tax (land tax, building tax, housing tax), (2) Dog licence tax, (3) Tax for use of public space, (4) Tax for accommodation, (5) Tax for vending machines, (6) Tax for non-winning gaming machines, (7) Tax for the entry and remaining of the vehicle in the historic part of town and (8) tax for the nuclear device. The evidence of real estate tax is in Slovak Republic sufficiently detailed for a relatively precise quantification of the tax loss.

From the generally binding regulations of analyzed municipalities is clear that the stabilizing function of local taxes in specific conditions of Slovakia is reflected in these specific forms:

1. Real estate tax – It seems that municipalities do not use this kind of tax in their administration for supporting their local economy. The most frequented reflection of using the stabilizing function of the real estate tax is provision of tax reliefs on for buildings, serving as museums, galleries and exhibition halls. This step may be evaluated as an action with positive influence on local tourism. The second way of using the stabilizing policy of the real estate tax that appears in case of lands that are farmed by self-employed farmers (only town Skalica and town Snina have such regulation).

* (1) residential buildings, (2) recreational and gardening cottages, (3) detached garages, (4) other buildings and (5) multipurpose buildings.

2. Tax on vending machines – This tax is used as a tool of local economic support by more towns than the real estate tax. Slovak towns mostly provide reliefs for vending machines selling food (except alcohol and cigarettes) and vending machines selling milk and milk products. For example town Lučenec provides tax reliefs for vending machines selling toys for kids.
3. Tax on non-winning gaming machines – This tax has actually been used for supporting a local economy only in one case. Town Hlohovec provides tax relief for entertaining game machines designed for fun of preschool children placed in commercial establishments.
4. Tax for accommodation – Is used primarily to support local accommodation facilities except hotels. A specific regulation of local economy support has provided town Galanta. This town provides tax relief to accommodation facilities if they prove that they have confirmed by the contract of accommodation facility occupation as a whole or its part for the purpose of accommodation of individuals.
5. Dog tax – Tax reliefs in this case may be divided into three groups. The first group is tax reliefs provided with regard to property right. Tax reliefs are provided to legal persons and individuals providing protection of individuals or property (security services). The second group of tax reliefs is due to the dog location. Tax reliefs are provided for dogs allocated in (a) entrepreneurial facilities and (b) objects and lands of businesses and organizations. The third point of view is the purpose. Dogs are excluded from the tax obligation if they are serving for the protection of property and spaces of entrepreneurial subjects.
6. Tax on use of public spaces – This tax has the greatest expression in local economy support. Slovak district towns use tax reliefs or tax-exemption primarily to support local producers and businesses. Tax relief is mostly a subject to placement of stands (a) with the results of own economic activities of farmers, (b) for selling the goods of own production, (c) for selling or presenting of craft products and artworks by producers and authors during and occasional fairs, (d) for selling a folk craft products linked with the demonstration of their production, (e) for selling the folk-art and handicraft products on the occasion of cultural and social events, (f) for selling a small self-made articles of handicraft character at fairs or other events organized by the town, (g) for selling the antiquities and art products in the "crafts alley" during the grape harvest. The second most frequented regulation is tax relief provision for the establishment of summer terraces and seating. Another forms of local economy support is provision of tax reliefs for (1) allocation of circus, fun-fair and other attractions, (2) free artists presentation with no option of selling during the presentation, (3) presentation of the work of craftsmen during the fair, (4) allocation of flowers, flower pots, wreaths and evergreen plants in front of an establishment of flower shop, (5) sale of fruit trees, bushes, transplants of vegeTables and flowers, homemade grave wreaths and bouquets, (6) allocation of eye-catchers, presentation figurines in front of the corresponding establishment outside the pedestrian zone. Some sort of local economy support may provide a provision of tax relief for scaffold construction for the purpose of thermally insulation of flat house.

Slovak municipalities also provide tax reliefs, forgiveness of tax arrears upon request in order to support local producers. Table 1 contains a correlation matrix computed in the SPSS. The results show that there is only a weak relation between current deficits in year 2008 and the tax loss in order to support local economy in year 2009. Regression analysis showed that available data are too much fragmented that every computed model has shown as statistically insignificant. According to the results, contained in Table 1, it may be said that there is practically no relation between the use of real estate tax to support local economy and current deficits.

Table 1: **Correlations between deficits and real estate tax stabilizing function implementation**

		Deficit 2008	Deficit 2009	Deficit 2010	Deficit 2011	Deficit 2012	Deficit 2013
Stabilizing 2009	Pearson Correlation	**,252***	,202	,234	,041	,266*	,156
	Sig. (2-tailed)	,037	,097	,053	,738	,027	,202
	N	69	69	69	69	69	69
Stabilizing 2010	Pearson Correlation	,188	**,126**	,261*	-,001	,193	,102
	Sig. (2-tailed)	,123	,302	,031	,994	,113	,404
	N	69	69	69	69	69	69
Stabilizing 2011	Pearson Correlation	,180	,141	**,230**	-,009	,176	,089
	Sig. (2-tailed)	,139	,248	,058	,941	,147	,468
	N	69	69	69	69	69	69
Stabilizing 2012	Pearson Correlation	,187	,152	,241*	**,023**	,172	,103
	Sig. (2-tailed)	,123	,213	,046	,854	,157	,401
	N	69	69	69	69	69	69
Stabilizing 2013	Pearson Correlation	,135	,076	,250*	-,113	**,127**	-,085
	Sig. (2-tailed)	,270	,536	,038	,354	,298	,487
	N	69	69	69	69	69	69
Stabilizing 2014	Pearson Correlation	,073	,029	,167	-,253*	,057	**-,104**
	Sig. (2-tailed)	,549	,810	,169	,036	,641	,396
	N	69	69	69	69	69	69

Source: Own SPSS processing based on data from the Statements on real estate tax.
Note: * Correlation is significant at the 0.05 level (2-tailed).

Arithmetic mean of computed real estate tax stabilizing function implementation loss during the analysed season was 2.87% of potential real estate tax revenue. E.g. redistribution function implementation "costs" Slovak district towns in average 6.26% of potential real estate tax revenue. According to data it is clear that Slovak district towns use their assigned tax authority in order to support of local (economic and also social) development, but it is questionable whether this is sufficient volume. Municipalities do not use local taxes to support local economy often due to their low ability to influence a localisation decision of an entrepreneur. The analysis shows that Slovak district towns use local taxes primarily in order to tourism promotion. It is hard to say whether it is effective or not. Small municipalities however claim that this form of support can attract a significant number of tourists (primarily due to the tax on use of public space reliefs). It may be thus said that local taxes use as a tool of local economic development has its meaning.

4 Conclusions

Based on the research of a local economic development tools implementation by Slovak municipalities it is possible to say that (Šebová, 2009, 107-108):

- Tax reliefs provided to entrepreneurs by municipalities have no significant influence on decisions of an entrepreneurial subject.
- Entrepreneurial subjects, in spite of almost no influence on the location decision, state that local tax reliefs are an important tool of entrepreneurship support on the municipal territory.

Business Alliance of Slovakia (2005, 29) conducted a survey among entrepreneurs in order to find out which factors are the most important for their activities. Based on these results it is possible to state that more than half of a research sample declared that the level of local tax burden does not pose a major problem for them.

According to results presented in the submitted paper it is clear that Slovak district towns implement some activities in order to support local economy by their tax policies. The most frequented local economy support tax tool is tax on use of public space. In case of real estate tax (after applying a teleological interpretation of the components of this tax) the stabilizing function implementation tax loss value is only 2.87% of potential revenue of the real estate tax. Results showed that there is no relation between using real estate tax as a tool of local economic development and current deficits of Slovak district towns. Therefore an increase of current deficit does not lead into a decrease/increase of real estate tax loss volume spent on support of the local economy. Research

has, however, shown that there is a (relative weak) negative correlation between current deficits of Slovak district towns and use of real estate tax social (redistribution) function. It appears that the social function of local taxes implementation is in condition of Slovak municipalities (not only district towns) much more popular than using local taxes in order to local economic development support. But it will be an object of another paper.

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Effective Tax Rates in the "Foreign Parent – Czech Subsidiary" Links

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Abstract. The paper assesses the economic importance of Czech entities under control of the EU listed companies from a taxation perspective. Both national and EU policy makers deliberate changes in taxation, promoting thus a smooth mobility of capital flows. Two main measures considered – IFRS based taxation and consolidated group's taxation (CCCTB) – can either directly or indirectly influence tax bases of these Czech subsidiaries. Using individual corporate data and macroeconomic time series, the empirical evidence unveils (a) a wide dispersion in the effective tax rates suggesting profit transfers both into and out of the Czech Republic; (b) a significant share of these subsidiaries on the aggregate economic output, with a potentially large impact on revenue to public budget, if any change approved.
Keywords: IFRS adoption, taxation, CCCTB, effective tax rate, parent-subsidiary links.
JEL Classification: M41, H25

1 Introduction

The assessment of advantages and disadvantages of having financial reporting system a dependent or an independent of the taxation system is a key prerequisite of the two major taxation-related issues, currently deliberating by policy makers. The question, how accounting and corporate taxation systems should be constructed in terms of their mutual relations, is essential to decide, (a) whether to allow International Financial Reporting Standards (IFRS) to be a tax base and (b) whether to allow group taxation (represented e.g. by the concept of Common Consolidated Corporate Tax Base – CCCTB). The IFRS- adopting countries need to decide, whether the calculation of tax profits of IFRS entities shall be based on their statutory accounts, or on national accounting standards or independently on accounting regime. The approaches are influenced by local regulatory regimes (Procházka and Pelák 2015) and they vary across countries from the active preference of IFRS to their strict rejection (Procházka and Molín 2015). Allowing the IFRS to be tax base is also relevant for the corporate taxation of multinational enterprises (MNEs), which can easily shift the group's profits into countries with a more favourable tax regime via intragroup transfer pricing. The vision of fair tax competition requires a consolidated approach to taxation of MNEs. A proposal for CCCTB is a strategic response by political representatives.

The paper is to assess the economic importance of those Czech entities, which might be affected by the potential introduction of IFRS for taxation, either directly via calculation of tax profits based on IFRS accounting profits, or indirectly via harmonised tax basis under consolidated group's taxation. Previous research on related topics focus either on Czech listed companies (Procházka 2014), (Mejzlík et al. 2015), or on Czech subsidiaries of all EU companies (Nerudová and Solilová 2015b). Contrary to these studies, the paper deals with the Czech subsidiaries under control of the companies listed on regulated capital markets within the EU. According to the Article 4 of the Regulation (EC) 1606/2002, all firms, with securities admitted to trading on a regulated market of any member state, shall prepare their consolidated accounts in conformity with the IFRS. Consequently, any Czech subsidiary of an EU listed company has to provide its parent with financial statements and other reports based on IFRS, so that the parent can prepare the group's consolidated statements. Following the §19a of the Act on accounting, the Czech subsidiaries, which are subject of IFRS consolidation, are permitted to prepare their statutory annual accounts in compliance with IFRS. Therefore, this type of subsidiaries has the flexibility in choosing statutory accounting regime. A discretionary choice between Czech GAAP and IFRS can be an attractive method of tax optimisation, if CCCTB or IFRS-based taxation would be implemented by policy makers.

2 Literature review

Globalised flows of trade and investments requires a global standard of business language – accounting. Foreign investors and trade partners do not want to rely on financial statements prepared in conformity with national GAAP, as they are not familiar with local institutional environment surrounding financial reporting. Any unawareness may therefore result in suboptimal decisions about the allocation of investments because of the bias (Ahearne, Griever, and Warnock 2004), (Covrig, Defond, and Hung 2007). To lower a risk premium required by foreign investors for a compensation of higher information risk, the local partners have incentives to supply

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financial statements under internationally recognised principles (Ashbaugh 2001). The demand for and supply of harmonised financial reporting standards is therefore of an endogenous nature (Dumontier and Raffournier 1998). However, a wider usage of the IFRS is not automatic, but conditioned by the network effects (Ramanna and Sletten, 2009), with a decisive role of the processes within the EU, accelerating the self-reinforcing nature of the IFRS adoption (Ramanna and Sletten, 2014).

Current research investigates an enormous number of topics connected with the economic consequences of both mandatory and voluntary IFRS adoption. Certain attempts at their summarisation are carried out by (Soderstrom and Sun 2007) or (Brüggemann, Hitz, and Sellhorn 2013). Empirical evidence uncovers that the benefits of the harmonised financial reporting are not guaranteed. In fact, any improvement depends on an interaction of the companies' reporting incentives and the quality of a country's enforcement regime, as indicated by studies both in the pre-adoption (Gigler 1994), (Skinner 1994), (Ball, Robin, and Wu 2003) and the post-adoption period (Burgstahler, Hail, and Leuz 2006), (Christensen, Lee, and Walker 2007), (Lee, Walker, and Christensen 2008), (Daske et al. 2008), (Christensen, Hail, and Leuz 2013), (Daske et al. 2013).

The mixed evidence on the outcomes of the IFRS adoption around the world has also consequences for corporate taxation. The mandatory application of the IFRS in consolidated statements of listed companies is often accompanied with the mandatory or voluntary application of the IFRS in individual statutory accounts, as evidenced by (Procházka and Pelák 2015). Furthermore, many countries allow/require the unlisted companies to adopt the IFRS instead of local GAAP. In case of high book-tax conformity, i.e. the strong interdependence of corporate and tax accounting (Procházka and Molín 2015), the calculation of accounting profit according to IFRS may yield a substantially different amount compared to local GAAP and thus result in an unpredicTable tax base. The debate on suitability of the IFRS to serve as basis for corporate taxation emerged originally in German speaking countries (Eberhartinger and Klostermann 2007), (Schanz and Schanz 2010) (Kager, Schanz, and Niemann 2011) and (Kager and Niemann 2013), followed by intensive research in other EU countries (Haverals 2007), (Oestreicher and Spengel 2007), (Barbe, Didelot, and Ashta 2014), (Gavana, Guggiola, and Marenzi 2015), including the Czech Republic (Molín and Jirásková 2014), (Procházka 2014), (Mejzlík et al. 2015).

None of above studies addresses the potential impact of the IFRS taxation on Czech private entities, which have flexibility in choosing the statutory accounting regime determining the starting point for the calculation of tax profit. Similarly, the evidence on the role of the IFRS adoption by multinational enterprises is rare. (De Simone 2013) finds out that the tax discipline is alleviated at some extent after in the post-adoption era; similar findings are presented by (Watrin, Ebert, and Thomsen 2014). On the other side, (Tang 2015) investigates that the IFRS adoption has not affected the association between earnings management and tax evasion. However, the majority of recent European papers, dealing with the MNEs' taxation, focus on the issue of consolidated taxation via the concept of CCCTB, e.g. (Jacobs et al. 2005), (Kahle and Schulz 2011), (Spengel et al. 2012), (Spengel and Oestreicher 2012), (Domonkos et al. 2013), (Roggeman et al. 2013), (Roggeman et al. 2014), (Nerudová and Solilová 2015a), (Nerudová and Solilová 2015b). Despite these studies include the subsidiaries in calculations, they utilise data from the statutory financial statements only. However, a potential impact of the change in accounting regime (from local GAAP to IFRS, or vice versa), if allowed by local law, on tax base is not considered. For this reason, the next section analyses the economic importance of Czech companies under control of the EU listed companies, focusing on their effective tax rates. The assessment of effective taxation may bring additional insights, whether to allow IFRS based taxation or consolidated taxation in the Czech Republic.

3 Data and methodology

The information on the Czech subsidiaries of EU listed companies is obtained from Amadeus Bureau Van Dijk database. There are several imperfections using the Amadeus for this purpose. Firstly, data on financial institutions are not included; secondly the database regards as listed only the issuers of shares, but not for the bond issuers despite these have to also comply with the Regulation (EC); thirdly, regulated market of the RM-System is not screened for the inclusion of listed companies; fourthly, there are a quite a lot mistakes in the identification of companies. Using manual checks against the Business Register and manual searches in the PSE and the RM-System, the number of Czech companies under control of the EU listed companies is determined to be 1,347.

The Albertina database is used to generate an extract from the financial statements of identified Czech subsidiaries. Descriptive statistics of selected financial Figures are presented in Table 2. The sample contains some extreme values (e.g. Škoda Auto and RWE CZ are approximately three times larger than next big firms). Regarding the corporate income tax, more than a half of firms, for which financial statements are available, did not recognised any tax expense for years 2012 and 2013 and almost a half of them did not pay any taxes for 2014 (see the median values in the column CIT). Similarly, a significant share of companies reports the negative pre-tax accounting profits. Negative profits might be subject of interest for the corresponding parents to utilise losses and net off them, if consolidated taxation is introduced. In particular, 367 companies in 2012, 374 firms in 2013, and 141 entities in 2014 have the EBT below zero.

Table 1: Czech subsidiaries under control of the EU listed companies

Type on entity	Number of entities
EU listed companies (non-financial, equities traded)	7,851
Czech subsidiaries of EU listed companies according to Amadeus	1,629
Czech subsidiaries of EU listed companies after manual correction	1,347

Source: own analysis of records in Amadeus, Albertina, Business Register, PSE, RM-System

Table 2: **Descriptive statistics of Czech subsidiaries (mil CZK)**

Year		Total assets	Equity	Turnover	EBIT	CIT	EBT	EAT
2012	**Min**	0	-1,713	-1	-7,250	-1,291	-680	-810
	1st quartile	35	6	11	0	0	0	0
	Median	151	49	110	5	0	4	3
	3rd quartile	589	219	593	32	4	28	24
	Maximum	141,242	90,465	246,308	17,004	1,985	46,834	48,198
	Mean	1,474	755	1,625	102	19	145	127
	St. deviation	7,782	4,929	9,344	736	116	1,492	1,480
2013	**Min**	0	-407	0	-1,689	-409	-1,668	-1,538
	1st quartile	37	7	11	0	0	0	0
	Median	162	50	116	5	0	4	3
	3rd quartile	640	224	658	33	4	30	24
	Maximum	152,001	90,316	249,648	27,791	1,666	30,187	24,038
	Mean	1,600	792	1,728	127	20	146	122
	St. deviation	8,219	4,880	10,397	1,016	110	1,144	953
2014	**Min**	0	-648	0	-4,375	-35	-4,887	-3,995
	1st quartile	61	18	45	1	0	1	1
	Median	273	92	250	13	2	12	10
	3rd quartile	987	426	1,271	69	10	69	59
	Maximum	176,869	121,549	304,448	21,598	3,333	21,349	18,421
	Mean	2,446	1,336	2,671	174	32	181	150
	St. deviation	11,197	7,659	14,087	999	167	1,010	856

Source: own analysis of data from the Albertina database

4 Results

To assess the economic importance of subsidiaries in question, the data from financial statements are added up and compared with corresponding aggregate amounts for non-financial sector of the Czech economy published by the Czech Statistical Office. The results are outlined in Table 3.

The Czech subsidiaries under control of EU listed companies have command over 12.1-12.9% of assets employed by the firms operating in non-financial sector. Furthermore, they produce more than one quarter (26.4-29.2%) of aggregate output of Czech non-financial sector. Their macroeconomic importance is also confirmed by tax Figures, as their share on corporate income tax revenue to public budgets ranges from 17.3% to 18.6%. Once again, it has to be stressed that such amount of taxes is generated by 1,347 companies only, which is less than

0.3% of all active Czech business enterprises.* Any change in taxation towards IFRS or consolidated taxation can significantly influence the collection of corporate income tax giving the flexibility of this type of companies in a selection of statutory accounting system. For this reason, we return back to the analysis of individual corporate data in detail. In particular, individual historical effective tax rates (ETR) for 2012-2014 are calculated.

Table 3: Economic importance of Czech subsidiaries (mil CZK)

Year	Total assets	Equity	Turnover	EBIT	CIT	EBT	EAT
Subsidiaries	1,833,357	939,814	2,021,711	126,510	23,405	179 787	158,274
Non-financial sector	14,582,740	6,073,825	7,225,192	1,710,675	127,480*	621 162	517,867
Share in %	12.6%	15.5%	28.0%	7.4%	18.4%	28,9%	30.6%
Subsidiaries	1,966,037	972,864	2,124,319	155,878	24,640	179 107	149,790
Non-financial sector	15,208,502	6,482,650	7,278,048	1,701,327	132,558*	609 027	499,768
Share in %	12.9%	15.0%	29.2%	9.2%	18.6%	29,4%	30.0%
Subsidiaries	1,888,685	1,031,683	2,061,724	134,178	24,829	139 672	116,170
Non-financial sector	15,561,693	6,538,766	7,809,686	1,856,066	143,871*	746 000	622,741
Share in %	12.1%	15.8%	26.4%	7.2%	17.3%	18,7%	18.7%

Source: own analysis of company data from Albertina and data on non-financial sector from the Czech Statistical Office (http://apl.czso.cz/pll/rocenka/rocenkavyber.casrady_sek_en)

EBIT – Earnings Before Interest and Taxation; CIT – Corporate Income Tax (current); EBT – Earnings Before Taxation; EAT – Earnings After Taxation

*The aggregated Figures on CIT show the total collection of corporate income tax from all business enterprises

To get meaningful results, all observations with either negative EBT and/or negative CIT are excluded. Similarly, companies without any turnover are dropped out. Finally, extremely high values (over 250%)† of the ETR are also eliminated to avoid distortion, when interpreting the outcomes. The firm-observations are classified into a matrix, where the first dimension is the primary industry of an entity according to the CZ-NACE classification and the second dimension is the domicile of its parent. For each year observation, ETR is calculated as the ratio between CIT and EBT; the result is rounded to one decimal place. Group averages are computed as a simple average for all corresponding values. The composition of data is sketched in Table 4.

Table 4: Distribution of effective tax rates

Year	2012	2013	2014	Total
Number of companies	775	758	577	2,110
Mean (unweighted) ETR	19.1%	20.0%	18.3%	19.2%
Median ETR	19.0%	19.0%	18.9%	18.3%

Source: own analysis of company data from Albertina

The analysis unveils relatively sTable development of ETR, both for mean and median, ranging from 18.3-20.0% in case of the mean and 19% in case of the median. The comovement of legal tax rate with average ETR is surprising, but coincidental. The average ETR for the Czech subsidiaries under control of the EU listed companies is well below the effective tax rate of 26.5% computed for the total Czech economy (Svitlík 2015). Recalling Table 2 indicating that around one half of these firms do not pay any taxes, there are three explanation of lower effective taxation of these companies: worse performance compared to other companies in economy; tax incentives (tax reliefs) granted by the government; better tax optimisation within the MNE's through transfer pricing and other

* Actual share on tax revenue is surely higher, as the Albertina database does not include data for all companies in all years (delays in data collection; financial statements are not published in the Business Register; etc.). E.g. 118 firms-data are missing for 2013, 575 entries are not available for 2014 yet.

† In many cases, small EBT (around zero) are adjusted to high tax profits and hence high income taxes, resulting thus in exaggerated relative rates of taxation. The most extreme value was identified in year 2012, reaching 219,315.9% for one company in the sample.

channels. The first explanation seems not to be valid (see a relative high share of EBT and EAT compared to the share on invested capital by owners Table 2 and Table 3); the latter two alternatives shall be addressed by future research.

Table 5 presents the cross-sectional distribution of ETR across the subsidiaries' industries and parents' domiciles. Germany (616), French (250), and Czech parents (239) are most frequent as far as the domicile of parents concerns. Manufacturing (602), Wholesale and retail trade (454), and Professional, scientific and technical activities (259) are top 3 industry-affiliations of the Czech subsidiaries. The most instances appear for Czech manufacturing firms under control of German listed companies (187 occurrences), followed by wholesale and retail Czech subsidiaries of German parents (128) and French branches in manufacturing (84). 243 combinations of industries and countries (61.4%) do not show any observation. For 153 combinations, the number of observations is lower than 4. For this reason, the averages across the cells are not comparable. Cells highlighted in bold contain more than 10 observations.

Regarding the cross-country differences, the minimum average ETR is achieved by Czech companies having a Portuguese (5.2%) or a Greek (7.9%) parent. However, the number of such Czech entities is relatively small and the individual observations – despite grouped together – can still be considered as extreme outliners. From the more frequent cases, the lowest effective taxation is evidence for the subsidiaries of Finnish (14.4%), Belgian (14.6%), and Italian (16.5%) parents. In contrast, the highest level of taxation is common for Czech firms having a parent domiciled in Spain (26.4%), the Netherlands (25.2%), and Poland (24.4%). As far as the cross-industry analysis, the highest taxation is experienced by Agriculture (44.1%), followed by Accommodation (30.2%) and Administrative and support services (24.7%). If sparse industries are omitted, the minimum ETR is reached in Real estate activities (16.1%), in Construction (16.2%), and in Financial and insurance activities (16.3%). Finally, the analysis of the within-groups variation unveils that the most taxed entities are Czech companies, operating in Administrative services, with an Austrian parent (44.5%) and firms trading in Wholesale and retail, being under control of Spanish parents (42%). It is surprising that Austrian listed companies also command another extreme group of Czech subsidiaries, this time with a minimum average taxation of 4.7% (in Real estate industry).

The cross-sectional analysis of individual corporate financial data uncovers thus a wide dispersion of effective tax rates. Certain parent-industry combinations are taxed significantly higher over statutory tax rate (more than twice in particular cases), which might be an indication that foreign parent companies try to shift the tax burden to the Czech Republic. On the other side, other groups of companies experience lower effective taxation, which might be a sign of tax evasion. As all companies face the same accounting regime (Czech GAAP), which serves also as a basis for taxation, the immense variation in ETRs suggests that the amount of corporate taxation is only loosely linked to the amount of accounting pre-tax profit. The resulting corporate taxation is rather determined by the provisions of Act on income taxes, defining taxable and non-deductible amounts quite differently from the accounting regulation. This microeconomic evidence thus confirms the findings from previous studies, utilising aggregate time series on tax revenue, which identify that adjustments of accounting profit have a higher impact on the tax base than accounting profit itself (Mejzlík, Vítek, and Roe 2014), (Mejzlík et al. 2015).

5 Conclusions

The paper evaluates the economic importance of Czech entities under control of the EU listed companies, with a special attention to corporate taxation. Using individual corporate data and macroeconomic time series, the empirical evidence indicates (a) a wide dispersion in the effective tax rates suggesting profit transfers both into and out of the Czech Republic; (b) a significant share of these subsidiaries on the aggregate economic output, with a potentially large impact on revenue to public budget, if any change approved. The paper's findings might be relevant for the policy makers considering the implementation of consolidated taxation (such as CCCTB), or allowing the calculation of tax profits based on IFRS Figures. An extreme variation in ETRs signals that the corporate taxation is loosely linked to the calculation of accounting pre-tax profits, which might mitigate potentially negative effects, in case of the changes in taxation regime. However, future research shall address, what are the main determinants of corporate taxation of Czech subsidiaries under foreign control and explain thus the variations in the effective tax rates across the subsidiaries' industries and the parents' domiciles.

Table 5: Effective tax rates: averages according to the subsidiaries' industries and parents' domiciles

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	P	Q	R	S	Average	Count
AT		26,4	**13,8**	8,5		**14,6**	**25,3**		14,2	11,9		**4,7**	**16,5**	**44,5**				7,8	**18,7**	**148**
BE			**13,1**	16,8		9,9	11,1			0,0		9,5	24,3						**14,6**	**44**
CY			29,1																**29,1**	**4**
CZ	0,0	13,4	**19,7**	**21,0**	**14,2**	5,1	**15,4**	**18,8**		**33,4**		**13,9**	**19,7**	19,5		0,0			**18,8**	**239**
DE	80,0	**17,9**	**17,3**	**17,8**	29,7	**17,5**	**17,8**	**18,0**	18,4	**15,8**	**15,8**	**18,4**	**18,2**	**17,0**				2,7	**17,7**	**616**
DK			**14,9**		36,1		20,4	0,0		27,3		11,4	22,1						**17,6**	**37**
ES			**19,4**	17,1	**21,4**	67,5	**42,0**			22,8		**21,7**		13,2					**26,4**	**100**
FI			**13,6**			4,1	**13,3**			20,7		24,8	17,7	8,0					**14,4**	**64**
FR	15,7	19,6	**19,6**	19,3	18,6	**22,9**	**25,2**	0,0	28,3	**21,2**	21,5	**30,1**	**16,3**						**21,3**	**250**
GB			**13,9**	**16,4**		4,7	**22,5**	0,0	19,7	29,8		10,3	**20,2**	**14,2**				19,2	**17,7**	**174**
GR								14,5				4,7							**7,9**	**6**
HR													18,8						**18,8**	**3**
HU							12,1												**12,1**	**8**
IE			30,5			15,0	**22,1**						14,1						**21,2**	**35**
IT			16,1				**15,5**			13,1		22,4	19,8						**16,5**	**30**
LU	65,5		**8,6**	0,0	0,0	9,3	10,4		0,0	13,4	19,8	**14,7**	**32,9**	46,6	20,2				**19,1**	**125**
NL			**19,5**	60,2			**29,6**	20,5		23,2		0,0	18,7	0,0			13,9		**25,2**	**47**
PL			**24,6**	20,8			**15,1**		119,7			13,5	12,4						**24,4**	**47**
PT						3,6						7,4							**5,2**	**7**
SE			**20,0**	8,7		32,3	**24,9**	19,0		0,0	0,1	24,2	**23,0**	27,5					**22,0**	**105**
SI							20,5						34,1						**25,0**	**9**
SK						22,6	47,4			13,3		0,0	16,2						**20,4**	**12**
Average	**44,1**	**19,5**	**17,5**	**19,6**	**20,1**	**16,2**	**21,7**	**16,9**	**30,2**	**19,0**	**16,3**	**16,1**	**19,8**	**24,7**	**20,2**	**0,0**	**13,9**	**11,3**	**19,2**	**148**
Count	**11**	**26**	**602**	**130**	**53**	**109**	**454**	**62**	**17**	**108**	**21**	**197**	**239**	**71**	**1**	**1**	**3**	**5**		**2,110**

Source: own analysis of company data from Albertina; in columns Industry of Czech subsidiaries according to CZ-NACE, in rows Domicile of their parents

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Effective corporate income tax rate and benefits to top management: a study based on Czech and Russian listed companies

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Abstract. The paper analyzes connection between effective corporate income tax rate and benefits that are provided to the top management of the studied companies to total expenses ratio. The companies were chosen from the Czech and Russian listed firms. Only firms preparing their financial statements according to IFRS were taken into account to ensure the comparativeness of the data.
The analyses demonstrated that statistically significant correlation between the above-mentioned indicators was not observed.
Keywords: IAS 19, employee benefits, effective tax rate, corporate income tax, benefits to top management.
JEL Classification: H25

1 Introduction and literature review

Actuality and importance of ways of motivating employees have been only growing since the labor market appeared. It is obvious that a highly motivated employee is able to fulfill his duties with better qualitative and quantitative results that an employee who is not interested in his job.
Nowadays, every company offers a range of benefits to their employees. IAS 19 *Employee Benefits* (IASB, 2011) contains a list of possible payments, bonuses, goods, services and programs that can be recognized as benefits. In addition, IFRS 2 *Share-based payments* (IASB, 2013) and IAS 26 *Accounting and Reporting by Retirement Benefit Plans* (IASB, 1994) deal with specific kinds of employee benefits.

On the one hand, employee benefits (at least wages and salaries) are an important part of policy of each firm and are supposed to have a positive impact on its financial results due to productivity growth and strengthening of the firm's reputation among its customers, employees and often the authorities. On the other hand, tax legislations of most countries do not consider a big part of the benefits, which are not directly connected with the productivity of the employee or with the process of generating the firm's income, to be tax deductible. This fact especially influences benefits to top management, as there exists a wide range of payments and bonuses (e.g. prepaid vacation, extra medical insurance, vehicle, etc.) that are provided from the net income sometimes as some of them are not tax deductible. More than that, tax legislation of different countries can take various position regarding deductibility of concrete types of benefits.

Tax impact of employee benefits was studied, inter alia, by M. Otavova and J. Glaserova (Otavova, Glaserova, 2009) who compared the IFRS and Czech accounting standards in this aspect and demonstrated influence of different types of benefits on absolute amount of advance corporation tax. However, effective tax rate has not been studied in the mentioned paper. The author did not manage to find papers that analyze correlation between effective tax rate and benefits to top management.

The aim of the paper is to analyze if the effective tax rate of a firm is connected with the amount of benefits provided to top management. It may seem possible that the positive correlation between these two indicators will be recognized, especially if one considers employee benefits to be mainly bonuses. Nevertheless, IAS 19 (IASB, 2011) regards wages and salaries that are tax deductible and form usually a great deal of an employee's income received from a firm as a benefit.

To continue the logical chain, the following hypothesis can be formulated:

H1. Correlation between the effective tax rate of a firm and the amount of benefits due to top management cannot be observed in a statistically significant level.

It is expected that the hypothesis H1 will be accepted or at least cannot be rejected.

The next part of the paper will be devoted to analysis connected with this hypothesis.

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2 Analysis of effective tax rate and benefits to top management

Methodology

To study the problem described above, it is necessary to dispose of financial information of a sample of companies. To ensure data comparability, only companies preparing their consolidated financial statements according to IFRS are analyzed in this paper.
The choice of the Czech Republic and Russian Federation as the target countries can be explained with the fact that the author's main scope of interests being researched in her PhD thesis is accounting in the mentioned countries due to the growing importance of standardizing of financial accounting not only among the European countries but also among Europe's trade and business partners all over the world.
As soon as the sample of companies is obtained (this process is described in the section 2.2 Data search) effective corporate income tax rate should be calculated. After that, the benefits to top management to total expenses ratio will be shown.
Then, correlation between the analyzed indicators is to be calculated using the Pearson correlation coefficient. The hypothesis H1 will be accepted or rejected according to the meaning of the coefficient.

Data search

One of possible ways to gain a sample of Czech and Russian companies preparing their consolidated financial statements according to IFRS is to search this information in the stock exchanges' websites. Czech and Russian companies whose securities are traded on an official stock exchange have to use IFRS while preparing their financial statements.
Prague Stock Exchange offers PX index consisting of shares of the following companies as at 21. 03. 2016 (Prague Stock Exchange, 2016):

- Komerční banka, a.s. – 22.17%,
- ČEZ, a.s. – 20.96%,
- Erste Group Bank AG – 20.11%,
- VIENNA INSURANCE GROUP – 10.28%,
- O2 Czech Republic a.s. – 8.20%,
- Philip Morris ČR a.s. – 3.89%,
- PEGAS NONWOVENS SA – 3.73%,
- UNIPETROL, a.s. – 3.39%,
- Stock Spirits Group PLC – 2.91%,
- CENTRAL EUROPEAN Moscow Exchange DIA ENTERPRISES LTD. – 2.11%,
- Kofola ČeskoSlovensko a.s. – 1.05%,
- Fortuna Entertainment Group N.V – 0.92%,
- New World Resources Plc – 0.28%.

A 5% materiality level was used in this paper to receive a relevant sample of companies. The first five firms from the ones listed above comply with this criterion and represent a total of 81.72%. All these companies prepare their consolidated financial statements in accordance with IFRS. This criterion is necessary to ensure the comparability of financial data. However, Erste Group Bank AG reported loss in the financial year 2014 (Erste Group Bank AG, 2015) and was therefore excluded from the sample.

The sample of Czech companies includes the following firms:

- Komerční banka, a.s. (hereinafter "KB"),
- ČEZ, a.s. (hereinafter "CEZ"),
- VIENNA INSURANCE GROUP (hereinafter "VIG"),
- O2 Czech Republic a.s. (hereinafter "O2"),
- Philip Morris ČR a.s. (hereinafter "PM").

Moscow Exchange offers so-called "blue chips" index including shares of 15 Russian companies as at 21. 03. 2016 (Moscow Exchange, 2016):

- PAO "Gazprom" – 17.97%,
- PAO "Sberbank Rossii" – 15.19%,
- PAO "LUKOIL" – 14.25%,
- PAO "Magnit" – 7.52%,
- OAO "NOVATEK" – 6.57%,
- PAO "GMK "Norilskij nikel" – 5.83%,
- OAO "NK "Rosneft" – 5.21%,
- Bank VTB (PAO) – 4.98%,
- OAO "Surgutneftegaz" – 4.54%,

- OAO “AK “Transneft”, preference shares – 3.66%,
- PAO “Tatneft” im. V. D. Shashina – 3.29%,
- OAO “Surgutneftegaz”, preference shares – 3.19%,
- PAO “MTS” – 2.89%,
- PAO “Moskovskaja birzha” – 1.77%,
- AK “ALROSA” (PAO) – 1.57%,
- PAO “Severstal” – 1.56%.

First seven companies from this list fulfill the condition of 5% materiality level. However, PAO “LUKOIL” prepares its consolidated financial statements under US GAAP (PAO “LUKOIL”, 2015) and was therefore excluded from the analysis. PAO “Magnit” has not published its consolidated financial statements for the financial year 2014 so far (as at 21. 03. 2016). PAO “Sberbank Rossii” did not specified details about benefits to top management in its financial statements for the year 2014 (PAO “Sberbank Rossii”, 2015).

Thus, the following five companies will be included in the sample:

- PAO “Gazprom” (hereinafter “Gazprom”),
- OAO “NOVATEK” (hereinafter “NOVATEK”),
- PAO “GMK “Norilskij nikel” (hereinafter “GMKNN”),
- OAO “NK “Rosneft” (hereinafter “Rosneft”),
- Bank VTB (PAO) (hereinafter “VTB”).

3 Analyzed indicators

The following Table 1 contains financial information used for calculating of the above-mentioned indicators described in the section 2.1.

Table 1: Financial information of the analyzed companies for the financial year 2014, million RUB/CZK/EUR

Company	Wages and salaries	Benefits to top management	Earnings before tax	Corporate income tax	Total expenses
Russian companies					
GMKNN	78 298	1 424	118 753	25 353	350 952
Rosneft	231 000	7 000	478 000	128 000	5 195 000
NOVATEK	12 009	1 746	52 843	15 928	316 545
Gazprom	516 778	4 393	306 823	149 631	5 718 843
VTB	145 800	5 900	32 800	31 500	1 339 100
Czech companies					
KB	6 754	62	16 030	2 669	24 639
PM	1 079	54	2 821	566	11 366
CEZ	18 852	413	28 656	6 224	172 682
O2	4 623	135	5 178	1 180	40 311
VIG	592	4	518	127	10 933

Source: PAO “GMK “Norilskij nikel”, 2015; OAO “NK “Rosneft”, 2015; OAO “NOVATEK”, 2015; PAO “Gazprom”, 2015; Bank VTB (PAO), 2015; Komerční banka, a.s., 2015; Philip Morris ČR a.s., 2015; ČEZ, a.s., 2015; O2 Czech Republic a.s., 2015; VIENNA INSURANCE GROUP, 2015.

In the Table 2, effective tax rate and benefits to top management to total expenses ratio are presented.

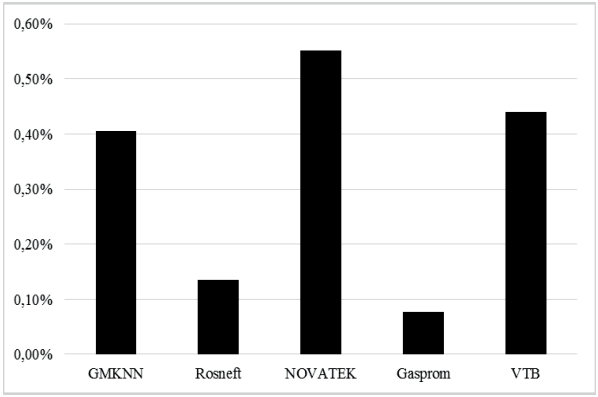
Table 2: **Effective tax rate and benefits to top management to total expenses ratio of the analyzed companies for the financial year 2014, %**

Company	Effective tax rate	Benefits to top management/Total expenses
Russian companies		
GMKNN	21,35	0,41
Rosneft	26,78	0,13
NOVATEK	30,14	0,55
Gazprom	48,77	0,08
VTB	96,04	0,44
Czech companies		
KB	16,65	0,25
PM	20,06	0,48
CEZ	21,72	0,24
O2	22,79	0,34
VIG	24,50	0,04

Source: The author's own calculations in MS Excel 2013 based on: PAO "GMK "Norilskij nikel", 2015; OAO "NK "Rosneft", 2015; OAO "NOVATEK", 2015; PAO "Gazprom", 2015; Bank VTB (PAO), 2015; Komerční banka, a.s., 2015; Philip Morris ČR a.s., 2015; ČEZ, a.s., 2015; O2 Czech Republic a.s., 2015; VIENNA INSURANCE GROUP, 2015

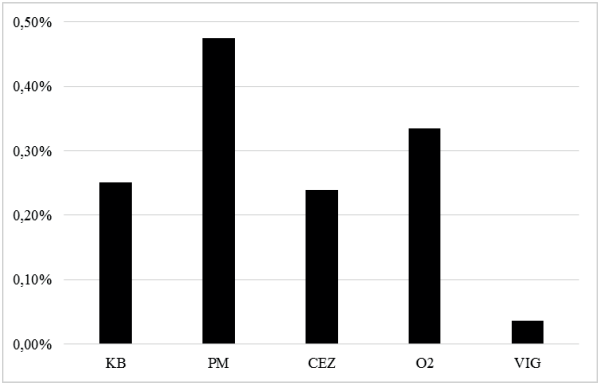
The data in the Table 2 was sorted in ascending order using effective tax rate as a criterion. The Table 2 and the Figures 1 and 2 shown below demonstrate that correlation between effective tax rate and benefits to top management to total expenses ratio was not found. This fact can be also supported by calculating of correlation coefficients in MS Excel: correlation coefficient for Russian companies is 0,12, for Czech companies it is –0,44.

Figure 1: Benefits to top management to total expenses ratio: Russian companies



Source: The author's own calculations in MS Excel 2013 based on: PAO "GMK "Norilskij nikel", 2015; OAO "NK "Rosneft", 2015; OAO "NOVATEK", 2015; PAO "Gazprom", 2015; Bank VTB (PAO), 2015; Komerční banka, a.s., 2015; Philip Morris ČR a.s., 2015; ČEZ, a.s., 2015; O2 Czech Republic a.s., 2015; VIENNA INSURANCE GROUP, 2015

Figure 2: Benefits to top management to total expenses ratio: Czech companies



Source: The author's own calculations in MS Excel 2013 based on: PAO "GMK "Norilskij nikel", 2015; OAO "NK "Rosneft", 2015; OAO "NOVATEK", 2015; PAO "Gazprom", 2015; Bank VTB (PAO), 2015; Komerční banka, a.s., 2015; Philip Morris ČR a.s., 2015; ČEZ, a.s., 2015; O2 Czech Republic a.s., 2015; VIENNA INSURANCE GROUP, 2015

4 Conclusions

Analysis conducted in this paper demonstrated that a statistically significant correlation between effective tax rate and share of benefits to top management in total expenses was not observed. In the case of the Czech companies, medium inverse correlation was found. However, the reasons of this fact are not clear and may be explained with the fact that the size of the sample cannot exclude a possibility of a random coincidence. Thus, the hypothesis H1 formulated in the beginning of the paper cannot be rejected.

The reasons of different correlation coefficients calculated for Czech and Russian companies can be a field for further research. It is also possible to enlarge the sample of the analyzed firms. The main problem on this way is lack of comparable data even for well-known companies, as was shown above. Due to lack of the data, it was not possible to divide the benefits to top management into tax deductible and non-deductible, which would be a logical continue of the research.

The results of the paper can be a further step in studying of influence of benefits to top management on effective tax rate and may be an informative source for the companies that operate on the markets of the mentioned states.

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Selected Factors of the Business Environment in the Czech Republic

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Summary. The purpose of the paper is to evaluate the development of the general legislative environment on the basis of selected applicable legislation or measures or any draft amendments thereof, which affect the quality, financial and time requirements as well as the load on entrepreneurs, especially sole traders and small and medium-sized companies, and to assess these drafts and propose variant solutions of problems arising out of such laws, especially in relation to the electronic records of sales, changes in waiting periods, amendment of the anti-smoking law, and other selected areas of legislative amendments in 2016 in the Czech Republic.
Keywords: legislative environment, taxes, collection of taxes, motivation
JEL Classification: H2, H30, H50, H71

1 Introduction

Entrepreneurs, sole traders and especially small and medium-sized companies perceive themselves as a progressive entity component as far as the enterprise development and the employment of people is concerned and the actual support of these entities is perceived as a certain democracy indicator. Within the Czech Republic, support to business is merely been declared, especially as far as small and medium-sized companies are concerned, but there´s no real support due to the following three reasons:

a) In spite of the number of officials rising, the state is unable to fulfil its basic functions and continuously transfers its basic functions businesses, especially when it comes to tax administration and tax collection.
b) Implementation of Brussel´s bureaucratic ideas.
c) The MPs´, senators´ some ministers´ desire to regulate anything if possible by introducing social engineering with the argument that these people are doing everything possible via orders, prohibitions, higher sanctions and restrictions in order to serve the benefit of the citizens.

Especially the Czech Ministry of Finance prepared several measures targeted against "dishonest entrepreneurs" who do not pay the proper tax amount. This primarily relates to widening the reverse charge application, furthermore, the unreliable VAT taxpayer instrument is to be mentioned. In 2016, the control reports and the electronic income monitoring have been introduced. A central bank account-list and the enterprises higher criminal liability is now being negotiated with the Czech National Bank. The tax administration is planning to collect data on companies and citizens into a so-called data warehouse, not only VAT taxpayers are going to be regarded as unreliable, a new instrument of unreliable persons is being prepared which means that a new blacklist shall be created. The idea of abolishing the so-called waiting period during temporary incapacity from work or the notion of paid holiday for a husband within a length of 4-7 days in cases of childbirths, and the shop opening hours regulation are altogether entering the tax relevant scene.

The growing globalisation of world economy is a new feature in the conditions of the implementation of tax reforms [5]. With its new proposals for the fight against tax evasion, the European Commission has opened a new chapter within its campaign for a just, effective, and growth-enhancing taxation within the EU. The package against tax evasion is calling upon the member states to implement a stricter and more coordinated attitude against companies who are trying to evade just tax amount payment by implementing international norms against the tax base erosion and the transfer of profits [6].

There is an immense number of cases of creativity of lawmakers, including: introduction of the so-called check report, electronic records of sales, extension of the reverse charge mechanism, re-introduction of a sick pay for the first three days of sickness, the so-called "father´s leave", reduction of opening hours, tightening of the anti-smoking law, the duty to wear reflective elements at night outside the urban area, the right of an officer to enter a dwelling in order to check the heating source, mandatory checking of chimneys, mandatory checking of boilers, proposed introduction of a road tax also for private cars, changes in transfer of vehicles leading to significant deterioration of the legal state and growth of crime, punishing of kindergartens by the Czech State Inspectorate for organising supplementary clubs as they discriminate against socially disadvantaged children, a planned central health register, compulsory third-party insurance also for small tractors and other motor vehicles, which are not road users, introduction of higher fines for driving offences.

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2 Data and Methods

Within this article, we apply the methods of description, analysis and synthesis.

Any measure aims at increasing the tax income. The idea that any entrepreneur reports his income and pays taxes is certainly correct. Yet the question is whether the people such measures are actually being designed for, will suddenly become honest and will pay taxes for their income. The control report and the electronic income monitoring is going to affect accountants who are going to fill in the report forms for the entrepreneurs or who are going to enter income not linked to a code into the system within 48 hours. Let us consider the example of a self-employed worker who finishes his work on Friday at 6 p.m., who receives his payment, but who does not have a smartphone nor a printer, or who isn´t able to carry out such an activity. Such a worker reports the income to his accountant on Monday and is going to demand that the accountant enters the data into the systems yet the worker will not manage to stick to the deadline because on Monday, 48 hours will already have passed. This whole system leads to an increased bureaucratic load and higher costs caused to the entrepreneurs.

The state administration is transferring its duties to the taxpayer or rather, to his accountant who then have to charge higher fees as the amount of their work increases and as it consumes more time, they have more duties, responsibilities and are facing more possible sanctions. Any company or private individual spends several thousand CZK per year on the sheer training in the field of the ever-changing legal regulations and new duties.

A significantly cheaper solution would be strengthening the faith into the whole tax system. The state administration should succeed in convincing the taxpayers that the same rules apply to everybody and that the payments themselves actually make sense. According to our opinion, companies paying taxes and creating job positions are not being motivated.

Furthermore it is important that the companies pay taxes within the area where they generate their profit.

3 Discussion

The reverse charge procedure

The Czech Republic made use of the option given by the Council Directive 2006/112/EC of 28th November 2006 on the common performances services whose provision shall give rise to the transfer of tax liability. The reverse charge procedure applies to all performances hitherto defined in the Act on VAT, i.e. to gold supplies (§ 92b), to the supply of goods listed in annex No. 5 of the Act (§ 92c), to the transfer of greenhouse gas emission permits (only a minor change was carried out here, or rather – the government regulation No. 361/2014 Sb. 3 lays down the continuing reverse charge procedure for the transfer of greenhouse gas permits from 1.1.2015 onwards) and to carrying out construction or assembly works (§ 92e).

The reverse charge procedure [8] shall be applied in cases of taxable performances such as the delivery of selected goods, if the overall tax base amount of all the supplied selected goods surpasses CZK 100 000 – this applies from 1.4.2015 onwards on any selected goods with the exception of sugarcane (tax tariff nomenclature code 1212 91), where the regulations apply from 1.9.2015 onwards. Selected goods as such are: the already cited governmental regulation says that in order to be able to use the reverse charge procedure the respective goods have to be verbally specified and specified by the respective tax tariff nomenclature code (e.g. grain, metals, video consoles listed under the tax tariff nomenclature code 9504c, cell phones listed under the tax tariff nomenclature code 8517 12 00 or 8517 18 00, integrated circuits, such as microprocessors and central processor units, listed under the tax tariff nomenclature code 8542 31 and printed circuits equipped with these circuits that are delivered prior to the integration into the products for the end users, porTable automatic data processing machines listed under the tax tariff nomenclature code 8471 30 00, such as notebooks or Tablets. The tax tariff nomenclature code is a cipher code listed in annex No. 1 of the Council Regulation (EEC) No. 2658/87 of 23rd July 1987 on customs and statistic nomenclature and on the mutual customs tariff, as amended.

In our opinion, the reverse charge regime is an example of an efficient procedure. On one hand, it will prevent the occurrence of deductions, where the taxable person on the other side fails to pay the value added tax. Although, in essence, the extension of the reverse charge mechanism is a crutch of state administration replacing the inability to penalise tax evasions, but it actually solves only part of the problems. There is still a question whether the value added tax system is satisfactory in the condition of the economic globalisation or if it should be replaced by another system. Introduction of a modified form of the turnover tax should be discussed by experts.

Electronic income monitoring

Another frequently discussed topic is the electronic income regulation [7]. The taxpayer has to send a report on the income to the tax administration authority at the latest when the goods are paid for and he has to issue the buyer a bill. The data sent to the tax authority shall include the Tax Identification Number (Czech abbrev. DIČ), the designation of the shop and the cashbox, the bill number the date, the income height, the amount excluding VAT

and the VAT amount as well as the safety and signature code. If the taxpayer doesn´t get a receival confirmation, he has to send the data again within 48 hours.

Probably, there will be a simplified mode income regulation monitoring in regular public passenger transport vehicles. The government shall have the option to define further areas for a simplified mode income regulation monitoring via a government regulation; this refers to areas where the usual monitoring would hamper or disable an efficient execution of the activity. Also the Financial Authority shall have the right to permit a simplified monitoring.

This monitoring does not apply to income for the state, regions or municipalities, post offices, banks, insurance companies, investment and pension funds neither to energy companies´ and water supply companies. Furthermore the income of school canteens, in airplanes, income resulting from train ticket sales or from public transport means ticket prices and from vendor machines as well as from public toilets shall be excluded as well.

The taxpayer is obliged to publish the information that he is obliged to give the buyer a bill and to note down the income within the common or simplified regime. The buyer may prove using the internet whether he has been given the taxpayer really send the income data to the tax administration

The Act shall become effective with the eighth month following the publication in the Czech Collection of Laws. During the first three months, accommodation and catering services shall be covered by this measure and subsequently, wholesale and retail shall be added. Starting with the 16th month from the entry into effect, any income except workers´ income shall be covered as well, yet the workers´ income shall be cover as well from the 18th month onwards. The government shall have the option to define that a certain type of income may temporarily not be a monitored income type.

The control authorities are going to assess via proof purchasing whether the electronic income monitoring is being stuck to. The authorities will have the option of immediately shutting down the respective shop or suspending the performance of the respective activities in cases of extraordinarily severe infringements of the duty to hand in data on the monitored income or to issue bills.

Individuals, companies or entrepreneurs who “hamper, or mar the income monitoring in a severe and deliberate way”, may be fined with up to CZK 500,000. There shall be threat of the same fine for companies and entrepreneurs if they do not hand the tax administration the data or if they do not issue a bill to the buyer. An entrepreneur who does not provide information on his duty regarding electronic income monitoring or who manipulates the authentication data or the certificate in a way that might lead to a misuse shall be fined with up to CZK 50,000.

The Ministry of Finance of the Czech Republic is authorized to carry out a bill lottery where material prizes or money can be won and in which people can participate based upon their handing in a bill or the data that is obligatorily listed on the bill.

The entrepreneurs shall have the option of using a discount of up to CZK 5,000 on the costs linked with the income monitoring implementation. The discount sum shall be derived from the entrepreneurial tax base. Catering services shall be located in the 15 % VAT tax class (with the exception of the sale of alcohol-containing beverages) in comparison to the current 21 % group.

Again, this duty will again put the most load on entrepreneurs who are issuing the bill automatically, without the requirement to be online. Furthermore, there are costs incurring due to the technology acquisition and due to further training so that the CZK 5,000 discount is negligible. This duty cannot stop the system from a cheaper “paperless” operation.

According to our opinion, the introduction of the control report and the electronic income monitoring should have been preceded by an analysis using e.g. the ABC method [1] which would have led to the definition of decisive taxpayer groups to be focused on by the tax administration resulting then in the highest possible fiscal impact

Further selected and prepared governmental legislature provisions

Let ´s just list some examples of proposals by the Czech Minister of Labour and Social Affairs, Mrs. Marksová. She is e.g. proposing higher payments by childless persons, or maybe by people who do not provide for the living of their children any more. Further proposals are connected to the Czech Labour Code. The ECHO24.cz daily reported on Mrs. Marksová trying to regulate home-office work – in such cases employers would be obliged to cover a part of their employees´ energy costs or to control work safety. The Czech business-oriented daily Hospodářské noviny published the Ministry of Labour and Social Affair´s proposal to put through an employer´s duty to prevent his employees´´ stress on the workplace. Thus, entrepreneurs would be facing controls and judicial trials with dissatisfied and stressed employees. This proposal hardly needs any commentary.

Another top-story is the renewed sick benefit provided within the first three days of an illness. The Chamber of Commerce of the Czech Republic has carried out a survey, according to which 73 % of the Czech entrepreneurs oppose the abolishment of the waiting period. Yet the social security insurance payments for the employer´s are

to drop from 25 % to 24.9 % of the assessment basis via lowering the healthcare insurance payments from 2.3 % to 2.2 %, and the entrepreneurs are against such a compensation.

According to latest surveys, already one third of large Czech companies is offering the benefit of the so-called health-leave (i.e. the sick-days). Usually the health-leave period consumes 3-5 days per calendar year. These days are not subtracted from the actual holiday and this and they are paid days. The pensum not used in one year is not transferred to the next year, neither are the unused health-leave been financially compensated.

The principle of this benefit consists in the fact that a shorter recovery is more advantageous for both parties than a long-term illness and such a measure enables the employee to fight a beginning cold more effectively, such an employee does not spread the illness to other colleagues. Furthermore, such a colleague can stay at home without needing the doctor´s confirmation which in turn would lead to their wage being lowered. These employees can then return to their workplace faster.

Neither the Czech Labour Code nor any relevant regulations do mention the term of health-leave. Thus, this merely forms a benefit agreed upon with the employer who is in turn the person determining the specific sick days conditions deepening trust between the employer and the employee. Consequently, the proposal for a financial compensation for the waiting period presents a further proposal burdening the entrepreneurs who manage to find better solutions than the wage compensation proposed by the government which is subject to reductions. Given the circumstances that the government wants the employers to extend compensation payments for temporary incapacity to work and taking into consideration that the government has shifted this both duty to the employer for a period of the first 14 days and for the waiting period, there already is the option of health insurance payments right from the first day of the sick-leave, i.e. the wage compensation instrument during an illness can be abolished.

Another proposal is the so-called "paternal leave". According to the calculations carried out by the Ministry of Finance of the Czech Republic, the seven-day option would cost the state approximately CZK 700 million. "*In our opinion, the proposed measure is superfluous and inadequately selected. It would increase the load on the employer and the Czech Social Security Administration,"* as the Czech Social Security Administration´s spokesman Jakub Vintrlík says. The government is going to negotiate this proposal in spring and the new benefit is about to be paid out from January in the next year. The "paternal" leave would be financed out of the healthcare insurance and would be calculated similarly as the financial support during maternal leave, it would amount to max. 70 % of the wage and according to the last proposal this measure would be applied for 4 days. This means that the state burdens the expenses another time and that the employer´s "paperwork" intensifies. Nowadays, an employee is merely entitled to have a paid leave for the period necessary to drive his wife to hospital or to transport her back home. If the employer wants to be present during the birth itself, he has the right to take an unpaid leave – yet in everyday life such situations are being provided for via an agreement between the employer and the employee, without state interference becoming necessary.

The amendment of the anti-smoking law is another example. Based upon the hitherto valid wording of the act, significant investments have been carried out by e.g. the restaurant operators, declaring a restaurant as non-smoking has become a competitive advantage in many cases so that currently, this problem has been solved to a significant extent. Consequently, the legislators´ effort appears like breaking into a house with open doors. The state largely profits from the sale of tobacco products and it does not even have a moral right to regulate the tobacco product use. In such a case, we can´t exactly quantitatively assess the fiscal impact, yet one can envisage a certain tax collection decrease. There´s an indirect proof represented by the trend where the consumption of bottled beer (with a 10 % profit margin) has risen in comparison to draught beer (with a 50 % profit margin) leading thus to lower tax payments by restaurants.

The lawmakers aim to increase the income of the state treasury by introducing higher fines for driving offences, which is very questionable, especially in the case of camera measuring, where the road user is often informed about his/her offence only after he/she has reached the limit for revoking his/her driving licence. Preventive measures consist in punishing any offence immediately by properly marked police cars, which is, in our opinion, the only way how the safety on roads can be ensured. Perhaps, the fiscal result would be higher. Keeping the power to measure the speed by municipal police officers in the least dangerous places in order to increase the income of the municipal treasury is a special chapter.

The latest hit the members of parliament have been dealing with is the reduction of the opening hours "in the employee interests" on national holiday. It is everybody´s free choice to run his business or to buy and it is up to the buyer and the seller to whether he wants this task to be done on a national holiday or not. On the other hand, working on a national holiday is favoured by many employees due to the higher remuneration so this regulation would affect only some people giving thus the opportunity to circumvent law.

We intended to demonstrate with these few examples that according to our opinion, the unnecessary and expensive interferences by the state into the entrepreneurial ambiente are making the situation more complicated and raising the administrative load laid upon the entrepreneurs and although they are presented as growth measures they are rather a bureaucratic burden. In this relation, senator Kubera´s opinion regarding the members of

parliament and senators is interesting: “They are completely fond of fines, prohibitions and regulations. These guys are crazy.”

4 Conclusion

Taking into consideration the analytical work carried out on the project idea, the goal of this internal grant is to evaluate the development of the legislative environment on the basis of selected valid or planned legislative acts or planned amendments to laws or measures affecting the quality, financial and time demands and load on entrepreneurs, especially sole traders and small and medium-sized companies.

The above-mentioned analysis renders these partial conclusions regarding selected issues: According to our opinion, the introduction of the control report and the electronic income monitoring should have been preceded by an analysis using e.g. the ABC method which would have led to the definition of decisive taxpayer groups to be focused on by the tax administration resulting then in the highest possible fiscal impact. According to our opinion, the current legal regulation will not only fail in achieving the proclaimed effect but it is going to excessively burden all taxpayers and to cause an increased administrative load as well as to lead to further unnecessary restrictions aiming especially at entrepreneurs who will have been fulfilling their duties properly.

Extending tax liability is in itself the state administration´s little help in supplementing the administration´s inability punish tax evasion, yet at the moment, it addresses merely a part of the problems. The question remains whether the value added tax system actually remains proper and whether it should not be substituted by another system. The introduction of a modified turnover tax would be topic for specialist discussions.

There´s only one permissible solution to the trade union evergreen is the abolishment of the waiting time given the condition that the social security administration registers surpluses on its accounts – the state should pay the salary compensation for the period of temporary incapacity from work paying the sick leave maybe right from the first day. Companies will surely welcome such a measure. If we take into consideration the opposite option then it´s necessary to say that the so-called sick days already applied by many companies represent an accepTable solution.

In our opinion, driving offences should be penalised immediately by properly marked police cars, ensuring higher safety on roads instead of general introduction of higher fines.

We do regard the non-smoking act amendment as equally absurd. Based upon the hitherto valid wording of the act, significant investments have been carried out by e.g. the restaurant operators, declaring a restaurant as non-smoking has become a competitive advantage in many cases so that currently, this problem has been solved to a significant extent.

We recommend a positive approach and providing bonuses for companies and entrepreneurs, who are laying taxes and creating jobs, we further recommend to abolish the artificial antagonism between employees and entrepreneurs. We also recommend to prohibit continuing legislative changes affecting entrepreneurs. Real help has to consist in a most simple administrative load and a maximum level of free choice.

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VAT Control Statement – problematic aspects

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Abstract. The paper covers the issue of control statements. Entering into force on 1 January 2016, this new measure requires VAT payers to send tax authorities control statements simultaneously with the value added tax return. The authors focused on the problematic aspects that relate to the production and submission of control statements. This particularly involved the issue of the strangling effect of sanctions stipulated by the Act and that of unreliable payers in the business chain.
Both of the observed traits can be seen to have a negative impact on honest tax entities that will incur additional administrative and financial costs in connection with the control statement.
Keywords: Czech Republic, Tax evasion, VAT Control Statement.
JEL Classification: H26

1 Introduction

From 1 January 2016 onwards, all payers of value added tax (VAT) in the Czech Republic are required to provide information to the tax authority to a greater extent than previously. While it was sufficient in 2015 to file a VAT return and, where applicable, a summary statement, there is also a control statement from January 2016 onwards, a document that must be sent electronically. The purpose of the measure is to reduce fraud in VAT. The legal amendment is based on the fact that it is no longer possible to disburse a taxpayer an excessive deduction just on the basis of taxpayer's claims. For other taxes, one must submit a relevant document for the payment of refunds. Examples include tax benefits for children, where a carbon copy of child's birth certificate and a statement from the other parent that it will not claim a tax benefit for the child for the current tax year form the basis for payment. For VAT, tax obligations of payers are determined solely on the basis of the summary rows in the tax return. Another disadvantage of structure of tax returns can be seen in the fact that it is impossible to determine whether the reduced rate involves a delivery charged with 10% or 15% rate. These deficiencies are expected to be eliminated with control statements.

Although VAT can be considered a tax with resistance against tax evasion (Kubátová, 2009; Široký et al., 2008), the authors have observed that there may be exceptions to this. The Member States of the European Union are fighting with fraud in the long term. Examples can include a carousel fraud, which appeared as early as the 1990's with eliminated border checks within the European Union. Now carousel fraud experienced a huge boom over the last decade. Some authors (e.g. Tumpel and Wurm, 2012) even speak of aggressive attacks against VAT.

The Czech Republic too is trying to amend the Value Added Tax Act, generally to ensure its resilience against fraud. Such a trend can be seen since 2011. As an example, there is a pre-condition for claiming a deduction when the recipient of the taxable supply can claim input tax only when it has a physical possession of the relevant tax document [Article 73 (1), the VAT Act]. For quarterly VAT payers, such a claim may be delayed for nearly four months (three months of the tax period plus 25 days to submit a tax return). Furthermore, the Value Added Tax Act is gradually extending the conditions of liability for unpaid tax (Article 109, VAT Act). The recipient of a taxable supply can be asked by the tax administrator to pay the tax due for the provider of the taxable supply if they knew or should have known that it was a part of a tax fraud or in cases where the goods or services were acquired at an unusual (non-market) price. Liability can arise even when the provider of the taxable supply has been identified to be an unreliable payer. This condition requires the recipient of the taxable supply to do repeated checks of business partners, because this designation will be very difficult to find without an active approach. Although some accounting applications can alert that it is an unreliable payer already when entering the invoice into the accounting records alone, they usually will not do so for tax documents entered previously so if it happens that the tax document has a longer maturity and the provider becomes an unreliable payer during the period, the recipient of the taxable supply should respond promptly to that fact. For larger quantities of business partners, this is at least complicated and costly in terms of paperwork and funds due to the need of hiring additional labour, which will be responsible for checking business partners.

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Compared with the liability for unpaid tax and unreliable payers, the VAT control statement does not seem to be threatening for a taxpayer at a glance. A closer look into the wording of the act, however, suggests several risks at a time. Semerád and Bartůňková (2016) consider entirely inappropriate sanctions to be one of the main risks in that a sanction can be imposed even for a minor error that does not affect the calculation of tax liability.

Interestingly, the Tax Code (Article 250 Section 1, Tax Code) allows for late filing of tax returns in general; for VAT returns specifically, it enables five working days. Value Added Tax Act (Article 101e Section 3), however, expressly prohibits delayed filing of VAT Control Statement. Requesting an extension of the deadline for submission is not possible for both VAT returns and VAT Control Statement; this is a special provision toward the general rule used in Tax Code (Article 4 Section 36, Tax Code - an extension at the request in general and if there are revenues from abroad; Article 136 Section 2, Tax Code - the tax entity must have their financial statement audited, or filing is made by a tax advisor or lawyer on tax entity's behalf). The time limit within which taxpayers have to remove defects in the VAT Control Statement is set to be five calendar days. Many critics argued that according to the Tax Code (Article 32), the time limit may be laid down shorter than eight days only in exceptional cases that are considered particularly urgent (and in such cases the tax authority has to provide grounds for such a shorter period); it is unfounded: the rule of eight days applies to administrator's deadlines (as determined by the tax authority). Since the time to remove defects in the VAT Control Statement (Article 101g, VAT Act) is a legal deadline, the analysed provision has no impact on it

The new, above-mentioned provision is criticised particularly by taxpayers who have no data box set up since the time limit starts running immediately after sending a warning to the mailbox of the tax entity. A situation where the spam filter has indicated the correspondence from the tax authority to be a spam e-mail is now enough to bring considerable complications for the taxpayer when taxpayers as natural persons are not legally required to set up a data box. Because it is very early to assess VAT control statements from this perspective, the focus was placed on other problematic aspects that may affect the taxpayer.

2 Methodology and Data

The article deals with practical issues and implications relating to the introduction of VAT Control Statement. The main objective was to identify issues that may arise on the part of a recipient of a taxable supply in claiming VAT deductions. The issue of legal certainty in tax administration was also discussed. Attention was given to burdens in the form of increased risk in the business of honest traders as well as legal uncertainty in exercising the right to deduct VAT and harsh penalties for failure to comply with the obligations. All this seems to be a new trend, which the Czech tax administration decided to set.

To achieve the stated objectives methods of analysis, description, comparison and prediction were adopted. The information published by the Financial Administration prior to the effective date and within the first weeks after the effective date of VAT Control Statement was analysed to evaluate the impact of this provision on a taxpayer. Subsequently, description and prediction were used to explore the impact of individual provisions of the law on honest traders. An unreliable taxpayer was used as a model to mark the weaknesses of this measure.

Methods of comparison and prediction were employed to evaluate the impact of sanctions on a taxpayer, while comparing the inhibiting effect of VAT Control Statement to the judgement from the Constitutional Court on fuel trader deposits, which were introduced in November 2013.

The article is divided into two categories which focus (i) on the issue of the hampering effect of fines defined by law and (ii) on the issue of an unreliable payer in the business chain.

3 The strangling effect

Sanctions that can be imposed for misconduct in producing VAT Control Statement can reach amounts from 1,000 CZK up to 500,000 CZK. Taking into account that sanctions are not scaled according to the size of each entity, fines may even have a destroying impact on micro businesses. The authors see this non-scaled restrictive measure to be an analogy to deposit payments for fuel distributors. In November 2013 a legal provision entered into effect; it required the fuel merchant to make a deposit payment of 20,000,000 CZK or a bank guarantee at the Customs Administration. Subsequently, after meeting further requirements (e.g. no debts and reliability), the merchant was registered as a distributor of fuel (Article 6a, Fuel Act). For some small and medium-sized distributors, a deposit payment was impossible to achieve and the business had to be terminated. The then effect on the fuel market fuel was that out of the initial amount of about 1,950 distributors, only 165 entities remained on the market (for more details on the issue, please refer to Semerád, 2014).

A group of 18 senators spoke out against the provision; demanding the Constitutional Court of the Czech Republic to propose repealing, the application eventually succeeded and the Constitutional Court identified deposits of 20 mil CZK (flat amount) as inadequate, pointing to their strangling effect (Constitutional Court Judgment Pl. ÚS 44/13). The Constitutional Court justified its legal opinion in a way that the strangling effect was affecting small-scale distributors at such a level that the mere provision of the amount of the deposit required is

little considerate in relation to the right guaranteed in Article 26 of the Charter of Fundamental Rights and Basic Freedoms, i.e. the right to engage in commercial and economic activity.

The authors' opinion is that sanctions can take the same effect as the deposit in the case of fuel distributors and one can assume that in line with these facts actions could be filed in future. Subsequently, it may happen with regards to the existing practice of courts that the State is not successful, albeit from legal point of view one cannot criticise anything in terms of legal regulation and the problem is rather seen at economical or moral levels. Only a fine for failure to submit a control statement within the prescribed period is without the administrative discretion of the tax authority. For all of the other cases, i.e. the higher sanctions (failure to amend/complete false or incomplete information by subsequent control statement, failure to meet a duty relating to the control statement making it seriously more difficult or obstructing the administration of taxes), an administrative discretion is presumed, though not in terms of sanction (i.e. sanctions must be imposed at a non-zero amount), but in terms of the amount while applying a conventional rule that the tax authority shall ensure to avoid the sanction being grossly disproportionate to the importance of the obligation breached and the severity of the aftermath for the tax administration and in doing so it shall take a particular account of the extent of cooperation on the side of the payer. Naturally, a variety of assessments is possible at the early stage as are the varying levels of sanctions by individual tax authorities; over time, however, things should certainly be unified. Assistance may also come from methodologies of the General Tax Directorate.

The entrepreneurs response, however, was very sharp and the Ministry of Finance of the Czech Republic, being aware that the level of sanctions is a marginal problem, responded through the Minister just 10 days after the effectiveness of the law with a proposal to cancel the sanctions in entirety (MF, 2016a). The Minister's intention was to cancel the sanctions, even retroactively, which could mean a retroactive effect. No matter how retroactivity is contrary to the requirement of legitimate expectations and legal certainty, even in this case of tax entities being the beneficiaries, it would not be the first time when it appeared in Czech law and because of the very benefit, one may not expect any arguing.

More detailed options in terms of sanctions resulted from negotiations of the Ministry of Finance with the Association of Small and Medium Enterprises and Crafts CZ (Morávek, 2015):

1. At least three months of tolerance period are announced during which the existing sanctions are not applied;
2. Sanctions bound to the response of tax entities to the tax administrator's call to amend, complete or confirm the data included in the submitted control statement are also subject to administrative discretion of the tax administrator, i.e. the amount of the sanction imposed takes into account the significance and impact, if any, of the breached obligation, as well as the level of cooperation of the taxpayer;
3. There is a deadline fixed for the tax authority to make a "special" call related to the submitted control statement and the deadline for submitting a subsequent control statement at the invitation of the tax administrator to complete, amend, or confirm the data is adjusted from 5 calendar days to 5 working days.

Eventually, the Government approved a proposal of the Ministry of Finance on 13 January 2016 to ease the sanctions and to extend the deadline for VAT control statements. The Ministry added a legal construct of waiving the sanction to the VAT Code; it concerns fines arising from the Act for failure to submit a control statement within the deadline, setting the sanctions to amount to CZK 10,000, CZK 30,000 and CZK 50,000. With this measure, it is expected to enable taking into account justifiable reasons for the delay in submitting a control statement and responses to the challenge of the tax administrator. The amendment will also be related to cases that occurred before the effective date (planned for 1 June 2016). For sanctions amounting to 1,000 CZK which are imposed due to the late submission of control statements, one error will be tolerated per calendar year. The tax administrator will take this into account automatically without having to submit an application for remission. Fines in such amounts incurred before the effectiveness of the proposed amendment to the law will disappear, which will re-create a transitional period of tolerance. The amendment approved by the Government also contains an extension of the deadline for taxpayer's responding to the call of the tax authority to eliminate the discrepancy in the submitted control statement from five calendar days to five business days (MF CR, 2016b).

Fears that the statement of the Minister (MF, 2016a) causes that VAT control statements are not filed properly and tax entities wait for the cancellation of fines, which would counter the legislator's intention, revealed to be unfounded in the light of the government's draft amendment to the Act. Of course, nobody can predict what form the amendment of the Act takes when passed by the Czech Parliament. However, if there are no major structural changes, the proposal should be considered good as it responds to the concerns of the business community without compromising the effect of sanctions.

4 Unreliable taxpayer in the business chain

The issue of unreliable payers was already outlined in the introduction. Since this legal construct may too have an impact on the legal uncertainty of taxpayers, it is covered in this section as well. VAT Control Statement operating principle is that there is the pairing of the data transmitted by both the provider and the recipient of the taxable

supply. Trading works under the usual rules, where one party provides goods or services while the other pays for the same. The buyer also checks the unreliable payer status in the register to which the buyer has remote access. If the seller is not indicated to be an unreliable payer, then the buyer pays the full amount of the purchase price.

The paper further describes a model situation that could cause the buyer's impossibility of entitlement to deduct. The example is based on a business relationship between Taxpayer A and Taxpayer B. Both entities are payers of value added tax where Taxpayer B is a natural person operating as part of quarterly tax periods. Because of its status of a natural person, it is possible to send the control statement at the same time as is one for submitting the tax return. Taxpayer A delivers the subject of taxable supply to Taxpayer B on 2 January 2016. A tax document has been issued with 14 day maturity and is flawless in terms of law. The transaction cannot be challenged to have taken place on the basis of written orders, receipts of a third-party transport company, and notes of delivery. Taxpayer B can, on 17 January 2016, before the payment of the tax document, check that its business partner is not identified as an unreliable payer. No other transactions take place between the two entities.

On 1 February 2016 Taxpayer A is declared an unreliable payer. It becomes a non-contact person and fails to file its tax return and produce the VAT control statement. On 25 April 2016 Taxpayer B submits a tax return, which takes into account the right of deduction concerning Taxpayer A. Because the taxable supply is missing in the tax authority's system, the Taxpayer B entitlement is challenged and rejected. Subsequently, a tax procedure opens and may end up with a legal action. It is possible that the VAT amount is not significant. Even if it was, an honest and exemplary taxpayer will have to wait. Its good faith, which is protected even under judgments of the European Court of Justice, for example Optigen (C-354/03) and Kittel (C-439/04), will have to be proved. In the authors' opinion, there is suppression of legal certainty and, due to protracted litigation, the fair-dealing taxpayer may become financially destabilised. This may result in its effective liquidation. Although it did not make any illegal step, the recognition of the right to deduct may be postponed.

Taking a look at the part of the non-contact entity gets the following findings. The tax administrator is not provided by instruments which could compel the non-contact entity to comply with tax obligations. Because it can be a low-income entity that has no funds to pay a tax, the tax authority will not be able to act even under a protective order.

To this extent, the Minister of Finance of the Czech Republic stated (Babiš, 2015) that "being there no sanctions, the control statement impacts an honest taxpayer only". According to the above example, however, it rather appears that sanctions under the control statement fall on honest entities only since non-contact entities will lack funds to pay not only tax due, but also sanctions.

5 Summary

In the opinion of the authors VAT Control Statement encounters an issue of legal certainty. To defend the legal instrument, legislators say that taxpayers had sufficient time to adapt to this new measure (MF, 2015). This argument is supported by the fact that the debate on the introduction of VAT control statement had been underway at least one year. However, one can argue using the common problem occurring in the Czech Republic - impossible expectations. In addition, there were plans to have a uniform rate of value added tax (17.5%) in order to simplify tax administration. The result, however, are three rates (a basic rate and two reduced rates). A question arises whether or not it is really possible to predict the legal development of tax legislation.

VAT Control Statement has been operating for a relatively short time and, after a few days, there is the intention of the Ministry of Finance to amend. From the perspective of taxpayers, this presents a long-term instability, which perhaps prevents a proper and timely preparation.

There is also a kind of a pool of taxpayers who are worried that someone else could use the data provided by them since control statements in fact provide names of business partners while making it possible to determine amounts of their turnover from the individual lines. If a certain taxpayer has been trading with an entity in the long term, it is expected that it is a satisfactory mutual cooperation. If someone is able to get access to the data, a better pricing policy will be enough to take over the honest taxpayer's customer. There is thus a possible alternative of something as data encryption. A question remains whether such encryption would meet the requirements of the Act concerning control statements.

6 Conclusions

The paper covers the issue of control statements which entered into force on 1 January 2016. There is a new VAT payer's obligation to provide an increased amount of information to the tax authority than previously and is required at the time of submitting the tax return for VAT. For tax authorities, the aim of this "counter-fraud" measure is particularly the possibility of pairing the data used for calculating the tax duty of taxpayers and their claims for deduction without having to inspect the tax entity physically.

The authors focused on the problematic aspects that can cause complications for an honest taxpayer in connection with the submission of the control statement. More specifically, it involved (i) the issue of strangling effect of sanctions defined by the Act; and (ii) the issue of unreliable payers in the business chain.

For the first observed issue the authors find an analogy with deposit payments for fuel distributors which were subsequently modified based on the findings of the Constitutional Court. The finding concluded that the uniform amount of the deposit (20 million CZK) had a strangling effect on small distributors. Since control statements too met with a wave of indignation among business entities once they were introduced, a proposal of the Ministry of Finance was approved by the Government on 13 January 2016 to ease the sanctions and to extend the deadlines to submit the statement. However, it is difficult to predict in what form the amendment is approved.

The legal construct of unreliable payers is found to be another problematic aspect. Using a model example, a situation was outlined where an honest entity fulfils all legal conditions for deducting incl. verification of a business partner in a list kept by the tax authority. The entitlement to deduct can however be denied to the operator because the software handling control statement data is unable to find the data of the provider of the taxable supply that after some time goes out of business as a missing trader and fails to submit both the tax return and the control statement. This negatively affects the honest taxpayer who will be required to prove in a complicated manner (i.e. through the court) that the transaction has taken place and that the taxpayer is, in accordance with the case law of the European Court of Justice, entitled to deduct.

Legislators argue that taxpayers had enough time to make preparations for VAT Control Statement. In the authors' opinion, however, the problem was not that taxpayers had little time to prepare; rather, there was the issue that is common in approving the Czech tax legislation - the impossibility to expect. For instance, there were plans in 2015 to have a uniform rate of value added tax (17.5%) in order to simplify tax administration. The result, however, are three different tax rates. The fundamental problem can therefore be seen in the fact that nobody is able to predict the legal development and tell whether or not an amendment results in a measure being postponed or cancelled even if planned on a long-term basis. Additionally, the Czech Ministry of Finance alone proposes an amendment as early as ten days of the effectiveness of the VAT Control Statement.

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Influence of corporate tax on business organizational form in the Czech Republic

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Abstract. The goal of this paper is to determine influence of corporate tax in the Czech Republic on decision, whether the owner of business will choose corporate or non-corporate type of organizational form for his business. By examining data from 1993-2015 about changes of relevant tax rates and numbers of corporate and non-corporate type of business each year this research tries to find answer. The influence is connected with the issue of double taxation of profits of corporate type of business. Corporate income is taxed twice by corporate tax and income tax, while non-corporate type of business is taxed only once, but owner also have to pay social and health insurance from the profits. The results suggest low level direct dependency between corporate tax and ratio of number of corporate and non-corporate business. This result is inconsistent with previous studies on this subject and needs to be investigated further by expanded theoretical model in the future study.

Keywords: double taxation, corporate tax, business organizational form

JEL Classification: H25, H32

1 Introduction

In the tax system of the Czech Republic, as well as in other countries like the United States, exists disproportion in taxing profits of corporate type of business (also called C corporations by the United States law) and non-corporate type of business (also called S corporations by the United States law). This disproportion is sometimes called double taxation of corporate profits. The profit of corporate business is first taxed by corporate tax, remaining profit is then taxed by income tax when owner wants to get earnings from his company. On the other hand, non-corporate type of business is taxed only by income tax, but in the Czech Republic owner of the non-corporate business also have to pay social and health insurance from its profits.

In the theory, increasing of corporate tax rate should motivate profiTable C corporations to switch its organizational form to S corporation to avoid double taxation, so its profits will be taxed only once by income tax. Conversely, S corporations which face losses should have incentive to incorporate switching its form to C corporation and gaining benefits of this type of organizational form, specially increased option of obtaining additional capital and limited liability.

The goal of this paper is to analyze influence of corporate tax on business organizational form in the specific tax environment of the Czech Republic between years 1993-2015. Analysis is based on adjusted theoretical model for measuring influence of corporate tax on business organizational form in the United States made by authors Mackie-Mason and Gordon (Mackie-Mason and Gordon, 1991). The model is adjusted for specific tax environment of the Czech Republic taking into account social and health insurance which are paid by S corporations and have significant impact on issue of double taxation and benefits of S corporations being taxed only once.

2 Current state of knowledge

The influence of corporate tax (or income taxes in general) on organizational form was subject of research in the past, mostly in the United States. Mackie-Mason and Gordon conducted two studies about effects of taxation on business organizational form (Mackie-Mason and Gordon, 1991), (Mackie-Mason and Gordon, 1994). In their work they created theoretical model, which described tax and non-tax factors influencing decision about business organizational form. Research of this article is based on this theoretical model. They also created empirical study about effects of corporate tax on choice of organizational form in the United States for data from years 1959-1986. They conclude corporate tax has small, but measurable effect on the choice of organizational form of business. Another similar empirical study was made by Goolsbee (Goolsbee, 1998) in the United States for data from years 1900-1939. In another study, Authors Ayers, Cloid and Robinson (Ayers, Cloid and Robinson, 1996) focused on effects of tax and non-tax factors on organizational form of small businesses in the United States. They concluded non-tax factors play important role in the selection of the organizational form of small businesses, however they could not reliably prove, that income taxes are important factor in selection of organizational form for small

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business. Authors Luna and Murray (Luna and Murray, 2008) examined effects of state taxes on choice of organizational form in the United States. They concluded that both federal and state factors determine the choice of business organizational form. Results of their analysis suggest that state tax policy does affect business decision-making including choice of organizational form of business. In Czech literature author Hrdý (Hrdý, 2011) created only theoretical general study, where he focuses on influence of taxes on financial management and business decision-making. He mentions organizational form of business can have huge impact on the amount of profits, which owners will get from company, because of double taxation issue. In Sweden, authors Karin and Gordon (Karin and Gordon, 2013) created study about influence of tax and non-tax factors on the choice of organizational form by closely-held firms. They compared their results with study of Mackie-Mason and Gordon mentioned earlier and concluded that estimated effect of taxes on the choice of organizational form is much larger. Interesting study is also the one made by Carrol (Carrol, 2010) in the United States. This study focuses on subject of harmful effects of double taxation on the United States economy and business and positive economic effects of lower tax rate on dividends enacted in 2003 by the Job and Growth Tax Relief Reconciliation Act of 2003.

3 Theoretical model

In theoretical model, originally created by authors Mackie-Mason and Gordon (Mackie-Mason and Gordon, 1991), which describes when it is favorable for company to incorporate and become C corporation, it is considered that company can choose only between two types of organizational forms, C corporation being taxed twice both on corporate and personal level and S corporation being taxed only once on personal level. Various factors that affect decision of company whether to incorporate or not are divided into two groups, tax factors and non-tax factors. With these conditions met, it is favorable for company to become C corporation if this equation is true:

$$g(1 - r_c - (1 - r_c)r_e) > I_x(r_c + (1 - r_c)r_e - r_n) \quad (1)$$

Where g means any non-tax factors that make C corporation form more attractive (g can be also negative), r_c is corporate tax rate, r_e represents implicit personal tax rate per dollar of income to equity, taking as given the division of this income between dividends and capital gains, r_n is personal tax rate on ordinary income and I_x stands for taxable income of the company. This equation tells us that for company is preferable to incorporate if effects on non-tax factors (g) applied when company chose to incorporate and become C corporation increase the net profit of the company more, than added corporate tax rate (r_c), applied on taxable income (I_x) of C corporation will decrease its net profit.

It is problematic, or even impossible to properly measure right side of equation (1) in numbers because of the variable g that sums up many non-tax factors, for example advantage of limited liability of C corporation for its owners or better access to additional capital. But measuring effect of corporate tax on business organizational form can be done by focusing only on right side of equation (1), specifically changes of included tax rates.

Based on equation (1), we can created these two general assumptions:

1. Increase of variables r_c and r_e from equation (1) will encourage companies with taxable profits to disincorporate and companies with tax losses to incorporate.
2. Increase in r_n from equation (1) will encourage companies with tax losses to disincorporate and companies with taxable profit to incorporate.

4 Data and analysis approach

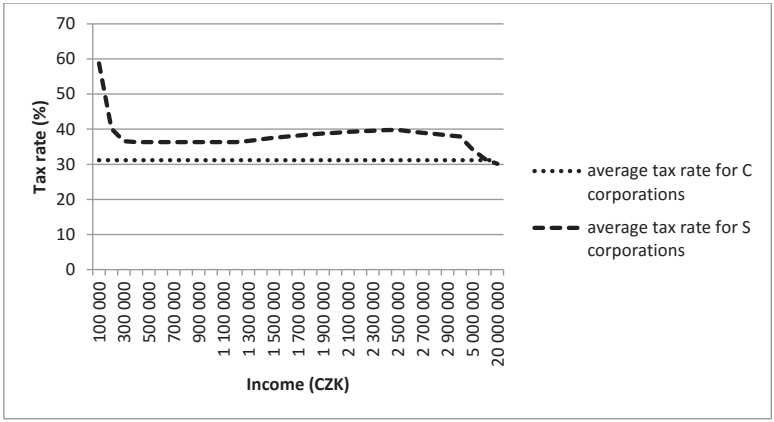
The analysis made in this study was working with relevant data about the Czech Republic from years 1993-2015 obtained from Business register of Czech Statistical Office (Český statistický úřad, 2016) and Macroeconomical Predictions of Ministry of Finance of the Czech Republic (Ministerstvo finance, 2016). Principle of the analysis was to test correlation between changes of relative tax treatment of corporate and non-corporate income (variable one) and changes in ratio of number of C and S corporations (variable two) each year in the Czech Republic between 1993-2015. Time series for both variables were created for years between 1993-2015.

First variable, called tax treatment is based on the original theoretical model from previous chapter, specifically from part of right side of equation (1): $r_c + (1 - r_c)r_e - r_n$. Tax treatment describes how changes of corporate tax rate r_c, personal tax rate r_n and implicit personal tax rate per dollar of income to equity r_e affect corporate and non-corporate income. Increase of value of the tax treatment caused by increase of corporate tax rate or implicit personal tax rate on equity means higher taxation of corporate income making the corporate form of business less beneficial and conversely. Decrease of value of the tax treatment caused by increase of personal tax rate means higher taxation of non-corporate income making the corporate form of business more beneficial and conversely. But this formula of tax treatment was suiTable for tax system of the United States, where the original theoretical model was made. To match the tax system of the Czech Republic, tax treatment had to be expanded with social and health insurance into this form:

$$TAX\ TREATMENT = (r_c + (1 - r_c)r_e - (r_n + s + h) \quad (2)$$

Wherer_c, r_e, r_n means same as in equation (1), s means social insurance rate and h means health insurance rate. It is crucial to include social and health insurance rate into tax treatment because it has significant impact. Health and social insurance does not affect corporate income, but is paid from non-corporate profit. This essentially means that advantage of non-corporate business being taxed only once is cancelled by the duty to pay social and health insurance. In fact, total tax (including social and health insurance) paid by non-corporate business can be higher than tax paid by corporate business. This problem is even more complex because of existence of maximal assessment basis for paying social and health insurance. With non-corporate profit high enough above maximal assessment basis, the duty to pay social and health insurance is becoming less significant and average total tax rate for S corporation (consisting of personal income tax, social and health insurance and also special tax for income above 48-times average wage) is decreasing. Figure 1bellow shows that average tax rate of S corporation is lower than C corporation when income is above 10 million CZK. And with higher income the tax advantage of S corporation is increasing. Average tax rate for C corporation consist of corporate tax and personal income tax rate on equity. The computation is done with tax rates from year 2015.

Figure 1: Average tax rates for S and C corporations with different amounts of income



Source: Authorial computation

To solve this problem of maximal assessment basis it is assumed in the study, that S corporations have such income, that social and health insurance have significant impact on their total tax paid and therefore social and health insurance rates are included in the variable tax treatment. Another problem with calculating tax treatment was personal income tax being progressive in some years between 1993-2015. The biggest range of personal income tax rates was in 1993 with lowest tax rate 15% and highest 47%. To deal with this issue, two crude measures were used for personal income tax rate. One was the highest statutory marginal personal tax rate in given year. Second was average personal tax rate each year. Personal tax rate on equity income r_e was calculated from this equation:

$$r_e = dr_d \quad (3)$$

Where *d* is part of the income paid in the form of dividends and r_d is tax on dividend income. It is assumed that rest of the equity income (*1-d)* in form of capital gains is realized in long term and therefore exempt from taxation. Again two crude measures were used for personal tax rate on equity income. On crude measure works with hypothetical premise, that all equity income is paid in form of dividends and therefore taxed. Second crude measure is working with study made by authors Bena and Hanousek (Bena, Hanousek, 2005) who calculated average pay-out ratio for companies held by Czech owners in the Czech Republic for the period 1996-2003. In this case, part of income paid in form of dividend is 0.12.

For correlation analysis was constructed four different tax treatment variables, differing in personal income tax rate used and value *d* marking part of equity income paid in the form of dividends. For tax treatment 1 was used the highest statutory marginal personal tax rate in case of progressive personal income tax rate given year and it is supposed that all equity income is realized in form of dividends. For tax treatment 2 was used average personal income tax rate in case of progressive personal income tax rate given year and it is supposed that all

equity income is realized in form of dividends. For tax treatment 3 was used the highest statutory marginal personal tax rate and dividend payout ratio is set for value 0.12. For tax treatment 4 was used average personal income tax rate and dividend payout ratio is set for value 0.12.

Second variable used in correlation analysis was ratio of number of C and S corporation in the Czech Republic in given year in period 1993-2015. C corporations consisted of public limited companies labelled as a.s. and private limited companies labelled as s.r.o. S corporations consisted of general partnership labelled as v.o.s. and also sole proprietorships. Limited partnership type of company was not included in the analysis as this type of company combines double taxation and single taxation of C and S corporation.

Based on the theoretical model was created hypothesis that increase of value of variable tax treatment caused by increase of corporate tax rate and personal tax rate on equity or decrease of personal income tax rate and social and health insurance rate will cause companies to shift its form from C corporations to S corporations and therefore value of variable ratio of C/S corporations will decrease and conversely. If the hypothesis is correct, correlation coefficient should have negative value implying indirect correlation.

5 Results and discussion

Results of the correlation analysis between variables tax treatment and ratio of number of C and S corporations is shown in Table 1 bellow.

Table 1: Correlation coefficients between variables tax treatment and ratio of C/S corporations

	C/S CORPORATION RATIO
TAX TREATMENT 1	**0.207**
TAX TREATMENT 2	**0.199**
TAX TREATMENT 3	**0.208**
TAX TREATMENT 4	**0.213**

Source: Authorial computation

The correlation coefficient has in all four cases value about 0.2 which means a low level of direct dependency. For this reason, original hypothesis must be rejected. Direct dependency suggest that increase of corporate tax rate and personal tax rate on equity or decrease of personal income tax rate and social and health insurance rate will cause companies to shift its form from S corporations to C corporations and conversely. Results of this study are therefore inconsistent with results of the previous studies made in the United States (Mackie-Mason and Gordon, 1991), (Goolsbee, 1998), (Luna and Murray, 2008) and Sweden (Karin and Gordon, 2013). Reasons for this inconsistency can be two. Firstly, this can be due to insufficient data structure of S and C corporations. For better analysis it would be necessary to obtain separate data for numbers of C and S corporations with taxable profits and tax losses. For example S corporation with tax losses can react to changes in corporate tax rates differently than one with tax profits, so even with increase of corporate tax rate S corporation can be motivated to shift into C corporation and gain non-tax benefits of this type of organizational form. In previously mentioned studies, especially one made by Ayers, Cloid and Robinson (Ayers, Cloid and Robinson, 1996) it is said the non-tax factors play more important role in selection of organizational form than tax factors. Another problem with the data is that in the number of C corporations used for calculation of the C/S corporation ratio are also included companies, which show no real economic activity. These companies should be filtered out in the future research for more consistent results. The issue of long-term inactive companies should only be the problem of C corporations, because S corporations with no real economic activity and no profit still have to pay social and health insurance from minimal assessment basis each year so it is highly discouraging to maintain inactive S corporation. Second reason for inconsistency of the results is also connected with non-tax factors. The analysis does not capture non-tax costs of organizational type shift. When company decides to shift from S corporation to C corporation, it is connected with administrative costs as well as other costs of increasing business activity. This can lead to S corporations not changing its form to C corporation even with decrease of corporate tax rate, increase of personal income tax rate and so on. Non-tax costs of organizational shift could have changed significantly in period 1993-2015 in the Czech Republic as it was transforming from central planning economy into free market economy. This is difference from analyses made previously in western countries like the United States.

6 Conclusions

This article examined the influence of corporate tax rate on business organizational form in the Czech Republic in period 1993-2015 using the model created for measuring the influence in the United States. Results are inconsistent with previous similar studies made in the United States and also Sweden, suggesting low level of direct dependency between corporate tax rate and ratio of number of C and S corporations. According to theoretical model and stated hypothesis the dependency should be indirect. In further research it will be necessary to work with more structured data which separates companies with taxable profits and tax losses and also to add another variable into the theoretical model that will capture the influence of non-tax costs of organizational form shift.

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Dependence between total value and taxation values in competitive report

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Abstract. This paper deals with dependence between total value of competitiveness in World Competitiveness Yearbook and taxation values in the Global Competitiveness Report. One can assume that a country is more competitive if the tax system is easy for tax payers. The goal is to find out if there is any relation between these values. Multiple linear regression analysis will be used as method.
Based on the results, statistically significant relation was identified between total values and taxation values in years 2014, 2015 and 2016.
Keywords:competitiveness, Global competitive report, regression analysis, taxation.
JEL Classification: H20

1 Introduction

How important is the effect of taxation for subjects if they decide to make business or to work in given a country? Is there a close relation between competitiveness of a country and country's tax system? Or the subjects do not care about taxation when they choose place for their activity?

Generally, the tax system has some impact on cross-country competitiveness. Productive factors – labor and capital – are considered as mobile productive factors, so they can be moved to another country with more favorable tax regime. The tax system is not the only factor which is important for subject for their decision about a country, but it has some influence on the decision making process on its movement.

The term competitiveness is used for comparison of countries, but this term does not have only one definition and some authors discuss if the term competitiveness can be used also for countries or just only for companies (Krugman 1994, Malý 2011). Despite these opinions, competitiveness is measured by many organizations (non-profit organization, banks, governments, etc.) and each of these organizations has its own methodology (including data source and weight of these data). However, the data about taxation in given a country are usually used as the input data. The World Competitiveness Yearbook (issued by IMD) (hereinafter WCY) and the Global Competitiveness Report (hereinafter GCR) (issued by WEF, World Economic Forum) belong among globally recognized studies of competitiveness.

There are many authors, who describe tax competition (Wilson 1999) and some of them also tried to measure the competitiveness (Liapis 2014). There are also paper, which discus tax competition if the countries differ in size (Kanbur 1993). Based on some model, decrease of tax rate can lead to the situation, that some workers will leave the country with lower tax rate than the tax rate in case of closed border (Smith, Webb 2001).

The aim of this paper is to analyze the relation between the total value of competitiveness in the WCY and taxation values in the GCR. If there will be found any relationship, next research should be done in this field. This paper will be done as part of Ph.D. thesis.

This paper analyses the relation between the total value of competitiveness in the WCY and values of taxation indicator in the GCR for period from 2014 to 2016. This analysis will be done for all countries for which are available data from the GCR and WCY.

2 Data and methodology

The relationship between the total value of competitiveness in the WCY and value of taxation indicator in the GCR is analyzed. Data are collected from the GCR and WCY database. Data in GCR database are collected yearly, starting from 2007 to 2016. There are also cases where some observations are missing, but it should not lead to bias. Countries with missing data are not used in this analysis for the year with missing value. Data prior the year 2007 are not available due to changes in the methodology.

Taxation is directly mentioned in the following three indicators of total ranking:

- 6.04 - Effect of taxation on incentives to invest
- 6.05 - Total tax rate
- 7.05 - Effect of taxation on incentives to work

The indicator 'Total tax rate' is in the ranking from the beginning (from year 2007); the other indicators ('Effect of taxation on incentives to invest' and 'Effect of taxation on incentives to work') are analyzed and are part of the

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ranking since year 2014. Because of this, the analysis is done only for period for which are available all 3 taxation values – it means for period from 2014 to 2016.

The methodology of data collection for these indicators is described in the GCR. The total tax rate states for a combination of profit tax, labor tax and related contributions and other taxes, which has to be paid by a business in the second year of operation. This amount is expressed as a share on commercial profits. It is a combination of corporate income tax, social security contribution and labor taxes payable by the employer, property taxes, turnover taxes, and other small taxes. The source of this information is in the document 'Doing Business' prepared by the World Bank/International Finance Corporation. In this document, the data about profit taxation, social contribution and labor taxes paid by employers and other taxes for companies in second year of operation can be found. For this indicator higher number means higher taxation in the country. So person, who does not want to pay high taxes, will prefer country will low value of this indicator.

The indicator 'Effect of taxation on incentives to invest' and the indicator 'Effect of taxation on incentives to work' are collected on basis of a survey made by the World Economic Forum, therefore these information can be described as soft data.. The values are between 1 and 7, while value 1 states for big extent of effect of taxation, value 7 mean no effect of taxation on incentives to invest/work. So person, who does not want to establish business in country, where taxation has big impact on incentives to invest or work prefer country will high value of these indicators.

Data for WCY are also collected yearly, from the year 1989. However, public available are only data about total competitiveness of circa 60 countries. Data are provided for purpose of ranking by local institutions. The total ranking of competitiveness is stated as percentage. 100% gets the most competitive country and other countries get values in percentage(lower amount than 100%), which states for value of competitiveness in comparison with most competitiveness country.

The analysis will be done as a linear multiple regression analysis and will be statistically tested.

Before testing, hypotheses have to be established. As a general principle it is assumed that there is dependence between the total value of competitiveness in the WCY and the taxation values in the GCR (total value of countries will be the same as taxation value of indicators). Now, the null hypothesis is written symbolically as follows:

$$H_0 : TV^t = V_T^t \tag{1}$$

where TV = total value of the country in the WCY,
V_T = taxation values.

Based on the null hypothesis, the alternative hypothesis is that there is no dependence between the total value in the WCY and taxation values in the GCR. This alternative hypothesis can be written symbolically as follows:

$$H_1 : TV^t \neq V_T^t \tag{2}$$

We can get the same results about correctness of the hypothesis, if we use log-log analysis. If the dependence is different from zero and is statistically important, so it can be stated that on some level of reliability there is dependence between these values. The countries values in field of taxation can be divided into three indicators (6,04; 6,05 and 7,05). So the total value for each year could be seen as dependence on each of these indicators. For that reason, following basic equation will be used:

$$TV = \beta_0 + \beta_1 * V_1 + \beta_2 * V_2 + \beta_3 * V_3 + \epsilon \tag{3}$$

where β_0 = constant component representing uncorrelated and sTable part of relationship between total value and taxation values. This component is introduced to the model in order to describe influences of other variables (rank of other variables than taxation),
β_1 = effect of value of indicator for influence of taxation on incentives to invest,
V_1 = value of indicator for influence of taxation on incentives to invest (indicator 6.04),
β_2 = effect of value of indicator for total tax rate,
V_2 = value of indicator for total tax rate (indicator 6.05),
β_3 = effect of value of indicator for influence of taxation on incentives to work,
V_3 = value of indicator for influence of taxation on incentives to work (indicator 7.05),
ϵ = stochastic term.

After the log-log transformation of the equation (3), the coefficients β is considered as sensitivity of total value on change of each taxation value:

$$\ln TV = \beta_0 + \beta_1 * \ln V_1 + \beta_2 * \ln V_2 + \beta_3 * \ln V_3 + \epsilon \tag{4}$$

where $ln\, V_1$ = natural logarithm of value of indicator for influence of taxation on incentives to invest (indicator 6.04),
$\ln V_2$ = natural logarithm of value of indicator for total tax rate (indicator 6.05),

$\ln V_3$ = natural logarithm of value of indicator for influence of taxation on incentives to work (indicator 7.05),

and where:

$$\beta = \frac{\frac{\Delta TV}{TV}}{\frac{\Delta V}{V}} = \frac{\%TV}{\%V} \tag{5}$$

3 Data analysis

First of all, it is important to check by multiple regression analysis if there is problem of possible "Apparent" regression. The "Apparent" regression occurs, when non-stationary time series are analyzed, and leads to a total debasement of the model. If all variables are stationary, the model can be created. This was tested and the stationary values were not found.

For testing of whole model the F-test is usually used. Other important value is coefficient of determination R^2, which states how much percent of scatter is explained by model. For each variable, it is also important to test, if the variable is significant or not. This is done by t-test (Arlt et al, 2002).

It is also important to check whether there is problem of autocorrelation. For this purpose the Durbin-Watson test was used. This test is based on testing of squares of residues compared to chosen D-statistics:

$$d = \frac{\sum_{i=2}^{n}(e_i - e_{i-1})^2}{\sum_{i=1}^{n} e_i^2} \tag{6}$$

where e_i = deviation of the actual and theoretical values of the model

Value of Durbin-Watson test is between 0 and 4. If the value is around 2, there is no autocorrelation, if the value is close to 0 or 4, there is autocorrelation. However, Durbin-Watson test is not able to indicate if there is problem of autocorrelation of higher order.

It is also important to check multicollinearity. The multicollinearity means, that there is dependence between at least 2 explanatory variables. This can be check by correlation matrix of explanatory variables. If there is this kind of correlation, one explanatory variable has to be eliminated; otherwise estimates of standard errors of the regression coefficients are too high and using both these explanatory variables does not explain any more of the variance. Some authors assume that the critical value for multicollinearity is 0,80.

For evaluation which model is better is used Akaike information criterion (hereinafter AIC) – lower value means that model is more accurate. For each year the most accurate model was found.

Year 2016

Please find bellow the most important result of analysis made for data for year 2016. Based on Durbin-Watson test and AIC criteria, the best values has models with indicators 6,04 - Effect of taxation on incentives to invest and 7,05 - Effect of taxation on incentives to work.

Table 1: **Regression results 2016 – indicators 6,04 and 7,05**

	Coefficient	**Std.Error**	**t-value**	**p-prob**
Constant	**3,47140**	**0,113950**	**30,46**	**5,80e-03**
$\ln V_1$	**0,816858**	**0,226377**	**3,608**	**0,0007**
$\ln V_3$	**−0,235829**	**0,234720**	**−1,005**	**0,3193**
R^2	**F(1,57)**	**AIC**	**DW**	
0,481819	26,50005	−39,30756	2,002429	

Source: GCR, WCY, own calculation

Table 2: Regression results 2016 – indicator 6,04

Indicator	Coefficient	Std.Error	t-value	p-prob
Constant	3,44107	0,109886	31,31	4,93e-038
$\ln V_1$	0,605648	0,0840026	7,210	1,30e-09
R^2	**F(1,58)**	**AIC**	**DW**	
0,472642	51,98214	−40,25426	1,959925	

Source: GCR, WCY, own calculation

Based on value of AIC these two models have the lowest value. However, in the first model (Table 1) is low value of t-value by indicator $\ln V_3$, so this variable is not statistically significant. Because of it, the most accurate is the model with variable $\ln V_1$ which explain 47 percent of scatter.

The first model is interesting because it shows opposite impact of indicators 6,04 and 7,05, but these two indicators should have the same impact on competitiveness. However, the firs model cannot be used because of statistic non-significance.

For indicator 6,04 - Effect of taxation on incentives to invest (Table 2), the following equation of dependence between total value and value of indicator 6,04 is valid for year 2016:

$$\ln TV = 3{,}44107 + 0{,}605648 * \ln V_1 + \epsilon \quad (7)$$

The equation means, that if the tax system of the country has lower impact on investment by value of 1, the total value of competitiveness increase $0{,}605648$ times.

The models for the indicators 6,05 and 7,05 are also statistically significant, but based on AIC (for the indicator 6,05 is the AIC −13,68956 and for the indicator 7,05 is the AIC −28,96331), the models are not as accurate as model with the indicator 6,04.

Year 2015

Please find bellow the most important result of analysis made for data for year 2015. Based on Durbin-Watson test and AIC criteria, the best values has models with indicators 6,04 - Effect of taxation on incentives to invest and 7,05 - Effect of taxation on incentives to work.

Table 3: Regression results 2015 – indicators 6,04 and 7,05

Indicator	Coefficient	Std.Error	t-value	t-prob
Constant	3,26781	0,112625	29,01	7,91e-036
$\ln V_1$	1,09504	0,297796	3,677	0,0005
$\ln V_3$	−0,421474	0,288731	−1,460	0,1498
R^2	**F(2,57)**	**AIC**	**DW**	
0,535895	32,90850	−38,31610	2,094561	

Source: GCR, WCY, own calculation

Table 4: Regression results 2015 – indicator 6,04

	Coefficient	Std.Error	t-value	t-prob
Constant	3,28107	0,113347	28,95	3,60e-036
$\ln V_1$	0,678418	0,0858358	7,904	8,88e-011
R^2	**F(1,58)**	**AIC**	**DW**	
0,518545	62,46817	−38,11401	2,020233	

Source: GCR, WCY, own calculation

Based on value of AIC, these two models have the lowest value. However, in the first model (Table 3) is low value of t-value by indicator$\ln V_3$, so this variable is not statistically significant. Because of it, the most accurate is the model with variable $\ln V_1$ which explain 51 percent of scatter.

In the first model (Table 3) is the same result as for year 2016 – the indicators 6,04 and 7,05 has opposite influence on competitiveness.

For indicator 6,04 - Effect of taxation on incentives to invest, the following equation of dependence between total value and value of indicator 6,04 is valid for year 2015:

$$\ln TV = 3{,}28107 + 0{,}678418 * \ln V_1 + \epsilon \quad (8)$$

The equation means, that if the tax system of the country has lower impact on investment by value of 1, the total value of competitiveness increase 0,678418 times.

The models for the indicators 6,05 and 7,05 are also statistically significant, but based on AIC (for the indicator 6,05 is the AIC −2,394749 and for the indicator 7,05 is the AIC −27,54429), the models are not as accurate as model with the indicator 6,04.

Year 2014

Please find bellow the most important result of analysis made for data for year 2014. Based on Durbin-Watson test and AIC criteria, the best value has models with indicator 6,04 - Effect of taxation on incentives to invest .

Table 5: Regression results 2014 – indicator 6,04

	Coefficient	**Std.Error**	**t-value**	**t-prob**
Constant	3,42656	0,113858	30,10	4,33e-037
$\ln V_1$	0,598176	0,0860690	6,950	3,56e-09
R^2	**F(1,58)**	**AIC**	**DW**	
0,454384	48,30193	−36,06067	1,956665	

Source: GCR, WCY, own calculation

Based on value of AIC this model has the lowest value. The model for indicator 6,04 explains 45 percent of scatter.

For indicator 6,04 - Effect of taxation on incentives to invest, the following equation of dependence between total value and value of indicator 6,04 is valid for year 2014:

$$\ln TV = 3{,}42656 + 0{,}598176 * \ln V_1 + \epsilon \quad (9)$$

The equation means, that if the tax system of the country has lower impact on investment by value of 1, the total value of competitiveness increase 0,598176 times.

The models for the indicators 6,05 and 7,05 are also statistically significant, but based on AIC (for the indicator 6,05 is the AIC −11,50461 and for the indicator 7,05 is the AIC −29,06587), the models are not as accurate as model with the indicator 6,04.

4 Discussion and conclusion

The aim of this paper was to analyze the relation between the total value of competitiveness in the WCY and taxation values in the GCR.

This analysis was made for period from 2014 to 2016. For this period values of three indicators related to taxation are available.

The results shows, that there is dependence between competitiveness and all tax indicators. This mean, that there should be done next research with the aim to find which exact tax indicators has impact on competitiveness.

Based on the AIC the most accurate model is the model with indicator 6,04 - Effect of taxation on incentives to invest in all 3 years. The competitiveness is positively dependent to value of this indicator.

The total value of competitiveness was also negatively dependent on values of indicator 7,05 - Effect of taxation on incentives to work. However, the results for indicator 7,05 (in the model together with the indicator 6,04) is statistically not significant.

Nevertheless the fact, that indicator 7,05 was in all years rejected as it was statistically not significant in the model together with the indicator 6,04, it is interesting that the indicator 7,05 has negative impact on the competitiveness. However, the indicators 6,04 and 7,05 should have the same (negative or positive) impact.

The constant for indicator 6,04 is in years 2014 and 2016 almost the same (value 3,42656 and 3,44107), also the value of dependence of total value on indicator is almost the same (values 0,598176 and 0,605648). In the year 2015 the value of constant is 3,28107 and the value of dependence of total value on indicator is 0,678418.

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Influence of evolution of the tax revenues to the sharing of tax revenues of the state budget and municipal budgets

Petr Tománek*

Abstract. The paper is focused on the evaluation of the evolution of tax sharing between the state budget and the budgets of municipalities in the Czech Republic. Tax sharing is based on the distribution of tax revenues between the state budget, municipal budgets, budgets of regions and state funds at a specified ratio. The system of tax sharing introduced in 2001 was evolved, however its main base, i.e. the types of shared taxes, remain unchanged. To evaluate there is observed ratio of taxes received by state budget on the one hand and the budgets of municipalities on the other. Evolution of monitored taxes respectively of their parts is autonomous and the resulting ratio of taxes between budgets is influenced by the structure of taxes, by changes of portions in tax sharing and by evolution of revenues in individual taxes. Paper evaluates key issues that affect the tax sharing between municipalities and the state budget.

Keywords: tax, state budget, municipal budget, tax sharing
JEL Classification: H71

1 Introduction

To finance the public goods from the public budgets at the decentralized level in the Czech Republic there is applied the system of the tax sharing. A substantial change in tax sharing has been introduced since 2001 for municipalities and since 2002 a similar system was applied for the newly established self-governing regions. This system of tax sharing at the decentralized level is used to create the sources for public budgets and is using various elements, however, is based on the principle of tax sharing based on the distribution of state enacted taxes between: state budget, municipal budgets, budgets of regions and the State Transport Infrastructure Fund. By the Act on Budget Tax[1] there are so well established rules for budget allocation of any taxes or their parts.

Tax sharing between the state budget and decentralized budgets (municipalities and regions) includes two taxes: income tax and value added tax, but income tax is disintegrating into seven parts in case of sharing for municipalities. To the sharing system, then there are not included some taxes from the tax system in the Czech Republic: land value tax (is fully entrusted to the budgets of municipalities), tax on transfer of immovable property and energy taxes (fully entrusted to the state budget) and road tax (fully entrusted to the State Fund for Transport Infrastructure).

The alternative for creation of sources for decentralized budgets on the principle of tax sharing from the national revenue is proved to be necessary. The possibility that the sources of decentralized budgets were based on the collection of taxes according to the place of their origin etc., is difficult to implement in a globalized economy, if not impossible, because to find the specific place of origin of tax (e.g. the municipality territory) is very difficult and possibilities of that determination are limited by the administration of taxes, i.e. the costs of this administration, but e.g. also by the companies' headquarters which is offsite of tax origin and the like. It turns out, according to the real conditions of the structure of the tax system of the Czech Republic and incomes of taxes in terms of territory, that the possibilities of usage of taxes determined by state not as shared taxes, but as a entrusted tax on the principle of place collection of tax, thus such generated revenues of local budgets, are so very limited and by each subsequent enlargement it would lead to the need to supplement the system by balancing transfer system (Tománek, 2015). Therefore, this paper focuses on issues of tax sharing.

From the above theoretical knowledge it is shown that there was previously delimited a number of requirements on tax incomes of decentralized budgets (e.g. Musgrave, 1994, p. 423); On the other hand, the current real conditions of the economies of countries in the 21st century such as globalization, industries networking, effort to improve tax systems in order to prevent tax evasion, computerization, etc., they bring other aspects that modify the conditions for the provision of adequate tax resources to decentralized budgets, respectively, theoretical knowledge in this area should be developed (Tománek, 2015). Linked to this is the issue of the use of tax autonomy within federal states (Blöchliger, 2011), or question the issue of settlement of tax capacity to use similar tax burden, which is given in close context with resources balancing within fiscal federalism (Blöchliger, 2007).

Existence of resources for decentralized budgets in the form of shared taxes makes possible to assume great stability of tax incomes for individual budgets. Shared taxes also reduce the large disparities in tax revenues

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between the individual budgets and allow spread the risks of non-fulfilment of tax revenue between the state and local government (Peková, 2011, p. 120).

The article talks the issue of tax sharing particularly from the perspective of municipal budgets. In the Czech Republic conditions is applied tax sharing for municipalities in the form of income tax (tax on income of individuals and corporations) and value added tax. Entrusted to municipalities there is the land tax and the part of tax on corporate income, where this corporation is the village.

On the other hand, the municipal budgets are not affected by excise tax (this tax is shared by the state budget and the State Transport Infrastructure Fund), the energy tax and a tax on the acquisition of immovable property (revenue is collected to state budget) and road tax (this tax is intended to State Transport Infrastructure Fund).

The aim of this paper is to evaluate the tax sharing system on the base of the proportions of the evolution of the real size of the tax incomes of municipal budgets and the state budget.

2 Methodology and Data

Assessment of the evolution of rate of tax sharing between the state budget and municipal budgets are made on the basis of revenues calculation of individual taxes, respectively of their parts for the respective budgets. For assessment of the issue there were used as source data the actual revenues of monitored budgets of individual types of taxes. The data cover municipalities in the whole CR (incl. Prague budget) on one side and the state budget on the other side.

There is analysed the period 2002 - 2014. In this period, there were not the sharing portions the same, so when assessing this issue, it is necessary to take into account changes in these portions. Evolution of these portions of tax sharing for municipalities and regions in the period 2001-2017 is shown in Table 1.

Table 1 Overview of the shares of municipalities to national taxes revenue in the period 2001-2017

Shares in %	2001	2002 - 2007	2008 - 2011	2012	2013 - 2015	2016	2017
Land value tax	100	100	100	100	100	100	100
Tax from individual income from the business	30	30	30	30	30	30	0*
Tax from individ. income from depend. activity	0	1.5	1.5	1.5	1.5	1.5	1.5
Tax from corporate income (municipalities)	100	100	100	100	100	100	100
Tax from individ. income from depend. activity	20.59	20.59	21.4	21.4	22.87	23.58	23.58
Tax from individ. income from business (60 %)	20.59	20.59	21.4	21.4	23.58	23.58	23.58
Tax from individ. income withholding	20.59	20.59	21.4	21.4	23.58	23.58	23.58
Tax from corporate income	20.59	20.59	21.4	21.4	23.58	23.58	23.58
Value added tax	20.59	20.59	21.4	19.93	20.83	20.83	21.4

Source: Own processing on the basis of the Act on Budget Tax no. 243/2000 Coll.

Note: *since 2017 there will be stated income for municipalities abolished and replaced by income from value added tax.

Due to the fact, that there are not used all taxes within this evaluation, there was first defined range of taxes used in various budgets and evaluation method.

Monitored spectrum of taxes of the state budget includes the following types of taxes[1]:

- value added tax (except the portion allocated for municipalities and regions budgets),
- tax from corporate income (except the portion of income when the taxpayer is a municipality or region and except the portion allocated to the incomes of regional and municipal budgets),
- tax from individual income (except the portion allocated for incomes of municipalities and regions budgets),
- excise duties (except the portion allocated for the State Transport Infrastructure Fund),
- tax on transfer of immovable property,
- energy tax.

Monitored tax spectrum of municipal budgets:

- land value tax,
- value added tax (except the portion allocated for the state and regional budget),
- tax from individual income (except the portion allocated for the state and regional budget); into municipal budgets is provided in six ways,

- tax from corporate income (except the portion allocated for the state and regional budget); into municipal budgets is provided in two ways (but into assessment is included only one part; there was not included tax from corporate income for municipalities due to zero impact on municipal budgets).
- In individual years in the period 2002-2014 there were evaluated, based on actual tax incomes of the state budget and municipal budgets, absolute revenues of relevant taxes for the both kinds of budgets and in each year there was then calculated the rate of tax sharing in %, see (1). Graphical representation of the results is depicted in the graph 1.

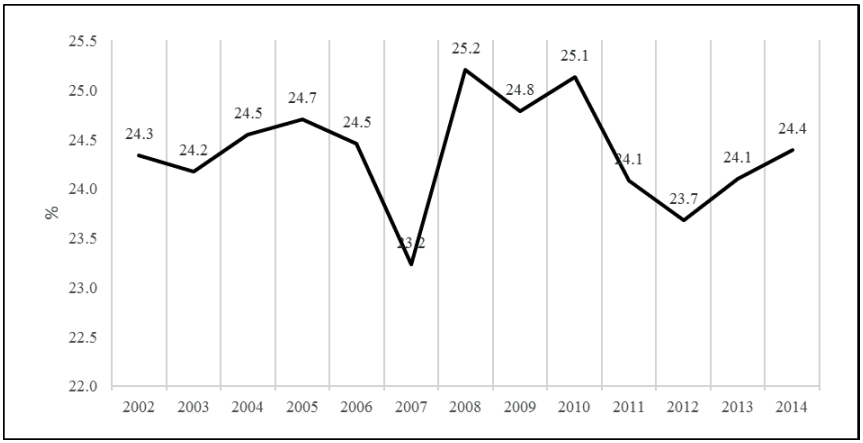
Equations

$$M = \frac{Ob}{SR} * 100 \quad [\%] \qquad (1)$$

where:

M = rate of tax sharing (v %)
Ob = monitored spectrum of incomes from municipalities tax (in bill. CZK)
SR = monitored spectrum of incomes from the state budget tax (in bill. CZK)

Figure 1: The rate of tax sharing between municipal budgets and the state budget



Source: Own processing on the basis of financial management data
Note: To highlight the trend is the axis of the percentages adjusted to range of existing values

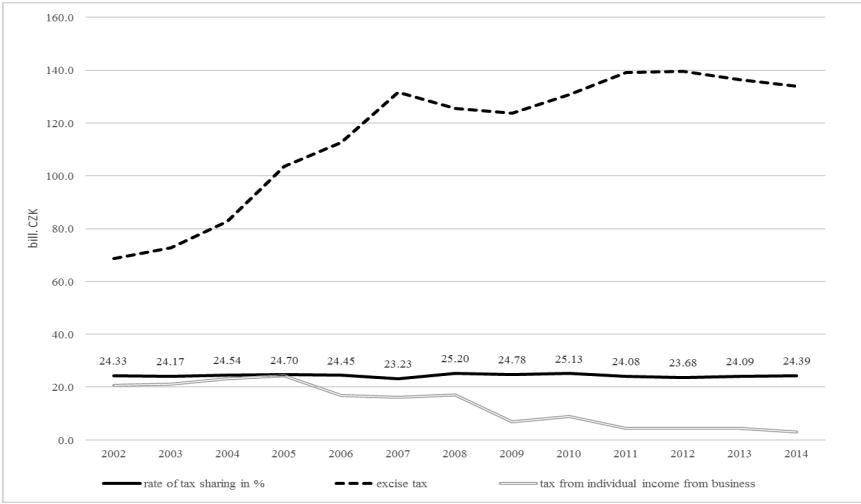
The found values show that the rate of sharing in the period 2002-2014 is ranged within lowest value of 23.2%, i.e. the value in 2007, up to a maximum value of 25.2% in 2010. In terms of time evolution seems, that the rate of tax sharing has not changed much, but the change of rate of sharing by 1 percentage point in terms of tax incomes of municipalities here in 2014 represents about 5.5 bill. CZK, which is due to the tax incomes of municipalities around 4%.

The evolution of tax yields of individual taxes is to be relatively sTable, but yields of some taxes vary considerably. Such a tax is a tax on from individual income from the business, which in the monitored period registered a significant decline when in the period 2005-2014, dropped its yield at about a quarter, see Graph 2. Such changes are then significantly reflected in the tax revenues for public budgets, and thus affect the ratio of sharing. Therefore, description is accompanied by illustration of the evaluation of this tax and also because in compare with the share of other taxes, this tax portion is more significant for municipalities.

In terms of evolution of rate of the tax sharing in the monitored period there are substantial significant changes in trends between 2007 and 2008 and between 2012 and 2013 (see Graph 1). In the conclusion there are discussed factual context of these changes, respectively their impacts.

Furthermore, due to its significant volume on sharing rate, the excise tax influences on it, due to the fact that here is no portion provided to municipal budgets. On the example of these two given taxes we can demonstrate the importance of the percentages portions of tax sharing by individual budgets. Different evolution of revenues of these two taxes to the state budget shows that the decrease of tax from individual income from the business there was more than compensated by the evolution of incomes from excise taxes, see Graph 2.

Figure 2: Trend in evaluation of tax sharing by municipalities and by state budget (in %), taxes from individual income from business (state budget) and excise taxes in the years 2002 to 2014



Source: Own processing on the basis of financial management data

3 Conclusions and discussion

The paper focuses on the issue of sharing of taxes between municipalities and the state budget. Based on our analysis, we can folowing conclusions.

In the monitored period 2002 - 2014 were no significant variations in the rate of tax sharing between municipalities and the state budget; In this period, the maximum and minimum rate of tax sharing differed by two percentage points; on this causes a varying extent of the portion of tax revenues for the respective budgets and individual evolution of revenues of individual taxes, so in terms of the rate of taxation there is no clear trend (increase or decrease this rate).

The largest negative change in the spectrum of shared taxes, it was the tax from individual income from business, which is relatively more tied to the budgets of municipalities (ca. double portion of this tax is allocated in frame of sharing into the municipal budget, compared to other taxes), however it's shown that aggressive decrease of this tax at the time was compensated in another way, respectively by increase of other taxes.

In 2008 was introduced energy taxes, as a part of the excise taxes (revenue from excise tax is allocated to the state budget), however, this does not increase the state income from excise taxes and caused there individual changes in other excise taxes.

Into the taxes sharing is reflected an individual state's plans, e.g. the implementation of the solidarity tax (since 2013), or change of the tax sharing of value added tax in context with pension reform (since 2012).

In the monitored period there were made two major changes in the portions of shared taxes, and that in 2008 and 2013, with the declared intentions to strengthen municipal resources at the expense of state budget revenues, respectively as a form of compensation for a reduction of provisioning of subsidies of state budget to the municipal budgets (2013); However, analysis showed that these changes essentially didn't mean the provisioning of increase of rate of tax revenues for the municipalities budgets (see below).

Declared substitution of resources for municipalities in 2013 was not so good for municipal budgets, but rather for the state budget. It was realized in the way that for municipalities was reduced the state budget by about 10 billion CZK in form of discretionary grants and were transferred into tax revenues of municipalities in the form of a higher rate of tax sharing (which was welcomed by the municipality due to the simpler ways of obtaining resources for their budgets due to the usual complicacy of applications submitted in the form of grants). And therefore, that by this change the state stopped the decline tendency of shared taxes for municipalities (which would otherwise have to make) and replaced it with their resources by reduced need of providing grants to municipalities. So it can be stated that the municipalities in essence lost that amount (in the form of a reduction in the provision of subsidies).

Performed increase of rate of the tax sharing in behalf of municipalities in 2008 again meant only stop of the downturn of declining of rate of tax sharing between municipalities and the state.

In terms of volume significant tax there are not included the excise taxes; as shown by the evolution of their revenues, their yield is obviously influenced by commodity prices, by consumption size, as well as by individual interventions in the tax rates. Since it is a fairly significant source of tax only for the state budget, the question is the appropriateness of its inclusion into the tax sharing also for territorial units. In this direction would probably be a common opinion of mutual "breathing" of both segments of budgets and it would be appropriate to include this tax into sharing (so that the positive or negative impact were carried by both budgetary segments similarly).

Article discusses defined segment of the revenues of the state budget and municipality budgets, without bindings to other sources of surveyed public budgets. However, the conclusions of the evaluation of the given topic show that this issue should be analysed further in context with budgetary determining taxes or with its changes.

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Employees' and self-employed persons' pension replacement rates in the Czech Republic – new findings from the new dataset

Alena Vančurová* – Stanislav Klazar**

Abstract. The topical issue within the pension system in the Czech Republic is the level of coverage of self-employed persons who constantly report their income near the level of minimal basis during their lifetime. We estimate the standard measures of pension system efficiency (replacement rates, lifetime benefit/contribution index) using the unique dataset of Assessment Base for Pension Insurance to shed the light on this problem. We can sum up that the income distribution of self-employed persons is highly concentrated, with the peak at the profit level which corresponds with the minimal base for pension contribution. This profit level is approx. 66 % of median wage and 50 % of average wage in 2012. Due to the high degree of the Czech pension system progressivity, the general result is that the self-employed persons are better off in comparisons with the employees if we concentrate on relative measures, but worst off if we concentrate on nominal measures. The nominal pension for self-employed persons reporting the minimal base is CZK 7 631 with comparison of CZK 12 471 (11 702) for average (median) wage.

Keywords: Income distribution, employee, self-employed persons, pensions, replacement rate, redistribution, progressivity, lifetime incidence.
JEL Classification: D3, D63, E24, J2, H23, H55

1 Introduction

The newly recognised and highly problematic issue within the Czech pension system is the difference between the nominal benefits and relative level of benefits for self-employed persons measured by the standard gross or net replacement rates (RRs) or by the lifetime measures of impact of system on the disposable income.

This difference stems from the construction of assessment base of the self-employed person and is partly defensible under some assumptions. In our paper, the nominal and relative levels of coverage will be estimated and compared for full employees and full self-employed persons to shed the light on the resulted difference between these two measures. Some recommendations will be derived as conclusions.

The main contribution of the paper is to utilize unique dataset and calculate the nominal (absolute) and relative measures of individual pension system efficiency for the two main groups of insured persons.

The rest of the paper is organized as follows. The next section describes the Czech pension system with the focus on the benefits from the system and the payments to the system, also, simplified model for calculation of lifetime benefit and payment flows is introduced with the discussion of assumptions, under which the model is valid. In the next section, the pros and cons of the dataset are discussed and basic characteristics are compared with other datasets. The high level of usefulness of chosen dataset is proved. The next section compares the main results for both groups of the insured person and derives some recommendations for the public policy.

2 Methodology and modelling

In this section the Czech pension system is described, with the focus on the benefits from the system and payments to the system, and simplified model for calculation of lifetime benefit and payment flows is introduced with the discussion of assumptions, under which the model is valid.

Historically – pension system should exhibit two partly incompatible characteristics:

- some level of solidarity and
- should take into account (if possible) the lifetime living level.

Appropriate level of these characteristics is the question for policymakers of individual countries. Under these assumptions the final level of pension benefits should be able to cover the future needs of pensioners, but also express some solidarity between rich and poor people, again, under the auspice of policymakers.

Newly this question is also grasped by the judges (Constitutional Court 2010) and some changes are not the result of the public choice. It can also be stated that these differences (between decisions by the policymakers in

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the process of public choice and follow up changes established by the Constitutional Court) are something new in our public policy and they can have far-reaching consequences in the future (Lapková 2016).

3 Pension benefits

Czech ordinary pension benefit consists of two parts:

- basic (fix) part (which induces solidarity) and
- earning-related part (which corresponds with the lifetime living level).

The basic (fix) part expresses the level of solidarity of the system, but the solidarity is also strengthen by the progressive formula. This value is the same for all participants. The value is updated according to average wage. The value of the basic pension is equal to 9 % of the legislated average wage. In 2013 it was CZK 2 330 per month (this translated into an annual benefit equals to CZK 25 889).

The second part of pension benefit is earning-related part. The calculation is rather complicated. This part takes into account not only the previous earnings (but only for limited period - 1986-2012), but also the number of years of insurance (so called service years).

First step – influence of number of services ("n", see later): The earnings-related pension equals to 1.5 % of "almost lifetime reduced updated earnings" for each service year. The definition of service years is rather complicated and takes partly into account also the years of higher education or some similar periods dedicated to children raising (care).

Second step – influence of living level - "Almost lifetime" term means that the earnings measure currently averages across all years starting from 1986. Levels of earlier earnings are not taken into account. This measure will probably gradually reach "whole lifetime average" for pensioners requesting for the benefit in future. Authors infer that this limitation is due to technical and practical unavailability of precise earnings data from earlier years, before 1986.

"Updated earnings" means that the nominal earnings from the previous years (period 1986-2012) is recalculated in to the value of the year 2012. Every early earnings from the period 1986-2012 is multiplied by so called "Coefficient of increase of general assessment base". This coefficient measures (with some level of simplicity) change of nominal average earnings between two years (year in column 1 and 2012 in our analysis). For example coefficient for pair of the years 2012 and 1986 is 8,7326 and means that the average nominal earnings in 1986 was 8,7326 lower than in 2012. This coefficient is used to update the individual earnings reported by the insured person in 1986 to the nominal value of 2012. In other word we are calculating the present value of earnings from 1986 for the year 2012.

Finally the progressive benefit formula is applied. "Reduced earnings" means that there is a progressive benefit formula, under which income thresholds are applied to reduce average career earnings into the calculation basis. Due to this formula the increase of the benefit is relatively lower than increase of earnings. The first reduction threshold is equal to CZK 11 389, the second is CZK 30 026 and the third is CZK 103 536 in 2013. Up to the first threshold the earnings will be replaced by 100 %, between the first and second by 27 %, between the second and the third by 19 % and the rest of the earnings will be replaced by only 6 %. It should be pointed out that this formula is under the every year adjustments and the level of progressivity is gradually reduced (the earning-benefit relation is strengthened).

As a very final step there is a test of solidarity. To strengthen the solidarity there is minimal level of the final pension payment (which is sum of basic and earning related pension). The total value of the minimum public pension benefit is CZK 3 100 (for monthly pensions newly granted in 2013), which is made up of a minimum earnings-related pension of CZK 770 plus the basic component of CZK 2 330.

To summarize the process of individual pension calculation, see next scheme:

Individual monthly pension is sum of:

- Fix part (2330 CZK) and
- earning-related part, which is calculated as
    - N*0,015*(„reduced" „almost lifetime" „updated" monthly earnings),
      where:
        - N is the number of „service years"
        - "Almost" lifetime earnings means that only 1986+ period are taken into account
        - "Updated" means that earnings are expressed in value of present year
        - "Reduced" means that the progressive formula is applied.

4 Pension payments to the system – assessment base

Pension benefits are financed from the pension payments to the system. Pension system is predominantly based on PAYGO system of financing. There are two groups who finance the system – employee and self-employed person. Payment base for employee is gross wage with some minor exemption.

There are two modifications applied for self-employed person. There are:

- fundamental reduction of payment base
- minimal payment base

The payment base for self-employed person is half of their economic profit. These 50 % is an estimate of the self-employed person wage – so called income from labour. The rest of the profit is the capital income, which is not usually subject of pension insurance. Argument for this approach is as follows: Capital income is not limited by the age of economic subject, is not limited by his/her ability to work; this income can flow after the usual working period of employees. As a result it is not necessary to cover this period by pension insurance, so it is not necessary to pay the insurance payments to the system. Nevertheless, the dimness and ambiguity of this approach can be illustrated by the changes in the proportion of Capital/Labour profit index. The system started with the value 35%, but was increased in 2004 and again in 2005 to 40 and 45 % respectively, from the year 2006 the value is sTable on the level 50 % but there are some recent attempts to continue in increasing trajectory (MFCR 2015).

There is also minimal payment base for self-employed person. This base is derived as a portion of legislated average wage and is updated every year.

Pension payments to the system - rates

There is rather complicated system of different linear payment rates based historically on Bismarck pension system with divided rates, 28 % for self-employed person and total 28 % for employee system (6.5 % plus 21.5 % covered by employee and employers in 2012).

For our analysis it is important to discuss the economic incidence of pension payments. The question is whether the part paid by employer by the law (21.5 %) is also economically born by employer.

Although social security contributions (SSCs) represent one of the most important part of total public revenues (25 % in ("OECD Pensions at a Glance" 2016) countries on average, even larger share can be identified in countries with high level of social insurance, for example 40 percent of total tax revenues in France or Czech Republic), it must be stated that „Surprisingly, these taxes have attracted much less attention in the public finance literature than features of income taxation." (Bozio et al. 2016)

As a result there is not a clear understanding of the incidence/impact of this kind of public revenue (in other words - one is not sure who really bears the SSCs burden, whether employer or employee). The number of studies is relatively low and the researchers deliver much more ambiguous responses in comparison with the analyses of incidence of income taxes (Saez, Slemrod, and Giertz 2012) for a survey of personal income tax incidence and impact).

This low level of interest for SSCs incidence is partly due to common thought/believe that the results should be similar as for the personal income tax. So some economists believe the special research is not needed.

On the other side there are some special features of SSCs which can modify the final incidence based on classical assumption for personal income tax. The most important feature is the potential relation between the sum of the payments and sum of benefits received later. Some economic theorists believe that the tax-benefit linkage is likely to matter for the incidence of SSCs. To be more clear this relation is "zero for income taxes", but in some countries this relation is strong (Sweden, Slovak Republic), in some countries is low for SSCs (Ireland). It can be measured by the index of progressivity of pension system or by the proper analysis of differences in replacement rates (RRs). To be more specific, index of progressivity is one (100 %, low relationship) for so called "pure-basic systems" and zero (0 %, high relationship) for so called "pure-insurance pensions". According to Pensions at Glance (2011) it can be stated, that "Pure-basic pension systems pay the same benefit regardless both of their earnings history and their other sources of income. The relative pension level is independent of earnings and the replacement rate falls with earnings. Pure-insurance schemes, in contrast, aim to pay the same replacement rate to all workers when they retire." Index for the Czech pension system was 68 % in 2010, 8th place of 41 analysed countries. It means the system is more progressive (pro poor) in comparison with the average.

Based on above mentioned and following the results ((Gruber 1995), (Klazar and Slintakova 2009) and (Slintáková and Klazar 2012)) that indicates that SSCs with some level of tax-benefit linkage are expected to be fully shifted to employees, we decided to use in our modelling the rate for employee in amount of 28 %.

5 Dataset and modelling of lifetime individual position

In this section the pros and cons of dataset are discussed and basic characteristics are compared with other datasets, usually used for such kind of analysis in previous research.

In this paper we used the unique dataset (covering year 2012) delivered by the Ministry of Labour and Social Affairs (MoLSA 2016). Previous analyses (Slintakova and Klazar 2008) were predominantly based on the datasets as SILC, IPSV ("ISPV - Mzdy a Platy Podle Profesí" 2016), CES ("Consumer Expenditure Survey" 2016), national Household Surveys or ADIS ("Database of Tax Information and Data (ADIS)" 2016), but all these previously used datasets exhibit some drawbacks for such kind of analysis.

MoLSA – pros and cons

MoLSA covers the whole population of persons who are subjects of pension system (1st pillar, PAYG financing), roughly 4.6 million of economics subjects, employee, self-employed persons and persons with the mix of these incomes. There is no other comparable dataset to this one. From the statistical point of view, we can sum up it covers not just a sample, but the whole population, so the results from the statistical analysis are not just estimates, but the real measures describing the whole population. Another advantage for analysis of pension system coverage is that the information concerning earnings are directly the same as are used for the calculating of the both contribution to the system and the benefits from the system.

On the opposite side, there are also some drawbacks of the MoLSA usage. This dataset is proprietary designed and is not compatible with datasets from other countries. So it is not generally suiTable for direct international comparisons. There is also a lack of other (control) variable covered by this dataset. There are almost no data concerning the socio-economic status of the insured person.

Modelling of lifetime incidence

We decided to calculate final position of employees and self-employed persons in the pension system as described in (Slintáková and Klazar 2012). We reduced the sample only on full employee and full self-employed person, so excluded the person with the mix of the income. It enabled to us the calculation of the lifetime benefits (with some level of simplicity).

According to the data (Appendix A) almost 50 % of full self-employed persons reported the base for payment at the level of minimum (for 2012 it was CZK approx. 75 thousand per year). We calculated the lifetime measures for these self-employed people and also for the employees from 25th to 75th percentile. So our results cover the half of population of self-employed persons and employees.

Assumptions for our simplified model are as follows. The persons apply for the pension in 2013. Our data covers the year 2012 as a starting point for our analysis. The number of the "service years" was chosen as 45 years. There are no excluded days and the real income is the same for the whole last 26 years (almost lifetime period). According to the data from Pensions at glance 2015, section Gross replacement rate for average earners with different wage growth), the Czech pension benefits are highly immune to the changes of the income during the working career. The same results are derived in (Klazar and Slintakova 2009). We believe this assumption and minor simplifications are still defensible. According to (Holub 2008) the contribution to the system is paid only circa 80 % of service years (we chose 35 years of contributions).

There is a small modification for self-employed persons. Individual assessment base for period 1986-1989 was chosen equal to the average wage, same as for the employees, due to some minor time inconsistency of pension systems (MoLSA 2016) – we anticipate that the self-employed persons were actually employees for this short period. We also suppose that the person will live (and receive the benefits) for the 15 years (Pensions at glance, 2015, Expected remaining life expectancy).

We focus only on the first pillar, which is the mandatory basic pension insurance, defined by benefits and funded on a running basis (PAYGO). The pension from the basic pension insurance is drawn by more than 99 % of the population whose age is higher that the retirement age, see (MoLSA 2016) and forms more than 95 % of pensioner revenues (Pensions at glance, 2011, section Balance between the public and private provision of mandatory pensions).

6 Results and Discussion

In this section we compare the main results for both groups of insured persons and derive the recommendations. The results for self-employed persons with the lifetime minimal base are summarised in next Table.

Table 1: Summary results for self-employed person

Base 2012 // profit (minimum)	Absolute (relative) frequency	Monthly pension benefit	gross replacement rate	lifetime payments	lifetime benefits	benefit/payment ratio
75 420 // 150 840	266 934 (48 %)	7 631	0,61 (1,22)*	739 116	1 373 580	1.86

Note: Payment rate is 28 % for the whole payment period (35 years). We suppose that the pensioner will be receiving the pension for 15 years (see Section 3 and Appendix A for comparison with employees. Lifetime measures are expressed in the present value of 2012. For * see discussion below.
Source: MoLSA, own calculations.

We analysed the situation for 266 934 individuals, fully self-employed. Under the plausible assumption – that the payments to the system were derived from the minimal base over the whole working career – the final monthly pension is CZK 7 631. It means that the gross replacement rate (defined as the individual pension entitlement divided by gross pre-retirement earnings (profit), not taking into account the personal income taxes and social security contributions, see Pensions at glance 2015) was not lower than 61 %. In other words the first pension is 61 % of the previous profit (income minus costs). It is also possible, that the real individual replacement rate (pension/profit) is much higher for persons whose profit is much lower than the corresponding minimal base.

To test the change in living conditions of these people, we believe that the more appropriate number is 122 % (2*61%). The system assumes (see Section 2), that the half of the profit is connected with the capital activities, which can generate income also during the retirement period with no personal working activity. In case the person is able to invest half of the profit with the similar rate of return as is achieved in public pension system, the second measure/number (114 %) describes better the real change in living standards of pensioners (pensioner will receive not only pension but also the interests from the capital property).

The rest of the Table describes the results for the lifetime effects and it is clear that under our assumptions these persons receive more from the system than they pay to the system.

The same analysis was done for employees. The results are in the Appendix A. The analysis covers almost 1.6 million (the half of the population) employees with no mixed earnings (defined as full employee). The gross replacement rate for analysed group is in interval from 71 % for individual in 25th percentile to 47 % in 75th percentile, for median wages it is 56 %.

Analysis revealed that the rate of return for self – employed person estimated on the lifetime level is high, the same is true for the standard gross or net replacement ratios, all in comparisons with the employee. The nonstandard derivation of the assessment base for the self-employed person (base is not equal to the full profit, but only to half of the profit) may cause the illusion, that the replacement rate is small to keep the living conditions/standards during the retirement period for self-employed persons. It should be clearly stated, that this group of person should use the rest of profit carefully to reach the sufficient capital inflow during the retirement period – see discussion in section 2.2.

7 Conclusions

The analysis revealed, that the 50 % of self-employed persons face the gross replacement ration (RR) equals to 61 %, (or 121 % if the reduction of the profit by 50 % is taken into account - assessment base is a 50 % of profit), in comparison with the employees, who face the gross RR equals to 50 % for average wages and 56 % for median wages.

Completely different picture is revealed if we focus on the nominal measure (nominal pension for month or nominal pension on the lifetime basis). The nominal pensions for self-employed persons reporting the minimal base are CZK 7 631 with comparison of CZK 12 471 (11 702) for average (median) wages (see Appendix A).

The differences in nominal and relative measures are due to:

- differences in distribution of income (lover level and variance for self-employed persons) and
- different approach to the assessment base calculation (base is equal only to half of profit).

Due to high level of progressivity of pension system in the Czech Republic the “poorer” group reaches the better relative measures (gross and net RRs). Due to assumption, that capital income is not limited to the serviced period and is accessible also in the retirement period, the assessment base is reduced by law by 50 %. This reduction is the second reason of low level of nominal benefits for self-employed persons. We believe that academic and political discussion of the reduction level of assessment base will initiate the changes of this level. We also believe that easy accessible and correct information concerning the individual estimated future benefits (as for example in Sweden, (“Decide for Yourself When to Retire - Pensionsmyndigheten” 2016) can motivate the persons to increase the level of contribution (not only) to the public pension schemes.

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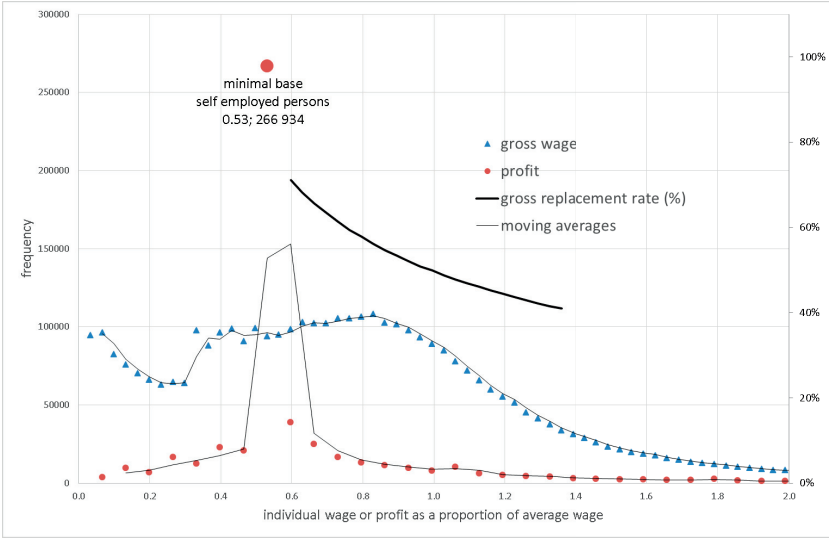
Appendix A – Summary results for employee and distributions of income.

gross earning (midpoint of interval)	absolute frequency	relative frequency	monthly benefit	gross replacement rate	lifetime payments (A)	lifetime benefits (B)	B/A
180 000	98343	3.06%	10 660	71%	1 764 000	1 918 800	109%
190 000	102824	3.20%	10 796	68%	1 862 000	1 943 280	104%
200 000	102070	3.17%	10 931	66%	1 960 000	1 967 580	100%
210 000	102173	3.18%	11 113	64%	2 058 000	2 000 340	97%
220 000	105359	3.28%	11 249	61%	2 156 000	2 024 820	94%
230 000	105431	3.28%	11 384	59%	2 254 000	2 049 120	91%
240 000	106472	3.31%	11 566	58%	2 352 000	2 081 880	89%
250 000	107990	3.36%	11 702	56%	2 450 000	2 106 360	86%
260 000	102714	3.19%	11 837	55%	2 548 000	2 130 660	84%
270 000	101555	3.16%	12 018	53%	2 646 000	2 163 240	82%
280 000	97839	3.04%	12 154	52%	2 744 000	2 187 720	80%
290 000	93271	2.90%	12 290	51%	2 842 000	2 212 200	78%
300 000	89140	2.77%	12 471	50%	2 940 000	2 244 780	76%
310 000	84835	2.64%	12 607	49%	3 038 000	2 269 260	75%
320 000	77743	2.42%	12 743	48%	3 136 000	2 293 740	73%
330 000	71955	2.24%	12 879	47%	3 234 000	2 318 220	72%
Coverage	1549714	48%					

Benefit and the lifetime measures are calculated under the assumptions discussed in section 3.
Source: MoLSA, own calculations.
Note: The data covers 48 % of the population of full employees. Monthly



Note: 0,53 under the minimal base label is actually 0,5, difference is due to intervals of data, interval step was CZK 10 000, gross RRs are displayed only for employee.
Source: MoLSA, own calculations.

How do opinions on tax evasion relate to shadow economy and VAT gap?

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Abstract. Tax evasion is one of highly discussed topics among politics, tax professionals, academics and also representatives of business. To understand the phenomenon of tax evasion it is necessary to estimate its volume and also factors driving it. This contribution attempts to find out the relations between the opinions on tax evasion expressed by citizens of EU countries in an extensive public survey and the estimates of the tax evasion (expressed by means of VAT gap) and shadow economy published for these countries. Our results point out the inconsistency in the estimates of different measures of the tax evasion – VAT gap and the extent of shadow economy. It also showed differences in the perception of different questions related to tax moral as just question pointed at tax evasion directly lead to different results compared to question pointed to tax evasion indirectly through cash payments.
Keywords: Tax evasion, VAT gap, Shadow economy, Tax morale, European Values Study.
JEL Classification: O17, H26

1 Introduction

The measures against the tax evasion are currently high on the agenda of politicians of most of the countries, as almost all the governments are struggling to reduce the tax evasion effectively. It is very difficult to estimate the level of tax evasion, as it is concealed by the definition. Nevertheless, there are some estimates used for evaluation of effectivity of tax collection and level of tax compliance by calculating so called tax gap or the extent of the shadow economy.

Numerous studies calculate the extent of tax evasion by estimating the tax gap - difference between the tax collected and theoretical tax liability (HMRC, 2015, Toro, 2013, Beckmen, 2014, Cobham, 2005, Schneider and Buehn, 2012). CASE (2013) elaborated for European Commission the study to quantify the VAT gap for all EU countries. It employs the so called "top-down" approach based on the National Accounts data. The latest update of the VAT gap calculated by CASE for 2013 reached EUR 168 bill. representing 15.2 % of theoretical VAT to be collected in the EU member states on average. Also most of the member states of the EU do their in-house estimates of the VAT gap (see e.g. European Court of Auditors, 2015), but these estimates are unfortunately not available to public.

In contrast to the data on tax gap, the estimates of the shadow economy exist in longer series Schneider (2005, 2011). The MIMIC method used for calculation of estimated values of the shadow economy provides only relative values in time and an absolute estimate of the shadow economy obtained from some other method has to be used as a baseline. OECD (2011) categorizes the shadow economy for the purposes of the completion of the national accounts and calculation of the GDP. OECD (2011) is quite critical towards the so-called macro-models applied e.g. by Schneider in order to estimate the shadow economy as they consider them to be exaggerated. It is also discussed whether the shadow economy should include also illegal activities as drug dealing or smuggling on one side and a "do it yourself work" of households on the other side (e.g. Pedersen, 2003).

It should be noted that the share of the shadow economy on official GDP only indicates the level of tax evasion to certain extent. The tax evasion expressed as a tax gap (difference between the tax that should be paid and the tax that was actually collected) includes in addition to illicit work and underreported income (the main parts of the shadow economy) also the tax fraud performed by criminals (e.g. Missing Trader Intra-Community – MTIC - fraud on VAT) or tax not paid due to insolvency or tax avoidance. Nevertheless certain factors affecting the shadow economy and the tax evasion are similar.

The factors influencing the shadow economy has been carefully researched as the MIMIC method applied in the estimation of the shadow economy uses the causes and indicators of the shadow economy to find the unobserved variable - shadow economy. Multiple-Indicators and Multiple-Causes - the causes influencing the

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shadow economy are for example tax burden, quality of state institutions or the level of regulation of the work market. The indicators of the underground economy are the currency demand (illicit transactions are often performed in cash), official GDP, official working time, etc. Feld and Frey (2007) claim that the shadow economy is lower in countries with higher tax morale and stricter deterrence measures. They also believe that tax morale is raised if politic decisions are viewed as fair and legitimate and further increased by friendly relationship of tax authorities to tax payers. Also Alm and Torgler (2006), Feld and Larsen (2009) and Torgler and Schneider (2009) provide the evidence that tax morale reduces the shadow economy. Pedersen (2003) found a negative relation between the undeclared work (substantial part of the shadow economy) and the individually perceived risk of detection.

Johnson et al. (1998a) or Friedman et al. (2000) report the positive effect of state regulations on the shadow economy. Johnson et al. (1998b) came to the conclusion that more corruption enabled by wide discretion of regulatory bodies increases the unofficial economy and on the other hand the high quality public institutions reduce the shadow economy. Teobaldelli (2011) and Schneider and Teobaldelli (2012) elaborate on the links between the political systems and the shadow economy. They find that federal countries and the countries using the direct democracy elements in their political systems have lower shadow economy. Share of self-employed is positively correlated with the shadow economy (Schneider, 2012). Bajada and Schneider (2009) found positive correlation between unemployment rates and shadow economy. Schneider and Buehn (2012) find positive influence of high indirect taxes, self-employment, unemployment rates, personal income taxes and tax morale (proportion of population answering that cheating on taxes is usually justifiable).

The following authors pursued the factors influencing specifically the VAT compliance and efficiency of VAT system: Agha and Haughton (1996), Christie and Holzner (2006), CASE (2013), Bodin et al. (2001), Aizenman and Jinjarak (2005) and Sanack, Velloso and Xing (2010). These researchers found that the important factor is the VAT rate applied (increasing the VAT gap), they also identified the role of tax morale, legal efficiency and level of corruption in the society (all three factors decreasing the VAT gap), higher unemployment rates (increasing the VAT gap), household consumption (increases the VAT gap).

The aim of this paper is to contribute to current awareness of the factors influencing the tax evasion by analyzing the relation between the tax morale and the tax evasion. Our objective is to verify whether a higher tax moral is positively correlated with the tax evasion expressed in the form of estimates of the shadow economy and values of VAT gap as suggests most of the above mentioned literature.

2 Data and Methodology

To observe the relation between tax moral and the extent of tax evasion, we compare the Pearson's correlation coefficients between the tax moral represented variably by two questions on perception of cheating on taxes by citizens on one side and VAT gap and shadow economy on the other side. Thus we explore the strength and direction of the linear relationship between those variables.

The values of tax moral come from the European Values Survey (EVS) database, where we observe two questions on opinions of citizens on tax evasion: first "Do you justify cheating on taxes? (v234)" and second "Do you justify paying cash to avoid taxes? (v245)". We processed them into the set of arithmetic means and medians of the answers (scaled from 1 - never to 10 - always) as in our previous research, using the last available wave of the survey for 2008. The highest scores in means calculated from the answers to the first question (v_234) - willingness to cheat on taxes - were around 3.2 but the medians were in most countries 1 (meaning that more than half of the respondents answered that they never cheat on taxes. The means for the second question (v-235) – willingness to pay in cash to avoid taxes – were slightly higher, the highest were around 4, the medians calculated for this question were more scattered. For complete results see Zídková, Tepperová, Helman (2016).

The estimates of the shadow economy are taken over from Schneider (2015) who employs the narrow definition of the shadow economy and includes productive economic activities that would be taxable if they were reported to the state authorities (i.e. does not estimate the income from illegal activities and unofficial "do it yourself" work). In other words, values of the shadow economy used in our analysis are represented mainly by undeclared work and underreported income.

The data from the VAT gap were withdrawn from CASE (2013) as they are the only comparable data on VAT gap available for almost all EU countries (except from Cyprus). The VAT gap includes not only the tax evaded due to the unofficial economy but also the tax stolen from the state budgets by VAT fraudsters especially by means of MTIC fraud (for details see European Court of Auditors, 2015) and VAT not paid because of insolvency, etc.

All data on shadow economy and VAT gap are for year 2008 to match the last wave of EVS database. We compare results for all EU countries except Croatia and Cyprus. There is no comparable Figure for VAT gap for 2008 for these to countries, as Croatia was not part of the EU by that time and Cyprus did not provided the national accounts data necessary for the calculation of VAT gap by CASE (2013) data.

3 Results and discussion

The values of Pearson's correlation coefficients between the individual variables were as follows in Table 1.

Table1: Pearson's correlation coefficients between perception of tax evasion and VAT gap / shadow economy (2008, EU countries except Cyprus and Croatia)

Variable	Shadow economy	VAT gap	Cheating on taxes (v_234)	Paying in cash (v_245)
Shadow economy	1			
VAT gap	0.45	1		
Cheating on taxes (v_234), means	0.12	0.33	1	
Paying in cash (v_245), means	- 0.57	- 0.19	0.49	1

Own calculations from EVS database for "(v234) – Do you justify cheating on taxes?" and "(v245) – Do you justify paying cash to avoid taxes?"; Schneider (2015) for the shadow economy (SE); CASE (2013) for VAT gap.

We found out a negative relation between the shadow economy and the willingness to pay in cash to avoid taxes which is a surprising result. The correlation coefficients between other variables are small and do not show significant linear dependence. Except small positive correlation between v234 (cheating on taxes) and VAT gap.

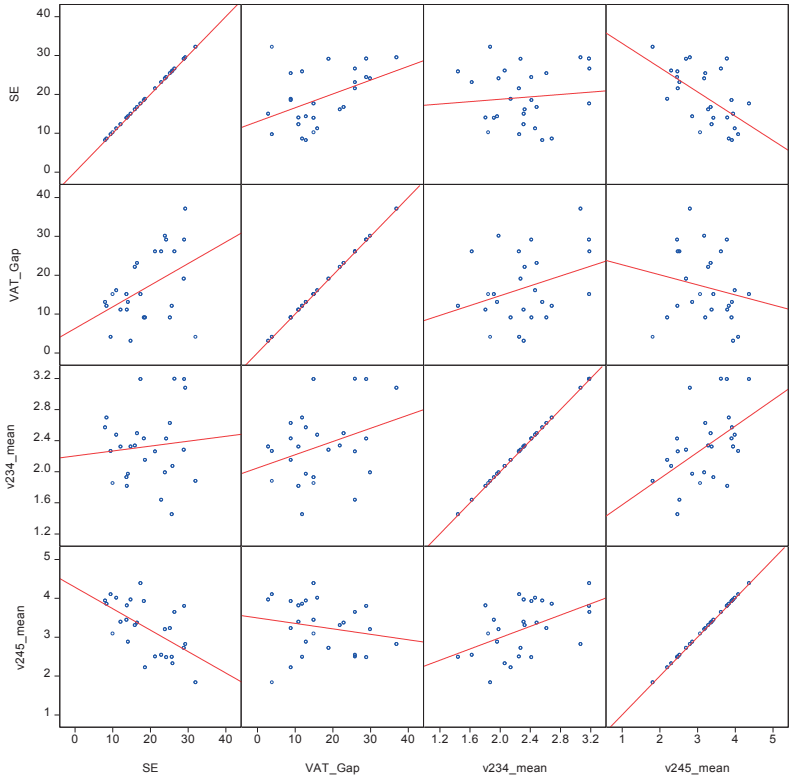
Certain scholars used similar approach based on the world values survey. They extracted the data on the tax morale using question "Cheating on taxes if you have a chance" (Schneider, Torgler, 2007 and Alm, Torgler, 2006). However, they used different scaling for the variable (tax morale) derived from the answers to the respective question on tax cheating. Also they used previous waves (1995 and 2000), as the data for 2008 were not available by that time. Their results are not consistent with ours, as they conclude that a higher tax moral leads to smaller shadow economy. That is why we also used similar scaling to the question "Do you justify cheating on taxes?" (v234) as in Alm, Torgler, 2006. The data was coded from responses 1 to 10 as 1 = never and 0 for all other cases. Meaning that only answer 1 was considered against tax evasion. After using such scaling on our data the correlation between willingness to cheat on taxes (v234) and shadow economy showed no correlation even after the different scaling. Correlation between willingness to pay in cash (v245) and shadow economy changed from negative to positive. We do not consider the scaling in Alm, Torgler, 2006 reasonable as it leads to loss of information that can be obtained from the responses originally scaled from 1 to 10.

Further, we run the correlation using medians and standard deviations (of answers in each country) when defining tax moral for both of the questions (v234 and v245) from the EVS database. The results with the use of medians (calculated just for question v245) are consistent with our results using means for both questions.

The use of standard deviations was to explore whether the disjoint in the society on the questions of tax moral is correlated with the VAT gap and extent of the shadow economy. In this case we received weak positive correlation between the willingness to justify tax evasion (v234) and VAT gap and intermediate negative correlation between willingness to justify paying cash to avoid taxes (v245) and the extend of the shadow economy.

Figure 1 presents correlation between the means of answers to questions regarding the tax evasion and estimates of shadow economy and VAT gap in symmetric matrix of scatterplots with the least squares regression lines.

Figure 1: Correlation between perception of tax evasion and VAT gap / shadow economy (2008, EU countries except Cyprus and Croatia)



Source: EVS database for "(v234) – Do you justify cheating on taxes?" and "(v245) – Do you justify paying cash to avoid taxes?"; Schneider (2015) for the shadow economy (SE); CASE (2013) for VAT gap.

4 Conclusions

Our analysis shows no correlation between the justification of cheating on taxes (v234) and shadow economy and only weak positive correlation between the same question and the VAT gap.
On the other side, no correlation is between the justification of paying cash to avoid taxes (v245) and the VAT gap. However, intermediate negative linear correlation is present for the same question and the shadow economy.

These results are surprising, as we assumed consistently with other literature that the higher the tax moral the lower the tax evasion no matter whether represented by the extent of the shadow economy or the VAT gap. One possible explanation of the negative relation between the willingness to cheat on taxes and the shadow economy would be a higher probability of dishonest answers of respondents in the countries where the shadow economy is more spread. On the other side, only very weak correlation of the VAT gap with the tax moral could be assumed, as the VAT gap from great extent includes MTIC fraud which is most likely not related to the perception of the tax avoidance and payments in cash by the ordinary citizens.

Our results point out the inconsistency in the estimates of different measures of the tax evasion – VAT gap and the extent of shadow economy. It also showed divergence in the perception of different questions related to tax moral, as question pointed at tax evasion directly ("Do you justify cheating on taxes?" leads to different results compared to question pointed at tax evasion indirectly through cash payments ("Do you justify paying cash to avoid taxes?"). Further, it showed that processing of the responses (different scaling) can lead to significant

changes in the results of the analysis (opposite direction of correlation between means of answers to v245 and shadow economy).

Tax evasion is currently very high on the agenda of governments and international bodies. OECD already provided its recommendations within the BEPS (base erosion and profit shifting) project and EU rushes with its implementation introducing tax-avoidance package. More studies on the extent of tax evasion and the relation to tax moral are being prepared to be used in this vivid debate. Based on our study we call for prudence and careful processing of data related both to tax moral and tax evasion as it can significantly influence the results of carried out analysis.

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Disclosure of deferred taxes in annual reports of listed companies at the Prague Stock Exchange

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Abstract. Accounting rules require published financial statements to reflect the tax consequences of economic transactions reported in those financial statements. In most jurisdictions, revenues and expenses recognized in given period for taxation purposes will not fully correspond to what is reported in the financial statements and therefore future tax consequences are to be recognized. As many users of financial information are dependent on published financial accounting information only, the way of disclosure plays important role for their economic decisions. Therefore the paper observes disclosure of deferred tax assets and deferred tax liabilities in financial statements of listed companies at the Prague Stock Exchange and analyses frequently disclosed deferred taxes.

Keywords: Disclosure of deferred taxes, deferred tax liability, deferred tax assets
JEL Classification: H25

1 Introduction

Despite the fact that accounting rules may differ from country to country, published financial statements have to reflect the tax consequences of economic transactions reported in those financial statements. Most economic transactions have tax cash flow consequences. In most jurisdictions, revenues and expenses recognized in given period for taxation purposes will not fully correspond to what is reported in the financial statements. When the taxation rules require that revenues and expenses be recognized in different accounting period from accounting principles, taxable income is temporarily different from pretax financial accounting income. In a subsequent period the even that caused the difference will reverse itself. The objective of accounting for income taxes are to recognize the amount of taxes payable or refundable for the current year and to recognize the future tax consequences of temporary differences as well as net operation losses and unused tax credits. These consequences are reported on tax returns.

International accounting standard IAS 12 (Income taxes) concerns accounting treatment for income taxes and refers those differences between pretax financial accounting income and taxable income may be either permanent or temporary differences. Temporary differences between pretax financial accounting income and taxable income affect two or more accounting periods and by that means involve the allocation of income taxes between accounting periods. Permanent differences do not have income tax consequences. Only temporary differences result in deferred tax income assets and liabilities.

Deferred tax is provided in full on temporary differences that arise between the carrying amount of assets and liabilities for financial reporting purposes and their corresponding tax bases. The recognition of deferred tax is based on a statement of financial position orientation, on the liability method. Deferred tax assets are recognized for deductible differences, the carry forward of unused tax losses and the carry forward of unused tax credits. Deferred tax liabilities are recognized for taxable temporary differences. Deferred tax assets recognized for deductible temporary difference, the carry forward of unused tax losses and the carry forward of unused tax credits are subject to a probability limitation. Deferred tax is only recognized to the extent that is probable that taxable profits are available against which the deductible temporary difference could be utilized.

The general principle is that a deferred tax liability is recognized for all taxable temporary differences with two exceptions. The first is temporary differences arising from the initial recognition of goodwill and the second is temporary differences arising from the initial recognition of an asset or liability in a transaction which is not a business combination and at the same time of the transactions affects neither accounting profit nor taxable profit. Special principles are applicable to the recognition of temporary differences associated with investments in subsidiaries, branches and interest in joint ventures.

Generally said, deferred tax assets disclosure is clear. Deferred tax assets should be included in the statement of financial position only if they are very likely to be realized in future periods. Since realization will almost certainly be dependent on the future probability of the reporting entity, it may become necessary to ascertain the likelihood that the enterprise will be profiTable. Under IAS 12 this “very likely” is to be probable. The standard establishes that:

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1. "It is probable that future taxable profit will be available against which a deferred tax asset arising from a deductible temporary difference can be utilized when there are sufficient taxable temporary differences relating to the same taxation authority which will reverse either:
   a) In the same period as the reversal of the deductible temporary difference; or
   b) In periods into which the deferred tax asset can be carried back or forward; or
2. If there are insufficient taxable temporary differences relating to the same taxation authority, it is probable that the enterprise will have taxable profits in the same period as the reversal of the deductible temporary difference or in periods to which the deferred tax can be carried back or forward, or there are tax-planning opportunities available to the enterprise that will create profit in appropriate periods."

Deferred tax assets and deferred tax liabilities are measured at the tax rates that are expected to apply to the period when assets are realized or liabilities are settled. The computation of the amount of deferred taxes is based on the tax rate expected to be in effect when the temporary differences reverse and therefore it is always under special attention of accountants at the year end.

As many users of financial information are dependent on published financial accounting information only, the way of disclosure plays important role for their economic decisions as only informed investor is willing to invest. Despite the fact that disclosed information may attract investors to invest into particular company, voluntary disclosure is not sufficient to justify mandatory disclosure. In many cases, requirement for information disclosure should be regulated. In response to law system where firms operate disclosure requirements are either regulated by local accounting rules or International financial reporting standards. The goal of this paper is observation of disclosed information on deferred taxes in financial statements prepared in compliance with IFRS from the perspective of investors into equity. For this purpose, listed companies on Stock Exchange in the Czech Republic, were chosen in order to observe the best practice. Paper therefore analyses several aspects of deferred tax assets and deferred tax liabilities disclosure in financial statements of companies listed on prime market at the Prague Stock Exchange as financial statements are prepared in compliance with IFRS. Paper focuses firstly on the way of disclosure, secondly on voluntary disclosure if any and thirdly on frequently disclosed deferred taxes.

2 Literature overview and methodology

There is a lack of research articles on deferred taxes in the Czech research literature, moreover articles concerning deferred taxes disclosure are omitted at all. On the other hand, there are few critical articles concerning deferred taxes. One of criticism addresses adoption of the rule for reassessment of once unrecognised deferred tax into the Czech accounting rules (Žárová et all, 2009). There is another serious criticism concerning the goodwill as goodwill is completely omitted in Czech Accounting Standard. The topic of goodwill is important and for the purpose of goodwill recognition IAS 12 should be implemented. However, the rules stated in IAS 12 does not permit the recognition of the resulting deferred tax liability because goodwill is measured as a residual and the recognition of the deferred tax liability would increase the carrying amount of goodwill (Pelák, 2009). Still, the reasoning of IAS 12 that goodwill was a residual and any increase in its carrying amount, resulting from the recognition of a deferred tax liability, would not have been appropriate, is understandable and with the related goodwill definition also conceptually defendable (Filinger, 2009). Recognition of goodwill in Czech accounting differs from IFRS approach and deferred taxes arise from business combination are not allowed to be account directly to goodwill, but in compliance with Czech Accounting Standard, into acquiree's equity. Fair value adjustments and revaluation of assets in a business combination or capital investment will give rise to differences which will result in a deferred tax (Skálová 2009). The carrying value of assets shall be increased to the fair value but the tax base shall remain in the amount computed according to the original acquisition cost. Where differences in respect of such assets arise, the accounting entity shall include them in the calculation of deferred tax in the following way. Žárová provided readers with impact of IAS 12 on deferred taxes regulation in the Czech Republic (2010) and with impact of IFRS on deferred taxes methodology in the Czech Republic and comparison with IFRS for SMEs (2011).

While there are quite a lot of studies, e.g. on the usage of deferred tax for earnings management, or on information content of deferred taxes, topic of deferred taxes disclosure is not very popular among researchers abroad. The first value relevance analysis of deferred tax disclosures under IFRS/IAS is written by Astrid K. Chludek (*2011*), where she shows that investors generally do not consider deferred taxes to convey relevant information for assessing firm value, with the exception being large net deferred tax assets. Gordon (2004) examines whether U.K. managers use the flexibility provided under the partial method for deferred taxes to measure unrecognized deferred taxes opportunistically. One implication of the results is that the recent U.K. standard change eliminating the partial provision method for deferred taxes potentially has reduced the usefulness of deferred tax disclosures. As a framework for discussed topic, there could be used paper on "Voluntary Corporate Disclosure by Swedish Companies", written by Cooke (1989). This paper reports on the extent of voluntary disclosure in the corporate annual reports of unlisted and listed Swedish companies. In addition, the paper assesses whether there is a significant association between a number of independent variables and the extent of disclosure.

As paper analyses several aspects of deferred tax assets and deferred tax liabilities disclosure in financial statements of listed companies at the Prague Stock Exchange, content analysis was used. Paper focuses firstly on the way of disclosure, secondly on voluntary disclosure if any and thirdly on frequently disclosed deferred taxes. In order to collect data for deferred tax assets and liabilities, annual reports of listed and registered companies on the Prague Stock Exchange (PSE) were used. Data were collected within two subsequent years, 2014-2015, on prime market at PSE.

3 Discussions and results

As it is said in Conceptual framework to IFRS (2015) "General purpose financial reports provide information about the financial position of a reporting entity, which is information about the entity´s economic resources and the claims against the reporting entity. Financial reports also provide information about the effects of transactions and other events that change a reporting entity´s economic resources and claims. Both types of information provide useful input for decisions about providing resources to an entity". Disclosed information may become the only source of information for different users of financial information such as potential investors, lenders and other creditors. Paper therefore focuses firstly on the way of information disclosure, secondly on voluntary disclosure if any and thirdly on frequently disclosed deferred taxes.

4 Deferred tax disclosure requirements in IAS 12

IAS 12 - Income taxes prescribes the accounting treatment for income taxes and the way of information disclosure but the standard doesn´t include manner and scope of disclosures to the issue of deferred taxes. Standard declares that major components of tax expense (income) shall be disclosed separately. Then the standard brings the list of components those shall be disclosed separately. Concentrated on deferred taxes, there are following disclosure requirements:

1. the amount of deferred tax expense (income) relating to the origination and reversal of temporary differences;
2. the amount of deferred tax expense (income) relating to changes in tax rate or the imposition of new taxes;
3. the amount of the benefit from a previously unrecognized tax loss, tax credit or temporary difference of a prior period that is used to reduce deferred tax expense;
4. deferred tax expense arising from the write-down, or reversal of a previous write-down, of a deferred tax assets in accordance with principle that carrying amount of a deferred tax asset shall be reviewed at the end of each reporting period.

The following shall also be disclosed separately:

1. the aggregate current and deferred tax relating to items that are charged or credited directly to equity;
2. the amount (and expiry date, if any) of deductible temporary differences, unused tax losses, and unused tax credits for which no deferred tax asset is recognized in the statement of financial position;
3. the aggregate amount of temporary differences associated with investments in subsidiaries, branches and associates and interests in joint ventures, for which deferred tax liabilities have not been recognised;
4. in respect of each type of temporary difference, and in respect of each type of unused tax losses and unused tax credits.

An entity shall disclose the amount of a deferred tax asset and the nature of the evidence supporting its recognition, when:

1. the utilisation of the deferred tax asset is dependent on future taxable profits in excess of the profits arising from the reversal of existing taxable temporary differences;
2. and the entity has suffered a loss in either the current or preceding period in the tax jurisdiction to which the deferred tax asset relates.

Paper compares IAS 12 disclose requirements with disclosed information in annual reports of companies listed on prime market on PSE. Paper analyses annual reports of listed companies, primarily statement of financial position then notes concerning deferred taxes. Analysis concentrated on two aspects of disclosure:

1. whether company discloses deferred tax assets and deferred tax liabilities directly on face of the balance sheet and/or
2. whether company discloses voluntary information on deferred taxes or only information required according to IAS12.

Overview of findings is in the Table 1.

Table1: Overview of deferred taxes disclosure

Company Name	2015	2015	2014	2014
	Disclosure on face of balance sheet	Voluntary disclosure	Disclosure on face of balance sheet	Voluntary disclosure
1. Borealis	NO	NO	NO	NO
2.CETV	NO	NO	NO	NO
3.ČEZ	YES	YES	YES	YES
4.Erste Group Bank	YES	YES	YES	YES
5.Fortuna	YES	NO	YES	NO
6. Kofola ČS	YES	NO	YES	NO
7. Komerční Banka	YES	YES	YES	YES
8. NWR	YES	YES	YES	YES
9. O2 C.R.	YES	YES	YES	YES
10.Pegas Nonwovens	YES	NO	YES	NO
11. PLG	YES	NO	YES	NO
12.TMR	YES	NO	YES	NO
13. Unipetrol	YES	YES	YES	YES
14.VGP	YES	NO	YES	NO
15.VIG	YES	NO	YES	NO

Source: Author's own research according to http://www.pse.cz/Kurzovni-Listek/Oficialni-KL

Annual reports analysis of listed companies, primarily statement of financial position then notes concerning deferred taxes, brings us to the following conclusions. Total amount of analysed companies was fifteen. Analysis focused on two aspects of disclosure. First aspect was whether company discloses deferred tax assets and deferred tax liabilities directly on face of the balance sheet. From fifteen listed companies, thirteen companies in 2014 and the same amount of companies in 2015 recognized deferred taxes on face of the balance sheet. The second aspect concerned whether company discloses voluntary information on deferred taxes or only information required according to IAS12. From fifteen companies only six companies provide readers with required information enlarged by some voluntary ones. From remaining eight companies only two ones recognised at least required information. The group of six companies namely Lobkowitz, Kofola, Borealis, CETV, Pegas, Nonwovens haven´t even published information in required details in their notes to financial statements.

5 Deferred tax assets and deferred tax liabilities components

Accounting entity shall always account for a deferred tax liability while deferred tax asset recognition should be realized under the prudent concept consideration. Considering prudence concept, there might be higher amount of deferred tax liabilities than assets. Paper analysed data collected from notes to financial statements and determine different deferred tax components of deferred tax assets and liabilities in notes to financial statements in order to recognize most frequent components to be disclosed.

The deferred tax assets and liabilities reported relate to temporary differences in the balance sheet items listed in the Tables below. It should be noted that deferred taxes, as far as permissible, are offset at the taxpayer level, and accordingly the different balances are shown either as assets or liabilities on the balance sheet. Deferred tax assets are recognised for unused tax losses, unused tax credits and deductible temporary differences to the extent that it is probable that the deferred tax assets can be used. Deferred tax assets are examined each balance sheet date and reduced to the extent that it is no longer probable that the associated tax benefits will be realised.

Table 2 represents deferred tax assets, deferred tax liabilities and both deferred tax assets and deferred tax liabilities recognized in the balance sheet.

Table 2: Deferred tax items recognized in the balance sheet

Items	Deferred tax assets	Deferred tax liabilities	Both deferred tax assets and deferred tax liabilities
Leases	1	1	1
Investment in subsidiaries	1	0	1
Investment incentives	1	0	0
Amortization of investment in subsidiaries	1	0	0
Derivatives	0	1	0
Property, plant , equipment	1	6	7
Revaluation of financial instruments	2	1	3
Accumulated provision	1	0	0
Inventories	3	0	0
Receivables	0	1	2
Unrecorded deferred tax asset	2	0	2
Other deferred taxes	0	0	4
Brand	0	0	1
Financial assets - available for sale	1	0	0
Other tax assets	4	0	0
Intangible assets	1	0	4
Reserves	0	1	1
Impairment adjustments and provisions	1	1	0
Financial liabilities at amortized cost	1	0	2
Other provisions	2	1	0
Loan to other institutions and advances	1	0	0
Banking provisions and allowances	0	1	1
Non-banking provisions	1	0	1
Long term employee provisions	3	0	2
Sundry provisions	1	0	2
Other tax liabilities	0	1	0
Other liabilities	1	0	1
Tax loss carry forwards	8	1	2
Capitalized interest	0	1	0
Loss from impairment	1	0	0
Unused tax losses carried forward	1	0	0
Equity impact:		0	0
Re-measurement of retirement benefits plan	1	1	0
Revaluation of hedging derivatives	3	1	0
Revaluation of available-for-sale financial assets	1	1	0
Currency translation	0	1	1

Source: Author's own research according to http://www.pse.cz/Kurzovni-Listek/Oficialni-KL

To summarize observation from analysis, the most frequent deferred tax assets title is tax loss carry forwards, then unspecified item "other tax assets" followed by long term employee provisions together with revaluation of

hedging derivatives and inventories. Among most frequent deferred tax liabilities, there is different depreciation methods used for accounting and tax purposes for property, plant and equipment. Among frequent deferred taxes titles recognized both as assets and liabilities in the balance sheet, there are different depreciation methods used for accounting and tax purposes for property, plant and equipment, followed by unspecified item "other deferred taxes", deferred taxes on intangible assets and revaluation of financial instruments.

6 Conclusions

Although most users of financial information are dependent on published financial accounting information only, companies are not very opened to disclose voluntary information. Paper focuses on disclosure of deferred taxes and analysed deferred taxes disclosure of listed companies at the Prague Stock Exchange. Paper addressed firstly the way of disclosure, secondly voluntary disclosure if any and thirdly frequently disclosed deferred taxes. Paper shows that the recognition of deferred tax assets and liabilities on the face of the balance sheet is significantly and positively related with disclosure quality in the notes to the financial statements.

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PART B – PUBLIC EXPENDITURES

Zoological gardens in the Czech Republic and Slovakia from the view of technical efficiency and productivity

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Abstract. This contribution evaluate technical efficiency and productivity of all zoological gardens operating in the territory of The Czech Republic and Slovakia that are members of Union of Czech and Slovakia zoos (UCSZOO), and have license to operate the zoo and are established in the legal form of contributory organization. The aim of this contribution is to evaluate these zoos from the view of level of technical efficiency and technical productivity. The technical efficiency is evaluated by the DEA method, in years 2006-2014. Than the technical productivity is evaluated, in the same period, by Malmquist index, which can be used for evaluation of efficiency of production units with multiple inputs and outputs and which allows the evaluating of the relative efficiency of selected zoos to the others of the group. Based on the results of DEA method is an output of technical efficiency the finding that the best results, in the selected period in the territory of the Czech Republic, are in the zoo in Decin, in Prague and in Zlin and zoo in Nova Spisska Ves in Slovakia. In terms of technical productivity the zoos in Decin, Vyskov, Plzeň, Ostrava and Hodonin improved in the Czech Republic between 2006 and 2014 and zoo Spisská Nova Ves in Slovakia. It was found out the stagnation or deterioration of technical productivity in selected term by the rest of zoos in the selected period.

Keywords: Contributory organization, Zoological garden, DEA, Malmquist index, Czech Republic, Slovakia

JEL Classification: H 39, H 76, L 31, L 83, P 35, Z 18

1 Introduction

Zoological garden (hereinafter ZOO) is a facility with legal personality, which is primarily used to breed animals in captivity and in the modern concept it is also a facility used for cultural and educational purposes. In terms of history, experts called as the first zoo in Europe, which are simile to those of today, Zoo in Paris or Vienna were established during the second half of the 18th century, for the pleasure of the governing members of noble families and later to the public as well. There is a trend to keep animals loosely in natural groups and in the environment, which is as close as possible to their natural environment from the beginning of the 20th century.

The mission of the modern zoo is not only to entertain visitors and bring them to a life of exotic animals but also to try to breed endangered species and return them eventually to the wild nature. Currently, zoo is used for scientific, research, educational, recreational and aesthetic purposes and as such deserves public funding.

Services, which are generally financed in whole or in part by public funds, where we rank the above mentioned services of zoos, can be describe as a public service. Public services are, in terms of their economic nature, mainly public (collective) goods of public consumption. Ochrana but also other domestic and foreing authors state the provision of public services is often associated with externalities and inefficiencies of spending, that leads to a lack of resources for ensuring of public services in a sufficient extent and in required level of quality. The level of provided services may be different and the purpose of this paper is to define the level of technical efficiency and the level of technical productivity, using DEA and Malmquist index, at those zoos whose founder is a public body.

Most of the zoos are established as contributory organization of state, region or municipality in the Czech Republic and Slovakia (a total 18 out of 29) and thus, by their very nature they are connected to public budgets of greater or lesser extent not a negligible contribution from their founders, as it is shown in the tinged part of the Table number two below. In the past decade, there are also other forms of these organizations, e.g. a generally beneficial companies (3) or limited liability companies (2) or joint-stock company (2), respectively the zoos that are set up by individuals that operate under special laws (4) and are granted a license for this activity. But in terms of scope of done activities they focus only on a narrow segment of activity (usually a species) and the activities of above-mentioned contributory organization cannot be compared in terms of total numbers of animals, the number of species, size, exposure or number of visitors. The only exception in the Czech Repulic is zoo in Dvur Kralove nad Labem which is established in the legal form of a joint-stock company and it is more or less comparable with aformentioned contributory organization in terms of other parameters.

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There are 14 zoos in the Czech Republic and 4 in Slovakia that operating in the legal form of contributory organization and they are, together with the zoo in Dvur Kralove nad Labem, members of the Union of Czech and Slovak Zoos (UCSZOO). In the Czech Republic, the Ministry of Environment gives them the licence to operate the zoos, according to the Act no. 162/2003 Coll., on zoos. In the territory o the Slovakia is the licence for zoos granted according to § 23 paragraph 1 of the Act of the National Council SVK no. 386/1996 coll. When issuing licenses for zoos, it is assessed, in particular, whether the facility has the suiTable space for housing animals in terms of their health and adequate living conditions; has introduced a measure to prevent leaks of animals; has secured regular veterinary care; carries out public education to conservation of nature (particularly by providing information about the exhibited species and their natural habitats and role in ecosystems); participates in research beneficial to the conservation of species and has plenty of professional staff due to the number of farmed animals.

The aim of this paper is to evaluate zoos in the territory of Czech Republic and Slovakia, which are established as contributory organization and determine their level of technical efficiency in the year 2006 and years 2010 - 2014 and the technical level of productivity among the selected periods. The reason for examining the technical and production efficiency within a defined period is the fact that the zoos in the legal form of a contributory organization are established for the purpose of public service (Mitwallyová, 2014) and as such are funded by the founder (state, regions, municipalities), which are public funds. The main feature of the public services is that this activity is not profiTable and has to be subsidized by the founder. In case of zoo it is a contribution from the founder's budget, which covers normal operating expenses, which include funds for labour costs of employees. In case you need to invest in assets, that is managed by the zoo or that it has entrusted, the founder decides on the allocation of specific grants for specific investment activity. Below assessing the technical efficiency and productivity is only assessed according to common subsidy of the founder of the reporting period, because investment activity is by the single entities uneven and as such it distorted the results.

As part of the national economy and national economies, there are many organizations and unions, which covers a specific type of activity or organization and whose aim is to promote common interests and mutual comparison with, for example using benchmarking, as described at the public administration and individual offices e.g. Vrabková (2012). Here we can include for example UCSZOO or botanical gardens union in the area of nature and landscape protection. The assessment of economic performance, or efficiency and productivity in terms of the aforementioned zoo in the Czech Republic (19 members UCSZOO) was not proceeded yet unlike other areas of public and private sector. However, this itself is no reason for such an assessment could not be made.

In terms of current literature, technical efficiency engaged, for example. Gues, Serra and Featherstone (2015), who solves the technical efficiency in the level of Kansas farms, which grow different types of crops on arable land or Bayarsaihan and Coello (2003), who dealt with the technical efficiency of agricultural crops in Mongolia. Jääskeläinen (2010), for example measures productivity in the organizations of public sector that provides public services in Finland. Within the Czech Republic, the DEA method has been used e.g. a technical evaluation of the effectiveness of organic farming in the Czech Republic (Kroupová, 2010), or measuring the efficiency of transport companies in 19 selected cities in 2012. Vaňková and Vrabková (2014, 2015) then evaluate the effectiveness of medical facilities with the legal form of contributory organizations in individual regions. Method for measuring the technical and production efficiency is thus used in private as well in public entities, where may be zoos established in the form of contributory organizations classified.

2 Data and methods

Evaluation of zoos in the Czech Republic and Slovakia is done using output oriented DEA with constant returns to scale (CRS) and Malmquist productivity index (MPI), based on data available from annual reports of individual Zoos, which are members UCSZOO in the year 2006 and years 2010-2014 and the economic indicators available in the system of the Ministry of Finance - ARIS and IISP - Monitor in the same years. Given period was choosen in the way to it is possible to evaluate, by the DEA method, the last five consecutive period in which it was possible to obtain comparable data, ie. the value for the years 2010 – 2014. DEA method evaluates us the effectivness of the zoo in a given year and the output oriented model was choosen for the reason, that one of the main index, for public services, is the number of visitors who used the public service in reporting period. The number of visitors is traditional reported index for organization that provides public services as well as the amount of funds, which the organization is able to secure by their own activities for their operating, ei. providing of public services for which the organization was established. Own revenues gained by each zoo from entrance fees were recalculated by the number of visitors so that the amount per one visitor was available.

For example the number of employees is one of the traditional inputs for technical efficiency. In the model, there was used, as an intput, data regarding the total number of employees and the number of animals of which these employees care, and for which a substantial portion of visitors come to zoos to use public service where the product provided by each zoo falls. The amount of finance required to finance the common operating of the organization increases with the increasing number of employees and animals. Expenditure on salaries and animal feed create the largest share of expenses of zoo. The last input, that was evaluated in the model, was total common

expenditure recalculated per a visitor of zoological garden in reporting period. The following Table number one shows inputs and outputs.

Table 1: Characteristic of inputs, outputs and assessed period

Model	Inputs - x	Outputs - y	Assessed period
DEA	number of employees; number of animals; the total current expenditure per a visitor (TCEV)	number of visitors; income from ticket sales per visitor (ITSV) which is without the contribution of the founder and the investments	2006, 2010, 2011, 2012, 2013, 2014,
MI			2006-2010, 2010-2011, 2011-2012, 2012-2013, 2013-2014, 2006-2014,
Source of data	Annual reports of individual Zoos; Economic indicators available in the system of the Ministry of Finance - ARIS and IISP - Monitor		

Source: Own processing.

Within Malmquist index, ranking the improvement of organizations between the years 2010 – 2014, it was also considered comparison of individual organization over a longer period, ie. in addition to the comparison between the years 2010 – 2014 also a comparison between 2006 and 2010, ie. after five years, and between 2006 and 2014, ie. after ten years. There are 18 contributory organizations and one joint-stock company, which is the zoo in Dvur Kralove nad Labem in the sample compared zoos. The values determined of management of Slovak Zoological Gardens, which for 2006 have been presented in thousands Slovak crowns were converted rate of Czech National Bank 29th December 2006 to Czech crowns. In the years 2010 - 2014 were thousand of Euros converted to Czech crowns to date 31st December 2010, 30th December 2011, 31st December 2012 to 2014 by the official exchange rate of the Czech National Bank. From the perspective of the compared characteristics are the input data within the individual zoo comparable.

Table number two shows selected indicators of zoos in 2014 (number of employees, number of animals, the total current expenditure per a visitor (TCEV), number of visitors, income from ticket sales per visitor (ITSV), which is without the contribution of the founder and the investments. The second part of the Table shows the % share of the founder´s contribution to total operating expenditure of the organization in given years. The contribution of founder was calculated by subtracting of the own revenues from total operating expenses recorded in the given year and expressed in %.

Table 2: Selected indicators in 2014 and the contribution of the founder of the zoo in 2006 and 2010-2014

Zoo	Year 2014					Countribution of founder in %					
	Empl.	Anim.	TCEV	visitors	ITSV	2006	2010	2011	2012	2013	2014
Bojnice	84.4	2 996	199	323 167	87	51.7	51.6	53.9	55.6	53.8	52.0
Bratislava	71.7	914	198	308 806	50	76.3	56.1	64.3	45.9	47.6	49.2
Košice	63.0	1 342	212	209 297	50	70.3	53.7	51.4	47.8	46.7	69.4
Spišská Nová Ves	12.8	342	82	91 076	31	70.1	51.3	45.0	47.6	44.8	40.8
Brno	82.6	1 635	285	273 944	66	66.6	60.7	59.5	54.4	56.8	65.4
Děčín	30.3	421	174	109 758	49	70.3	71.5	68.5	68.6	69.3	63.0
Dvůr Králové n L.	161.7	2 148	341	464 165	118	37.2	29.6	32.0	34.7	36.1	30.6
Hodonín	35.0	787	134	160 168	61	61.2	61.5	53.2	52.2	43.0	35.9
Chomutov	67.7	1 053	175	240 117	39	50.4	54.2	51.7	52.8	54.2	51.8
Jihlava	50.8	1 067	150	285 558	67	41.7	32.6	37.0	36.4	29.8	34.9
Liberec	106.0	825	273	332 525	88	41.0	50.8	46.1	42.5	45.1	45.0
Hluboká nad Vlt.	35.1	3 002	90	271 048	67	67.8	56.5	49.2	48.0	46.0	41.2
Olomouc	75.0	1 733	188	356 909	71	49.6	49.7	44.2	37.2	38.0	33.0
Ostrava	100.6	3 717	182	540 518	79	61.1	57.2	45.7	53.0	51.9	46.6
Plzeň	133.1	8 351	267	427 435	75	59.9	55.4	53.6	59.7	58.6	55.0
Prague	221.6	4 727	252	1382 243	134	38.8	22.0	20.8	16.1	13.5	14.7
Ústí nad Labem	72.3	1 156	419	149 187	72	71.0	60.8	68.9	65.6	66.8	67.0
Vyškov	29.6	760	123	163 689	59	25.3	50.2	48.8	37.7	42.8	42.2
Zlín	82.3	1 340	158	585 118	92	44.4	34.3	26.5	25.5	24.6	21.2

Source: Own calculations based on data available from annual reports of individual zoo in a given year.

Rating of technical efficiency of the production units based on the size of the input and output deal with models of data packages (DEA), when by Brožová (2014) may be evaluated units, individual enterprises, branches of banks, supermarkets, hospitals, schools, offices and other entites providing public services. Because the inputs and outputs, by which we evaluate the relevant unit, may be more kinds, we rank the DEA methods among multi-criteria decision. Analysis of data packages is suiTable for detecting technical efficiency units which are mutually comparable, which is, in the case of zoos, respected. It means that they use the same inputs to produce the same outputs, but there are some differences in their productivity. Units are compared among themselves and it is found out which ones are effective and which are ineffective. For inefficient units can be by a method of packaging data determine how should such an entity increase their outputs or reduce their inputs to become effective. Jablonský and Dlouhý (2004) states that in terms of history DEA method was first used by Farrell (1957), who measured the effectiveness of units with a single input and output or Charnes, Cooper and Rhodes (1978), who used to compute multiple inputs and outputs.

Primary CCR model oriented to output is formulated as follows:

$$\begin{aligned} &\text{Minimize:} && g = \textstyle\sum_j^m v_j x_{jq}, \\ &\text{Under condition:} && \textstyle\sum_i^r u_i y_{ik} \le \sum_j^m v_j\, x_{jk}, \qquad k = 1, 2, ..., n, \\ & && \textstyle\sum_i^r u_i y_{iq} = 1, \\ & && u_i \ge \varepsilon, \qquad i = 1, 2, ..., r, \\ & && v_j \ge \varepsilon, \qquad j = 1, 2, ..., m. \end{aligned} \tag{1}$$

Dual CCR model oriented to output is formulated in a matrix form as follows:

$$\begin{aligned} &\text{Maximize:} && g = \varphi_q + \varepsilon(e^T s^+ + e^T s^-), \\ &\text{Under condition:} && X\lambda + s^- = x_q\,, \\ & && Y\lambda - s^+ = \varphi_q y_q\,, \\ & && \lambda,\ s^+,\ s^- \ge 0. \end{aligned} \tag{2}$$

where s^+ a s^- are vectors of additives variables on constraints for inputs and outputs,, e^T= (1, 1,...., 1) and ε is infinitesimal constant, which is generally chosen equaly to 10^{-8}. The assessed unit U_q is effective if the following two conditions are met:

1. optimal value of variable Θ^*_q is equal to one
2. optimal values of all additive variables s_i^{+*}, i = 1, 2, ..., r and s_i^{-*},

- i = 1, 2, ..., m are zero..

The results of DEA model oriented to outcomes by evaluated Czech and Slovak zoos established in the legal form of a contributory organization shows Table number three.

Malmquist Productivity Index – it is a tool for assessing the efficiency of production units, which seeks to capture the impact of model of technological change and their separation from other efficiency increasing sources (Jablonský and Dlouhý, 2004). The Malmquist Productivity Index calculation requires two single periods and two mixed period measures. It is defined as the product of Catch-up and Frontier-shift terms. The catch-up (or recovery) term relates to the degree to which a DMU improves or worsens its efficiency, while the frontier-shift (or innovation) term reflects the chase in the efficient frontiers between the two time periods, (Cooper et al., 2007). The article accesses to Malmquist index in arrangements designed by authors Fare at all (1994), who in the calculation of the index based on DEA models and which are as further modified by Zhu and Cook (2013).

The Malmquist (MI) Productivity Index (3) is defined as (Zhu and Cook, 2013):

$$M_0 = \left[\frac{\theta_0^t(x_0^t, y_0^t)}{\theta_0^t(x_0^{t+1}, y_0^{t+1})} \frac{\theta_0^{t+1}(x_0^t, y_0^t)}{\theta_0^{t+1}(x_0^{t+1}, y_0^{t+1})}\right] \tag{3}$$

M_0 measures the productivity change between periods t and t+1. Productivity declines if $M_0 > 1$, remains unchanged if $M_0 = 1$ and improves if $M_0 < 1$.

The first part of the formula (on the right hand side) measures the magnitude of technical efficiency change between periods t and t+1 (catch-up). The other part of formulation measures the shift in the frontier between t and t+1 (frontier-shift).

Results of productivity according to MI (see Table 3), in the form of changes between the two periods *(t* and t+1) define whether the productivity of each DMU is improved, unchanged or declined: (a) improves if $M_0 < 1$ [↑]; (b) remains unchanged if $M_0 = 1$ [→]; declines if $M_0 > 1$ [↓].

The subject of this paper is modelling and assessment of technical efficiency and productivity of selected zoo in the Czech Republic and the Slovakia in 2006 – 2014. Models of technical efficiency and productivity will examine the ability of each zoo to achieve the maximum volume output - the number of visitors and total revenue

per visitor in relation to specified inputs - number of employees, number of animals and total operating expenses, expressed as a visitor. It is viewed as resources that consumes zoo to protect the main activities on the inputs, and their lower value leads to higher performance of the monitored production units.

3 Results and Discussion

DEA model results are based on the fact that for a given problem, there is a plurality of production possibilities, which is formed by all allowable combinations of inputs and outputs. The set of production possibilities is determined by effective border. If is the combinations of inputs and outputs, in the corresponding zoo, located on this border, it is an effective unit. From this perspective, therefore, the zoo is effective if it consumes a small amount of inputs (total number of employees, number of animals and total current expenditure, calculated per visitor) on a large number of outputs, e. g. the number of visitors and ordinary income attribuTable per visitor. If there is value = 1 in the corresponding zoo in the Table, then the zoo is effective, in given year, in comparison to other compared zoos.

If the zoo is not effective (not on production possibility border), it is necessary to adjust the size of their inputs or outputs so as to be able to achieve efficiency depending on the model. Given that the number of visitors management Zoo can affect only in a very limited extend, in this case it is necessary to try to affect the size of the input. In this case, raise of efficiency of the outcomes should be achieved by reducing the total number of employees or the number of pieces of animals, or efficiency can be increase by providing more funding per visitor, e.g. using funds of the founder in the form of a contribution or increasing their own income from economic activity, which may include e.g. an increase in revenues from rents or from entrance.

Table 3: Technical efficiency Zoo in CZ and SVK from the perspective of the outlets oriented model DEA

DEA: output oriented						
Zoo	**2006**	**2010**	**2011**	**2012**	**2013**	**2014**
Bojnice	1.07	1.32	1.32	1.00	1.00	1.05
Bratislava	1.06	1.00	1.00	1.00	1.00	1.01
Košice	1.07	1.11	1.11	1.05	1.03	1.06
Spišská Nová Ves	1.00	1.00	1.00	1.00	1.00	1.00
Brno	1.06	1.06	1.06	1.07	1.07	1.07
Děčín	1.00	1.00	1.00	1.00	1.00	1.00
Dvůr Králové nad Labem	1.06	1.04	1.04	1.09	1.07	1.07
Hodonín	1.04	1.04	1.04	1.10	1.08	1.06
Chomutov	1.07	1.06	1.06	1.10	1.08	1.07
Jihlava	1.00	1.04	1.04	1.05	1.04	1.02
Liberec	1.00	1.10	1.10	1.07	1.04	1.00
Hluboká nad Vltavou	1.06	1.00	1.00	1.07	1.01	1.00
Olomouc	1.07	1.08	1.08	1.06	1.08	1.10
Ostrava	1.05	1.14	1.14	1.07	1.08	1.22
Plzeň	1.03	1.00	1.00	1.08	1.10	1.44
Prague	1.00	1.00	1.00	1.00	1.00	1.00
Ústí nad Labem	1.06	1.03	1.03	1.04	1.03	1.04
Vyškov	1.00	1.00	1.00	1.00	1.03	1.00
Zlín	1.00	1.00	1.00	1.00	1.00	1.00
DEA = 1,0	7	8	8	7	6	7

Source: Own processing.

The results for individual zoo in the Czech Republic and Slovakia through the outputs oriented DEA method are summarized for the year 2006 and years 2010 - 2014 in the Table no. 3. The output of the Table is a division of surveyed zoo to effective (tint light gray) and inefficient (dark gray), the size of input sources and quantity of outputs, in our case, the output is the total number of visitors for the year and total revenues, calculated on a per visitor zoo in a given year. Method for the individual zoo compares their achieved values with respect to the best values of the other zoo in the year. We cannot derive any substantial conclusion from annual comparison. At first glance, it is obvious that the zoo Nova Spisska Ves, Decin, Prague and Zlin are in all years compared with others, in a given year, effective. Zoo Vyskov, Plzen, Hluboka nad Vltavou, Liberec, Jihlava, Bratislava and Bojnice are only effective in some of the years and the other zoo are compared with those in a given year inefficient. In 2006 the zoo are no major differences among surveyed zoo, in 2010 and 2011 are differences between the best and worst zoo, which was Bojnice zoo, crucial. In 2012 and 2013 there are again the differences between the best and worst zoo minimal and in 2014 the worst result achieved during the whole period zoo Plzen, followed by zoo in Ostrava.

Table 4: Results of technical productivity of zoos assessed according to individual years

Malmquist Productivity Index: output oriented												
Zoo	**2006, 2010**		**2010, 2011**		**2011, 2012**		**2012, 2013**		**2013, 2014**		**2006, 2014**	
Bojnice	0.89	↑	1.00	→	0.83	↑	0.94	↑	1.00	→	1.14	↓
Bratislava	1.17	↓	1.10	↓	1.12	↓	1.09	↓	0.99	↑	1.06	↓
Košice	0.98	↑	1.02	↓	0.99	↑	0.99	↑	0.98	↑	1.05	↓
Spišská Nová Ves	0.96	↑	1.09	↓	1.11	↓	1.04	↓	0.95	↑	0.92	↑
Brno	1.01	↓	1.02	↓	1.01	↓	1.00	→	1.01	↓	1.02	↓
Děčín	0.96	↑	0.86	↑	1.05	↓	0.96	↑	0.92	↑	0.78	↑
Dvůr Králové nad Labem	1.03	↓	0.97	↑	1.01	↓	0.98	↑	1.01	↓	1.01	↓
Hodonín	0.98	↑	1.00	→	1.04	↓	0.99	↑	1.03	↓	0.99	↓
Chomutov	1.01	↓	1.00	→	1.03	↓	0.97	↑	1.02	↓	1.01	↓
Jihlava	0.95	↑	1.02	↓	1.01	↓	1.01	↓	1.04	↓	1.00	→
Liberec	0.91	↑	1.03	↓	1.01	↓	0.99	↑	1.07	↓	1.06	↓
Hluboká nad Vltavou	1.04	↓	1.06	↓	1.09	↓	0.98	↑	1.26	↓	1.25	↓
Olomouc	1.00	→	1.01	↓	0.99	↑	1.01	↓	1.00	→	1.03	↓
Ostrava	0.96	↑	1.03	↓	1.04	↓	0.99	↑	1.04	↓	0.94	↑
Plzeň	1.33	↓	0.92	↑	1.13	↓	0.96	↑	0.96	↑	0.92	↑
Prague	0.92	↑	1.14	↓	1.10	↓	1.21	↓	1.25	↓	1.04	↓
Ústí nad Labem	1.02	↓	1.00	→	1.02	↓	0.99	↑	1.01	↓	1.02	↓
Vyškov	0.87	↑	1.08	↓	1.09	↓	1.04	↓	1.04	↓	0.86	↑
Zlín	1.03	↓	1.09	↓	1.05	↓	1.03	↓	1.14	↓	1.19	↓
No improves ↑	10		3		3		11		5		5	
remains unchanged →	1		4		0		1		2		1	
No declines ↓	8		12		16		7		12		13	

Source: Own processing.

The results according Malmquist index, which shows the Table number four, it is seen that in the long term (between 2006 - 2014) is the most improved zoo Decin, followed by zoo Vyskov. In the third place in improving were both zoo Spisska Nova Ves and Plzen, which were closely followed by the zoo in Ostrava. The only zoo without change was zoo in Jihlava. The result of the rest of evaluated zoos get worse.

During the reviewed period, however, the data of individual zoos are various, best long-term results in all compared years shows zoo Decin, that improved at all timepoints, except that of year 2012. There is shown regular improvements in zoo in Bojnice and Kosice in Slovakai and zoo in Plzen, Ostrava, Hodonin a Dvur Kralove nad Labem in the Czech Republic. The worst result in improving within the Malmquist index showed zoo Zlin, followed by zoo in Prague, Brno, Bratislava and Hluboka nad Vltavou. The numerically greatest deterioration in the technical productivity of the zoo was evaluated between 2011 and 2012. The improvement in the contrary a year later.

The efficiency of zoo is largely affected by the number of visitors in a given year, depending on various factors, e.g. the amount of population living in the catchment area of the zoo, the number of tourists coming to the area, a number of other cultural monuments in the area, etc. However, the number of visitors is affected by the weather in the summer months the most, as an example we may include extra heat weather or floods. Well-known example is flooding of large part of Prague zoo in 2002 and 2013. We can include the expansion of existing exposures by new kind of animals, which are attraction for visitors among the positive factors (e.g. keeping of elephants, giraffes and giant pandas) or opening a completely new exhibition, for example making exposures in the form of safari trains. The attendance may also lift a long anticipated birth of new animals, e.g. birth of the first baby elephant in the zoo Ostrava within UCSZOO.

Generally, by the public founders (state, country, municipality) it is placed great emphasis on increasing self-sufficiency in terms of its own funds of zoo and reducing the contributions of the founder while expanding the range of services for visitors and improving the quality of services provided. Primarily, the reasons are economic and sometimes political, when it is pressured to the management of the zoo, as well as to all other non-profit organizations in public ownership towards increasing the efficiency of use funds from the budget of their founder. Zoo Decin and Usti nad Labem gets the most long-term financial contributions from the butgets fo their founder to total current expendiures of oranization, where the founder is involved in the running of the organization between 63-71% annualy. According to the calculation in the grey-tinged part of Table two the zoo in Prague gets the fewest resources for common operation from its founder, about 15%, followed by zoo in Zlin

and zoo Dvur Kralove nad Labem where the founders contribute in between 25-30% of funds that are necessary to ensure common operation. In practice, then apply a logical structure, the larger are the output and the smaller are the inputs (not only of financial nature), the better is the efficiency and productivity of the monitored organization.

Due to the existence of modern zoos we have managed or it is still managed, in developed countries, to protect a variety of animal species threatened or threatened with extinction. Without visitors who come to the zoo to relax and have a fun, just to recreate, zoo would not fulfill their next, let´s say, "loftier" goals. Without public support, which is derived the support of the founders from, the zoos would not have reached further and further breeding success, to fulfill their educational role, would not have participated in the conservation of biodiversity and disengaged in scientific research for the benefit of all living creatures on the planet Earth.

4 Conclusions

Technical efficiency reflects the efficiency of input and output variables of the production process of unit. Production process in the context of this paper is meant the efficiency of zoos in the Czech Republic and Slovakia, which are predominantly funded in a legal form of contributory organization and are members of the Union of Czech and Slovak Zoological Gardens. Measuring the results of technical efficiency and productivity expressing of a production unit in time, i.e. Between two periods, allow methods of multi-criteria decision making and Malmquist productivity index. At 19 ranked zoo was used output oriented method DEA and Malmquist productivity index monitoring the effectiveness of the change between 2006 and 2010 to 2014. The efficiency of zoo was assessed by the total number of visitors and revenues falls on one visitor, since it is believed that one of the fundamental parameters in the allocation of public funds, is the meaningfulness of the spending of these funds and the impact (effect) on inhabitant who uses visit of the zoo in the form of public services.

Nonprofit organizations in public ownership in the legal form of contributory organizations are widely used to meet the needs of the population. These are mainly the areas of public life where you cannot or it is very difficult to realize a profit. Besides the above evaluated zoos we could include mainly organizations in the education sector (nursery, primary and secondary schools), culture (museums, theaters, galleries, concert hall) or social issues (homes for the elderly, nursing home) here. Similar features have also organizations in the health sector (some hospitals and hospice), rarely then in the transport sector (management and maintenance of roads) or in the provision of technical affairs at the level of local government (technical services, collection points, etc.).

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Cost-Effectiveness Analysis of University Hospitals in the Czech Republic

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Abstract. The paper deals with the cost-effectiveness of university hospitals in the Czech Republic between the years 2004 - 2013. Cost-effectiveness is evaluated by using indicators based on university hospitals accounting data acquired from the Ministry of Finance databases. These data were subsequently converted into performance indicators. The aim is to analyse the cost-effectiveness of university hospitals and to find out differences among them. As it is an initial analysis, it was found out, that development of individual hospitals significantly differed in monitored indicators.

Keywords: University Hospitals, Effectiveness, Cost-effectiveness analysis
JEL Classification: I10

1 Introduction

Inpatient hospital care is the key element of health care system and also its major cost item in all developed countries. This care means on average 45 % of total annual health care costs of Czech health insurance companies. The subject of this paper is the cost-effectiveness of university hospitals. These hospitals represent 25 % of total hospital bed fund and have a similar share in the total number of hospitalizations and nursing days in Czech hospitals - UZIS (2004 – 2013a) etc.

It is very important to spend financial resources at university hospitals as efficiently as possible. Therefore, if there the possible sources of inefficiency of the whole healthcare system are being searched, it would be suitable to start right there. It is necessary to mention, that the majority of healthcare spending in the Czech Republic belongs to the public resources, and thus in accordance with law no. 320/2001 Coll. on financial control in public administration and amending certain laws 3E criteria should be monitored.

Effectiveness evaluation of health care organizations is generally carried out as the analysis of the relationship between inputs and outputs. In the public sector are often used one criterion input-output methods (CMA, CEA, CBA, CUA). Rigorous application of these methods is associated with certain problems - the quantification of all costs and benefits including intangible and social ones, externalities, time value of money, uncertainty, risk, selection of community interest rates etc. - for details see Ochrana (2005) and Folland, Goodman, Stano (2014). We cannot forget that one of the main problems of these methods is the fact, that they reflect the impact of just one variable, which by definition can almost never comprehensively cover all effects, and so they might influence monitored situation. The challenging issue is also the valuation of human life, for details see Folland, Goodman, Stano (2014) and Vaňková, Vrabková (2014). Hospital effectiveness can be measured in many other ways. For monitoring the technical efficiency (which considers medical facility as a unit producing outputs with the given inputs) a number of econometric and statistical methods are being used - data envelopment analysis (DEA), stochastic methods (SFA), Malmquist's techniques as stated Dlouhý (2009), Jablonský, Dlouhý (2015), Jones (2000), Hollingsworth, Peacock (2008). In the health care sector patient satisfaction with provided services is also often monitored on the base of questionnaire survey; this satisfaction is called social effectiveness.

The aim of the contribution is to analyse the cost-effectiveness of university hospitals between the years 2004 and 2013 and to determine whether there is any significant difference among hospitals.

2 Data and Methods

When analysing the cost-effectiveness in health care, the problem of quantification of output in monetary units arises. This makes the practical application of cost-benefit analysis (CBA) method very difficult. So it is better to use cost-effectiveness analysis (CEA) method. There the input is needed in monetary units, but the output is expressed in physical units. Similar conclusions about the usefulness of methods can also occur on the basis of publications Ochrana (2011), Maaytová (2012), Garber (2000). The advantages of monitoring the cost-effectiveness only at university hospitals are their significance in the Czech health care system and more homogenous output than in the case of analysis of the whole hospital segment.

It might be generally stated that annual comparison of financial indicators is problematic, because hospital economic management is influenced by many external factors - inflation, changes in taxation and legislation, nationwide health workers wage agreements etc.. Annual changes may also occur due to changes in accounting

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and statistical methodologies. These factors influence all university hospitals in the same way, so they are abstracted.

Input data were drawn from the UZIS publication "Health Care in Statistical Data" for the years 2004 - 2013, because it is always better to rely on centrally published data, rather than to try to find values in annual reports, where is moreover not published the same scope and structure of indicators. Information about the university hospitals accountancy (profit and loss account) was obtained from publicly available databases of the Ministry of Finance, for the period of 2004 - 2009 in the "Automatizovaný rozpočtový informační systém" (ARIS) database, for the period of 2010 - 2012 in the "Účetní finanční informační systém" (ÚFIS) database and for the year 2013 in the "Monitor" database.

There were analysed the indicators of the following university hospitals – The General University Hospital in Prague (VFN; Všeobecná fakultní nemocnice v Praze), The University Hospital in Motol (FNM; Fakultní nemocnice v Motole), The University Hospital Kralovske Vinohrady (FNKV; Fakultní nemocnice Královské Vinohrady), The University Hospital Pilsen (FNPLZ; Fakultní nemocnice Plzeň), The University Hospital Hradec Kralove (FNHK; Fakultní nemocnice Hradec Králové), The University Hospital Brno (FNBR; Fakultní nemocnice Brno), The University Hospital U sv. Anny (FNUSA; Fakultní nemocnice U sv. Anny), The University Hospital Olomouc (FNOL; Fakultní nemocnice Olomouc), The University Hospital Ostrava (FNOST; Fakultní nemocnice Ostrava), The Military University Hospital Prague (UVN; Ústřední vojenská nemocnice - Vojenská fakultní nemocnice Praha). The last mentioned hospital acquired the status of a university hospital in the year 2012, nevertheless it was included into the analysis, as throughout the period it was a significant part of the Czech healthcare system.

Total costs and revenues drawn from accountancy were added as input data for performance indicators, but it was not possible to determine the proportion of staff used for the main or economic activity. It is clear, that the main activity dominated at all university hospitals for the whole period. Performance indicators were designed as share of selected revenues and costs to average recalculated number of doctors and nurses. These indicators are not published by UZIS in needed structure, so a different published value was used for their calculation based on this equation:

$$PDS = \frac{OD}{PD \times PPP}, \tag{1}$$

where PDS = average daily number of occupied beds per 1 doctor (nurse),
OD = number of treatment days (average length of stay X number of hospitalized patients),
PD = number of days of a given year,
PPP = average recalculated number of doctors (nurses).

Based on some algebraic modification of the first equation average recalculated number of doctors (nurses) has been expressed as follows:

$$PPP = \frac{OD}{PD \times PDS}. \tag{2}$$

For the variable the number of days of a given year was calculated with 365 days, except leap years 2004, 2008 and 2012, when it was calculated with 366 days. Otherwise, the input data for indicators were used exclusively as they were reported by UZIS. The analysis ignores established specialized medical institutes and other organizations, which could be incorporated into university hospitals, because of the averaged initial values.

Required input values for the analysis of performance indicators were determined while using the second equation. These indicators were compared with the average for all university hospitals. For graphical comparison all data were compared with the highest achieved value of that indicator (e.g. the highest value has the coefficient 1.00 and the others proportionally less).

At the end of the paper the relationship between wage costs per employee and similarly revalued revenues from the sale of services was monitored using the correlation coefficient. To get better explanation of results correlation coefficients were calculated for the whole time period from 2004 to 2013.

3 Results and Discussion

Performance Indicators

The first indicator is the **wage costs per doctor** indicator. The Table shows that throughout the period the above-average rate was reached by The General University Hospital in Prague (VFN) and then usually by The Military University Hospital Prague (UVN) and The University Hospital Hradec Kralove (FNHK). On the other hand there are some hospitals, which never reached an average, e.g. The University Hospital Kralovske Vinohrady (FNKV) – with the exception in the year 2012, The University Hospital Brno (FNBR), The University Hospital Olomouc (FNOL), The University Hospital Ostrava (FNOST). In the case of The Military University Hospital Prague (UVN) and The University Hospital Hradec Kralove (FNHK) coefficient of variation acquired higher value.

Table 1: Comparison of wage costs to average per doctor in a given year

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Average	SD (St. dev.)	CV (var. coeff.)
VFN	1.32	1.40	1.31	1.40	1.53	1.46	1.45	1.36	1.34	1.27	1.38	0.08	6 %
FNM	0.89	0.89	0.87	0.96	1.06	1.11	1.07	1.00	1.04	1.02	0.99	0.08	8 %
FNKV	0.96	0.92	0.85	0.97	0.89	0.95	0.94	0.87	1.00	0.97	0.93	0.05	5 %
FNPLZ	0.96	0.97	1.16	0.96	0.86	0.88	0.94	0.96	0.93	0.92	0.95	0.08	8 %
FNHK	1.43	1.44	1.36	0.99	1.12	1.11	1.03	1.04	1.03	1.06	1.16	0.17	14 %
FNBR	0.71	0.69	0.71	0.79	0.67	0.70	0.74	0.72	0.73	0.76	0.72	0.03	5 %
FNUSA	1.05	1.06	1.00	1.14	1.04	1.00	0.99	0.94	0.94	1.00	1.02	0.06	5 %
FNOL	0.78	0.76	0.75	0.79	0.79	0.82	0.78	0.78	0.79	0.81	0.78	0.02	3 %
FNOST	0.96	0.92	0.85	0.88	0.92	0.91	0.96	0.93	0.93	0.91	0.92	0.03	3 %
UVN	0.94	0.96	1.15	1.13	1.11	1.06	1.10	1.40	1.27	1.28	1.14	0.14	12 %

Source: author.

The indicator **wage costs per nurse** shows that throughout the chosen time period above-average levels were constantly reached only by The Military University Hospital Prague (UVN) and The University Hospital Hradec Kralove (FNHK). Whereas The University Hospital Brno (FNBR), The University Hospital Olomouc (FNOL) never reached the average value and The University Hospital Kralovske Vinohrady (FNKV) reached the average value only in the year 2004.

Table 2: Comparison of wage costs to average per nurse in a given year

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Average	SD (St. dev.)	CV (var. coeff.)
VFN	1.14	1.12	0.95	1.13	1.12	1.03	1.01	1.02	1.01	0.91	1.04	0.08	7 %
FNM	0.87	0.95	0.97	0.99	1.02	1.03	0.98	0.91	0.92	0.92	0.96	0.05	5 %
FNKV	1.08	0.89	0.91	0.90	0.97	0.96	0.96	0.86	0.93	0.90	0.94	0.06	6 %
FNPLZ	0.94	0.97	1.29	1.02	1.02	1.01	1.01	1.09	1.06	1.02	1.04	0.09	9 %
FNHK	1.17	1.23	1.19	1.17	1.14	1.15	1.19	1.21	1.11	1.10	1.17	0.04	3 %
FNBR	0.77	0.83	0.80	0.82	0.85	0.79	0.88	0.85	0.88	0.89	0.84	0.04	5 %
FNUSA	1.01	0.93	0.97	0.94	0.99	1.02	1.02	1.07	0.99	1.03	1.00	0.04	4 %
FNOL	0.94	0.95	0.91	0.88	0.82	0.87	0.90	0.92	0.92	1.00	0.91	0.05	5 %
FNOST	0.93	1.00	0.95	0.96	0.94	1.00	0.97	0.91	0.98	0.90	0.95	0.03	3 %
UVN	1.13	1.12	1.06	1.19	1.13	1.14	1.10	1.16	1.20	1.32	1.16	0.07	6 %

Source: author.

When comparing the average values of all hospitals for the whole period, it can be stated that in the case of labour costs converted to selected employees, if a hospital reached the above-average value for one group of employees, so it was the same for the second group.

From the revenues were calculated **revenues from sales of services per doctor**. Indicator "revenues from sales of services" is important because it represents hospital's income from health insurance companies. This

performance indicator reflects the most important part of human capital in hospitals. Development shows that throughout the period above-average value was achieved by The General University Hospital in Prague (VFN), The University Hospital in Motol (FNM) and The University Hospital Hradec Kralove (FNHK). This criterion represented particularly interesting value when compared to the average at The General University Hospital in Prague (VFN). Below-average value throughout the period was achieved by The University Hospital Brno (FNBR), University Hospital Olomouc (FNOL), The University Hospital Ostrava (FNOST).

Table 3: Revenues from the sale of services per one doctor to average in a given year

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Average	SD (St. dev.)	CV (var. coeff.)
VFN	1.27	1.33	1.28	1.49	1.71	1.60	1.60	1.55	1.58	1.59	1.50	0.14	10 %
FNM	1.04	1.02	1.00	1.05	1.16	1.18	1.15	1.08	1.11	1.09	1.09	0.06	5 %
FNKV	0.90	0.87	0.80	0.95	0.90	0.95	0.94	0.88	1.01	1.00	0.92	0.06	7 %
FNPLZ	1.04	1.05	1.25	1.00	0.88	0.92	0.99	1.00	0.92	0.94	1.00	0.10	10 %
FNHK	1.45	1.45	1.36	0.99	1.08	1.05	1.04	1.06	1.05	1.09	1.16	0.17	15 %
FNBR	0.72	0.72	0.75	0.80	0.68	0.70	0.77	0.73	0.75	0.74	0.74	0.03	4 %
FNUSA	1.03	1.04	0.97	1.13	1.03	0.99	0.91	0.82	0.81	0.78	0.95	0.11	12 %
FNOL	0.76	0.74	0.73	0.78	0.80	0.89	0.80	0.81	0.79	0.83	0.79	0.04	5 %
FNOST	0.95	0.94	0.88	0.91	0.92	0.92	0.98	0.93	0.95	0.93	0.93	0.03	3 %
UVN	0.84	0.85	0.98	0.91	0.83	0.81	0.81	1.14	1.03	1.02	0.92	0.11	12 %

Source: author.

The last analysed variable was the indicator **revenues from sales of services per one nurse**. During the whole period the average value was exceeded by The University Hospital Pilsen (FNPLZ) and The University Hospital Hradec Kralove (FNHK). On the contrary below the average was The University Hospital Brno (FNBR).

Table 4: Revenues from the sale of services per one nurse to average in a given year

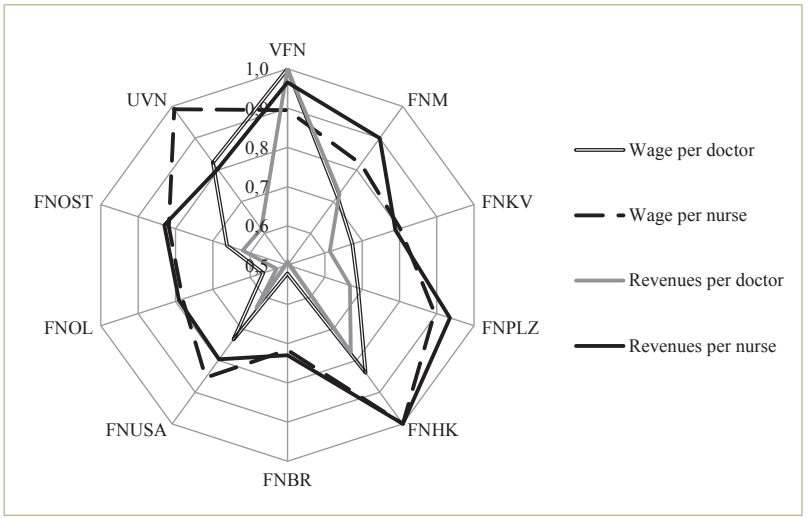
	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Average	SD (St. dev.)	CV (var. coeff.)
VFN	1.11	1.07	0.92	1.21	1.25	1.13	1.11	1.17	1.20	1.15	1.13	0.09	8 %
FNM	1.01	1.09	1.12	1.08	1.13	1.10	1.06	0.98	0.99	0.99	1.05	0.05	5 %
FNKV	1.01	0.84	0.85	0.88	0.98	0.96	0.96	0.87	0.95	0.94	0.92	0.06	6 %
FNPLZ	1.03	1.06	1.38	1.07	1.05	1.05	1.06	1.14	1.07	1.04	1.10	0.10	9 %
FNHK	1.19	1.24	1.18	1.17	1.11	1.09	1.20	1.25	1.14	1.14	1.17	0.05	4 %
FNBR	0.79	0.86	0.84	0.83	0.87	0.80	0.92	0.86	0.90	0.88	0.85	0.04	5 %
FNUSA	0.99	0.92	0.94	0.93	0.99	1.02	0.94	0.93	0.86	0.82	0.93	0.06	6 %
FNOL	0.92	0.93	0.89	0.88	0.85	0.95	0.93	0.95	0.93	1.04	0.93	0.05	5 %
FNOST	0.93	1.02	0.97	0.99	0.94	1.01	1.00	0.92	1.00	0.93	0.97	0.04	4 %
UVN	1.01	0.99	0.90	0.96	0.85	0.88	0.82	0.94	0.98	1.06	0.94	0.07	8 %

Source: author.

The Figure summarizes the findings of the previous text. If the curve for a given variable touches the edge, the hospital reaches the maximum average value, but it cannot be evaluated, where the specific hospital should optimally stand. This question would need a more detailed analysis. On the other hand, based on the analysis, it can be stated that development of individual hospitals significantly differed in the monitored indicators.

Differences might also occur due to existence of specialized centre for treating patients with some serious diseases (e. g. The University Hospital Kralovske Vinohrady focuses on burn injuries and The University Hospital in Motol focuses on treating children with cancer).

Figure 1: Comparison of university hospitals



Source: author.

4 The relationship between labour costs and revenues per employee

It can be expected that if a hospital has an above-average labour costs per one recalculated doctor (nurse), its employees could be motivated to reach a higher labour productivity. This means that revenues from the sale of services should be higher.

Table 5: Dependence between wage costs and revenues from the sale of services per employee

	VFN	FNM	FNKV	FNPLZ	FNHK	FNBR	FNUSA	FNOL	FNOST	UVN
Doctors	0.98	0.98	0.97	0.96	0.95	0.96	0.48	0.94	0.97	0.99
Nurses	0.97	0.97	0.97	0.97	0.99	0.97	0.81	0.95	0.98	0.99

Source: author.

The Table clearly shows that between the quantities in the reporting period was positive strong correlation (except The University Hospital U sv. Anny (FNUSA)). It must be stressed that staff productivity is influenced by many other factors – e.g by instrumental equipment, but first of all by the composition of treated cases in relation to revenues for services sold (i.e. mainly payments for medical outputs from health insurance companies differ significantly according to the individual medical procedures). The high correlation coefficients might be caused by apparent or conditional correlation between both variables.

5 Conclusions

The first thing that should be in similar analyses mentioned is that monitoring financial results in the health care sector is a controversial question. Profit maximization is definitely not the main goal of companies operating in the health care (standard hospitals managed by the public sector). Consequently, it is difficult to determine which criterion should be taken as maximization or minimization. Nevertheless, financial prosperity is certainly one of the most important secondary objectives. It is necessary to ensure financial sustainability of health care system as a whole.

Evaluation of the effectiveness of health care institutions is very difficult in practice. This paper could contribute to the debate about the hospital effectiveness as it is based on publicly available databases data and uses simple methods. This could be considered as a positive, because after further elaboration of other costs (e.g. material consumption), revenues or inputs (e.g. number of beds) it could be easily applied in future practice. For this it is necessary to determine the "standard" values of indicators that would be considered as standard. The

standard would subsequently enable to assess whether the particular institution is efficient and cost-effective or not. Nevertheless it is always necessary to keep in mind that every hospital is different, because it has a different case mix, produces various high-quality outputs, uses various numbers and differently structured bed fund and operates in a different market structure and also treats patients whose health status might be influenced by a variety of non-medical factors.

Other possible way how to elaborate theme of university hospital's effectiveness can be done as analysis of hospital technical effectiveness in the Czech Republic as Dlouhy (2009), Dlouhý, Jablonský, Novosádová (2007) or Gajdošová (2016). One of the biggest problem, that might appear is unavailability of necessary and comparable data.

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Identification of Basic Trends in Public Expenditures of Environmental Protection in the Czech Republic

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Abstract. Volume, structure and dynamics of growth of public expenditures on environmental protection correspond to the aims and objectives of the State Environmental Policy. Expenditures on environmental protection from public budgets are an important indicator of the level of environmental protection, not separately, but together with other instruments of environmental protection. The most significant central source of the funds is coming from the state budget, state funds through the State Environmental Fund of the Czech Republic and the defunct National Property Fund. The aim of this paper is to analyze central public expenditure on environmental protection in the Czech Republic in 1998–2014, including a prediction for two years. In connection with the analysis of the structure of expenditure on environmental protection will be outlined the tendencies observed in development. There are the main trends observed in the development and forecast for 2 years. Expenditure on environmental protection stemming from regional budgets, however are not included in the analysis. In relation to the expenditure of the state budget expenditures has amounted central government budgets of 3.0%. From the perspective of long-term development leads to an increase in spending, although with SEF can be expected to in the coming years and the stagnation of state financial assets even decline.

Keywords: environmental protection, State Environmental Fund CR, state budget, public expenditure, old environmental damages.
JEL Classification: Q50, Q56, H23

1 Introduction

Expenditure on environmental protection is closely linked with economic development and is therefore subject to discussions about their optimal level. Discussions will mainly focus on the interaction between public expenditure and environmental pollution (Barman, Gupta, 2009, 2010). Czech economic transformation has been associated with efforts to improve the state of the environment, which was in the early 90s one of Central Europe's most problematic (Tošovská et al., 2010). Following the adoption of a series of major laws on environmental protection in the Czech Republic (CR) in the early 90s there was a large financial burden on businesses while gradually increasing the expenditure of public funds. For example Špaček (1993) in its publication lists the cases of big polluters and pumping huge amounts of funds in relation to compliance with the law. In comparison with other EU states exists in the Czech Republic, one of the largest private sector share of environmental spending in the event industry in 2012 was 0.27% VAT (Statistical Yearbook of the Environment of the Czech Republic, 2014).

According to the currently valid State Environmental Policy of the CR 2012–2020 (SEP) can be assumed that increasing emphasis will be placed on the introduction of the concept of a sustainable economy (General definition of sustainable development can find an in Act 17/1992 Coll. This concept, although it so far there is no clear consensus, is gradually being implemented in a number of strategic policy documents and normative legal acts of many countries and multinational groups.), which is related to the promotion of environmentally friendly behavior towards the environment. It can be expected a greater emphasis on increasing investment in clean technologies, renewable energy and sound management of resources non-renewable nature, to protect and strengthen ecosystem services, biodiversity conservation and the development of sustainable land use. New priorities will place demands including on public expenditure on environmental protection. These are related to the ongoing analysis of expenditure with respect to their benefits and provide the basis for the most efficient use of public funds (Marinoni et al., 2012).

When analyzing the method of funding measures to protect the environment can be found with different support systems, including co-financing from the financial resources available. Nevertheless, it is quite accurately determine the rules by which they are used funds from various public budgets (Hájek, 2013).

The aim of this paper is to analyze central public expenditure on environmental protection in the Czech Republic in 1998–2014, including a prediction for two years. In connection with the analysis of the structure of expenditure on environmental protection will be outlined the tendencies observed in development.

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2 Methodology

The state budget expenditures on environmental protection as well are connected with expenditures of municipalities and counties. These expenses are not in this article analyzed with respect to transfers of funds from the state budget and state funds to those local budgets and the need for consolidation of these expenditures. Expenditure on environmental protection stemming from regional budgets, however are not included in the analysis. When using the data of local budgets would have to be carried out consolidation. To eliminate duplication in expenditures are not expenditures of local budgets included in the analysis.

The paper is based on an analysis of public budgets in respect of expenditure on environmental protection. To a system of public budgets of the CR belongs to the state budget, the budgets of municipalities, towns and regions and budget-funded organizations. In addition, they have their place in public budgets extra-budgetary funds primarily the State Environmental Fund CR (SEF). It is basically a formal earmarking some funds from public budgets, the logic of their income and expenditure, however, is the same (Černohorský, Teplý, 2011). For the analysis of public expenditure was chosen approach, which will first describe the overall trends in environmental improvements and economic growth and pollution discharged, compared with public spending, because they are used largely on reducing pollution discharged. When compared with the economic growth is not as important own decoupling, but rather a continuing trend of gradually reducing environmental impact and increasing economic growth (Wang et al., 2013). The following data is used to assess the reduction of environmental impact: final energy consumption, greenhouse gas emissions, solid pollutants, SO_2, NO_X. This effect is compared with the environmental issue of the central general government, which is used to represent the index of development. For all variables is the index 1 in the base year. An important aspect of environmental protection is to provide funding for projects aimed at improving the quality of the environment. It can be realized from public funds and EU funds aimed at improving the status of the individual components of the environment and support sustainable development (MŽP, 2016). The most important national financial resources from which support is provided for measures in the field of environmental protection, the State Environmental Fund CR and the state budget.

For statistical calculations linear and exponential trend forecast are used for future development based on the spacing of points a straight line method of least squares. Coefficient of determination R^2, indicates what percentage is the variance values of the dependent variables y (expenditures in million CZK) explains the changes in values independent variables x (years). The coefficient values from 0 to 1, the higher, the better the model is found (Hindls, 2007). In the case of linear regression coefficient of determination is equal to the square of the Pearson correlation coefficient.

$$R^2 = \frac{\sum_{i=1}^{n}(\hat{y}_i - \bar{y})^2}{\sum_{i=1}^{n}(y_i - \bar{y})^2} \qquad (1)$$

The paper also calculated the correlation coefficient (2). If the random variable X and Y are quantitative random variables with a common two-dimensional normal distribution, a specific value (x_1, y_1), (x_2, y_2), ... (x_n, y_n) sample correlation coefficient is given by:

$$r = \frac{\sum_{i=1}^{n}(x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum_{i=1}^{n}(x_i - \bar{x})^2 \sum_{i=1}^{n}(y_i - \bar{y})^2}} \qquad (2)$$

The following Table 1 describes the use of central funds for the purpose of environmental protection.

Table 1: Use of central funds for the purposes of environmental protection

State budget	SEF CR	Former National Property Fund, now part of the state financial assets
Investment and non-investment support.	Promotion of investment and non-investment actions to improve the environment.	Reimbursement of costs for measures that eliminate groundwater contamination, soil contamination and dump harmful waste.
Among other things, pays the cost of removing old material environmental liabilities.	Does not cover the cost of disposing of ancient environmental burdens (focusing on preventive measures).	Pays only the costs associated with the removal of old environmental burdens on the privatized property.
It solves the long-term priorities of environmental policy.	It supports long- and short-term priorities of environmental policy, allows operational changes aid in relation to the ongoing correction of the priorities of environmental policy.	Only solves a specific problem of environmental protection

Source: Hájek (2009)

The SEF is a special institution that is a major financial-resource in protecting and improving the environment. It is one of the basic economic instruments for the fulfillment of obligations stemming from international conventions on environmental protection, the obligations of membership in the European Union and the State Environmental Policy (SEF, 2016). Fund revenues consist primarily of payments for polluting or damaging the individual components of the environment (fees for wastewater discharges, charges for removal of land, air pollution fees, and fees for waste disposal) and the related repayment of loans and interest. The amount of these payments directly affects the amount of expenditure on environmental protection. Therefore, the development expenditure SEF is variable. The analysis will focus on monitoring the dependence of these expenditures on various factors, including income, but also the priorities of the State Environmental Policy of the Czech Republic (SEP) and the SEF priorities, or other connection. Prediction of spending and corresponds to the actual results of the analysis and development is primarily based on changes in payments by environmental laws.

Different development payments in case the state budget, primarily because the costs are not limited incomes, as in the case of SEF. This is essentially a reallocation to other priorities within the budget approval and expected long-term tendency towards solving the problem of environmental protection, at least related to SEP 2020. On the basis of long-term trends in spending can be used to predict the statistical methods (Stanciu, Brezeanu, 2012).

Data for analysis was obtained from statistical reports, particularly the Environmental Protection Expenditure Account (EPEA), which are available to the broader context of expenditure (Broniewicz, 2007) and the methodology was developed in Eurostat. For the purposes of this article, the data gathered from the Statistical Yearbook of the Environment so that it can be used more detailed information for analysis and management reports of SEF, where there is more information for analysis and prediction. Information on measures for the removal of old environmental burdens is regularly reported on the website of the Ministry of Finance. Authors used time series analysis (linear and exponential trend) with two-year forecasts for expenditure on environmental protection in the Czech Republic. At the time series, which came out coefficient of determination low values were expenditures on environmental protection from the SEF and state funds competently estimated.

3 Results

In this part of results will be analyzed domestic sources of financing environmental protection, foreign sources and predictions.

Domestic sources of financing environmental protection

The following Table 2 shows the expenditure from the central public sources (state budget, state funds and the National Property Fund) on environmental protection in the years 1998–2014. In proportion to the expenditure of the state budget expenditures on environmental protection peaked in 2011 and 2012 (in the amount of 3.0%)

Table 2: Expenditures from public sources on environmental protection in 1998–2014

Year (*t*)	Source of expenditures			
	State budget (mil. CZK)	**State funds*** **(mil. CZK)**	**State financial assets †** **(mil. CZK)**	**Total (mil. CZK)**
1998	4,732.4	2,278.4	2,174.0	**9,184.8**
1999	5,540.2	2,609.7	1,768.0	**9,917.9**
2000	5,038.4	2,884.4	2,143.0	**10,065.8**
2001	4,313.7	3,711.3	2,727.4	**10,752.4**
2002	4,954.8	4,131.8	3,230.0	**12,316.6**
2003	5,988.2	4,722.6	2,587.3	**13,298.1**
2004	6,613.8	4,203.2	3,563.3	**14,380.3**
2005	7,547.5	3,448.2	6,022.0	**17,017.7**
2006	16,252.8	2,406.0	5,172.0	**23,830.8**
2007	18,169.1	1,700.0	6,325.0	**26,194.1**
2008	11,759.2	2,049.8	5,728.0	**19,537.0**
2009	16,481.6	2,068.7	8,466.4	**27,016.7**
2010	18,473.3	4,444.7	5,921.1	**28,839.1**
2011	19,977.8	10,898.2	3,389.0	**34,265.0**
2012	19,860.1	11,267.6	3,392.0	**34,519.7**
2013	20,986.8	2,607.0	2,295.0	**25,888.8**
2014	33,726.7	3,540.6	1,155.0	**38,422.3**

Source: MoE (2006) a CENIA (2014) a CEI (2014), own elaboration

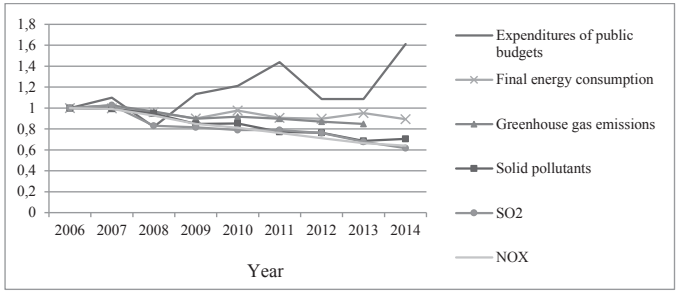
In Table 2 is evolution of public expenditure is detected in the years 1998–2014. In 2008, the value of expenditure from the previous two years dropped significantly due to the exclusion of European subsidies. In 2009, the value of spending increases again almost to the level of 2006. In 2010, the amount of expenditure differs compared to 2007 amount 300 million CZK. Increase in spending in 2006 and 2007 was caused by the inclusion of European funds. In percentage terms, the largest decline in spending from the state budget recorded in 2008 by more than 35% compared to 2007.

The largest increase observed values was recorded in 2006 by more than 115%, and then in 2009 by more than 40% compared to 2008. In 2013 it was recorded a rapid decline in the total expenditure, which has a relationship with the established legislative changes (Kubová et al., 2013). Expenditures of the State Environmental Fund according to Hájek (1993), gradually rising, which is due to the gradual increase of charges for environmental pollution (most important income of the Fund). According Peszko (1999) it is a manifest tendency declining share of public expenditure on environmental protection in all states in conversion to a market economy. This view was not historically confirmed.

According to Hájek (2009) should in future pay more attention to the income in order to maintain the operability of the SEF to secure new priorities. Figure 1 shows links between final energy consumption, greenhouse gas emissions, solid pollutants, SO_2, NO_X and expenditures of public budget.

* State Environment Fund and State Agricultural Intervention Fund.
† 1st January 2006 was National Property Fund repealed by Law no. 178/2005. Its expertise and resources expended for the removal of old environmental damage now administered by the Ministry of Finance CR outside the state budget. In Table 2 are listed under this item expenses for the remediation of past environmental damage incurred before privatization.

Figure 1: The links between expenditures of central public budgets, final energy consumption, greenhouse gas emissions, solid pollutants, SO_2 and NO_X (the change compared to 2006)

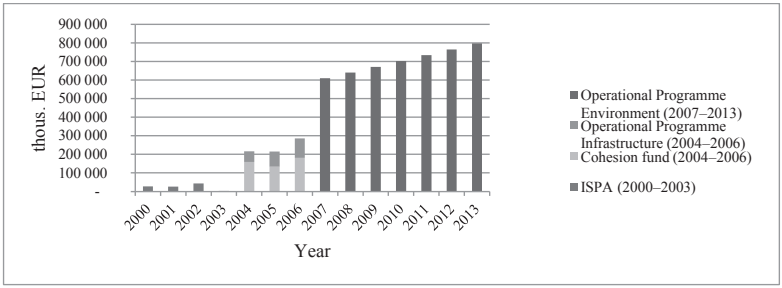


Source: Report on the environment of the Czech Republic

Foreign sources of financing environmental protection

Accession to the EU in 2004, the Czech Republic gained access to the spending of European funds. These include: Financial mechanisms EEA and Norway, Phare/Transition Facility, Revolving Fund of the Ministry of the Environment, LIFE, Operational Program Infrastructure, Operational Program Environment (OPE), Cohesion Fund, etc. (MŽP, 2016). In Figure 2 are quantified funding from EU funds for projects in the environmental field. In the OPE was from the beginning of the period to the end of 2014, filed almost 26,000 project applications requesting support from EU funds amounting to 9.8 billion EUR (Annual report OPE, 2015), which far exceeds the original overall allocation. Nevertheless, the final decision on granting subsidies reached by the end of 2013 projects corresponding to only 54% of the initial allocated amount that was actually spent only 43% of the allocation.

Figure 2: Allocation of financial EU funds to projects in the field of environment



Source: MoE CR, own elaboration

The total loss for the year 2013, when implementing the program OPE will be in the range of 7.2–8.2 billion CZK depending on the acceptance of documents to reduce the loss by the European Commission (CENIA, 2015). Operational Programme Environment 2014–2020 builds on the Operational Programme Environment 2007–2013. For the applicant has in store in the next few years nearly 2.637 billion EUR. From 2014 can be expected to increased uptake of European funds and the related listed below, increased utilization SEF and the state budget.

Prediction of state budget expenditures

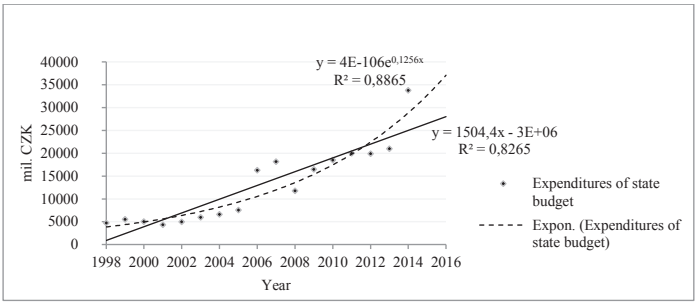
In the first column, the forecasts for 2015 and 2016 using a linear trend. In the second column of the Table 3 is a calculated value estimation exponential growth based on existing data from Table 2.

Table 3: Forecast value of expenditures on environmental protection for 2015 and 2016 using linear and exponential trend

Year (t)	Forecast (mil. CZK) Linear trend	Forecast (mil. CZK) Exponential trend
2015	26,505.3	32,698.3
2016	28,540.8	36,302.7

Source: own elaboration

Figure 3: Forecast value of expenditures on environmental protection for 2015 and 2016 using linear and exponential trend



Source: own elaboration

Figure 3 shows forecast for years 2015 and 2016 with coefficient of determination R^2 (1).

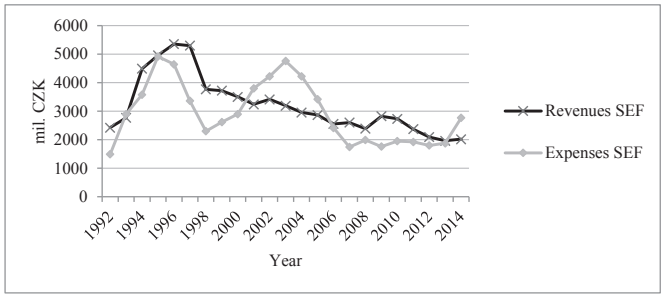
Exponential trend line is useful in the case where the data values increase or decrease constantly increasing speeds. It can be statistically expected in 2015 the expenditure value 32,698.3 million CZK and in 2016 it can be expected 36,302.7 million CZK (exponential trend has a higher coefficient of determination $R^2 = 0.8865$). This means that 88.65% of the variance $\bar{y}$ of the dependent variable y managed explains exponential function.

The paper also calculated the correlation coefficient r (2). The larger the absolute value of r is, the closer the correlation between the two variables. The positive correlation coefficient indicates a positive correlation between variables ($r = 0.909106055$).

Prediction of expenditures SEF

The expenditure of state funds comprises mainly expenditures SEF. SEF expenditure predictions are based on expected revenues. It is due to the fact that long-term spending has similar development as revenue excluding fluctuations in 1998 and 2003, which were given to politics SEF. Figure 4 shows revenues and expenditures SEF in 1992–2014 with no inclusion of expenditures related to the program "Green Savings in the years 2010–2013. In recent years, the Green Savings program has been funded by the Ministry of the Environment and is not reflected in spending SEF. In connection with the character of the process of expenditures on environmental protection in the Czech Republic cannot be used prediction time series via the least squares method, the coefficient of determination (1) reached a mere 0.19.

Figure 4: Revenues and expenses SEF in 1992–2014



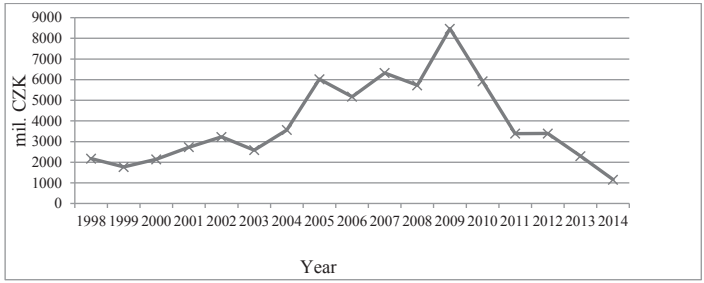
Source: Report on the environment of the Czech Republic

In development in recent years can be expected increased drawdown of European funds and thus co-financing from the SEF. This tendency was reflected sharply in 2014, but the next two years will fall again to the level of income, which is long-term (20 years) decreasing. We can expect to achieve the level of expenditure 2.5 billion CZK in 2015 and 2.1 billion CZK in 2016. Increased revenue and thus spending in the long term can be expected only in the context of the adoption of amendments to laws on water, waste and the law product end of life and their effectiveness, it means since about 2018. It may be an increase of about 500 million CZK.

Prediction of expenditures from the state financial assets

In connection with the character of the process of environmental expenditures from the state financial assets in the Czech Republic in 1998–2014 cannot be used prediction time series via the least squares method, the coefficient of determination (1) reached a mere 0.19. Expenditure for the removal of old environmental burdens gradually decline in the last five years (Figure 5). It is due to the financing of specific measures and the fact that most of the actions have already been implemented. Towards the end of the 1st half of 2015 amounted to a guarantee of the actual amount of 154,414 million CZK and implementation agreements were linked 63,586 million CZK, of which were spent 59,772 million CZK. This implies that in the coming years remains to draw 6% of funds earmarked to repair the damage. It can therefore be expected in the coming years, a slight drop in expenditure until all of the funds tied in implementing agreements. In 2015 will fall drawdown to about 800 million CZK and in 2016 to about 500 million CZK.

Figure 5: Expenditures of the state financial assets in 1998–2014 (from 1998 to 2005 expenditures of National Property Fund)



Source: Report on the environment of the Czech Republic

4 Discussion

When long-term comparison of data from 2000, when the state budget expenditure amounted to 5.4 billion CZK, can be seen an unprecedented rise in 2010, when the final financial sum amounted to almost 18.5 billion CZK – released funds increased to nearly 3.5 times. A large portion of these expenditures are funds from the EU pre-accession funds, and since 2004 the Structural Funds, which serves primarily to offset the environmental situation in the Czech Republic with other developed EU countries. Significant increase in spending from the state budget

can be observed in 2006 and 2007, when the involvement of funds from European funds to the financing of environmental protection in the country. These funds were released in 2008 to the newly prepared programs in the field of environmental protection, which resulted in a significant annual decrease in these expenses. Since 2009, spending on environmental protection from the state budget is growing again, because of the use of funds for co-financing projects to protect the environment. In 2010 the state budget expenditures on environmental protection 18.5 billion CZK, this leads to a further increase compared to 2009 2 billion CZK. Regarding the municipalities within current expenditures represent the largest proportion (almost 19%) of expenditure on local government, they are spending on social affairs (15%) and are significant expenditures on environmental protection, which make up 7% and 60 % expenditure on waste management. The share of environmental capital expenditure is 3.1% (Provazníková, 2009). Public expenditures in the field of environmental protection are the important part of total public expenditures even in time of financial crisis their amount will not decrease notably, thanks to the active policy of European Union (Soukupova, 2010). International organizations already recognize the complexity of size and efficiency of public expenditures and their management to protect the environment. There have been formulated advices referred as "good practices" for the management of public expenditure (OECD, 2003). Morgenstern et. al (2001) shows that reported expenditures are often cited as an assessment of the burden of current regulatory efforts (the potential for both incidental savings and uncounted costs means that the actual burden could be either higher or lower than reported values). Fisher et al. (2003) found that there is no unambiguous case for preferring any of these policy instrument (depends on the costs of innovation, the extent to which innovations can be imitated, the slope and level of the marginal environmental benefit function and so on).

While economic changes and environmental legislation and investments rapidly reduced emissions of pollutants in the 1990s, environmental investment dropped sharply over the review period, falling from 2.5% of GDP in 1997 to 0.7% in 2002. This partially explains the lack of progress in reducing the high levels of pollution and energy intensity. Expenditure for pollution abatement and control (estimated at 1.3% of GDP in 2003) was expected to be increased to implement new legislation and EU-related commitments. Overall, EU accession requirements related to the environment are expected to necessitate EUR 9 billion between 2004 and 2010, with a large part for water issues. This is despite important support expected from the EU through the European Cohesion Fund and Structural Funds. It is therefore essential for the Czech Republic to improve the cost-effectiveness of its environmental policies. Recommendation: increase environmental expenditure to levels needed to implement the EU environmental acquis, including by use of revenues from economic instruments and EU financing (OECD 2005). On the other hand, public expenditure as the indicator is somewhat controversial because it does not reflect the current state of the environment and the level of care of it.

5 Conclusions

Expenditures on environmental protection from public budgets are an important indicator of the level of environmental protection, not separately, but together with other instruments of environmental protection. In relation to the expenditure of the state budget expenditures has amounted central government budgets of 3.0%. From the perspective of long-term development leads to an increase in spending, although with SEF can be expected to in the coming years and the stagnation of state financial assets even decline. In any case, the increasing tendency of spending has a positive impact on environmental protection in harmony the SEP. It can be statistically expected in 2015 the expenditure from state budget value 32 698.3 million CZK and in 2016 it can be expected 36 302.7 million CZK. Expenses for the removal of old environmental burdens were solved until 2005 through the National Property Fund and after the abolition through the state financial assets. It can be expected that expenditure will gradually decline.

It can be expected to achieve the level of expenditure from SEF 2.5 billion CZK in 2015 and 2.1 billion CZK in 2016. Expenditure for the removal of old environmental burdens gradually decline in the last five years. It can therefore be expected in the coming years, a slight drop in environmental expenditure from state financial assets until all of the funds tied in implementing agreements. In 2015 will fall drawdown to about 800 million CZK and in 2016 to about 500 million CZK.

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Density & Economy: Power of decision-making

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Abstract. The greater the impacts of our decisions, the greater the importance of the quality of our decisions. In the city governance impacts of decisions made by decision-makers are enormous. This paper describes the results of our preliminary research focused on the relationship between population density and building and running costs of the city. Our attention is directed at the level of city blocks. We consider three types of buildings – atrium blocks, row houses and single houses. The main aim of this article is to compare building and running costs of public spaces and the number of inhabitants using these public spaces. The differences between the building and running costs seem to be very big which can lead to a new attitude towards land use planning of our cities. The beginning is devoted also to the embedding of this issue more deeply into the field of evolution of complex systems and the key role of human decisions in this process.

Keywords: density, city, economy, decision-making, structure

1 Introduction

In a long history of human society the main three scientific branches – natural, human and theological sciences – have taken different directions. Each of their newly discovered pieces of knowledge and, of course, their former goals, too, have pushed them further and further apart. We need to appreciate the contemporary era when quantum physics has identified the immanent presence of the stochastic phenomenon in our world (e.g. Dirac 1982), human sciences have begun to use many analogies and evolutionary principles from the animate as well as inanimate nature (e.g. Giddens 2009, Harari 2013) and also leading personalities of various churches (Habdgood 1994, cited in Coveney & Highfield 1995) have admitted evolutionary principles in a similar way to those advocated by natural sciences. However, for this penetration we should not look only into marginal fields of these most fundamental branches of science. Not only the evolutionary process, the evolutionary point of view, alteration of chaos and order, seems to be an obvious interconnection in our complex knowledge of reality. Our ability (and also necessity) to decide is a similarly important connecting link. After all, what is the difference among a decision, a stochastic decision (physical transcendence) and the will (theological transcendence)? We consider this relatively wide domain – the decision making process, the governance of the city, land use planning – to be similar linking connections among the main branches of science. We are convinced that this approach can be of use not only to decision makers, planners and politicians but also to genuine scientists.

It is very difficult to find an adequate border between regulation and free evolution. The long-term discussion across almost all branches of science can be perceived as evidence of this (e.g. Haldane & Madorous 2012). Even in the realm of the city governance the same discussion has been led for many years. Thus, it is possible to find totally different precedent examples of successful cities some of which are subject to extreme types of regulation and others are not (e.g. Lindner 2016). From a static point of view, it is almost impossible to decide which direction is the right one and which one does not lead anywhere. Even if we consider uniqueness and individuality of each respective city. It is logical because cities are complex systems, complex organisms, cores of regions, cores of places of concentrated natural, human and societal energy, places with the immanent presence of bifurcation in the evolution process. The complexity of a city is a very influential factor even if our viewpoint is evolutionary and not static. To find a better choice in the city development within the decision making process, we need to overcome this complexity. The only solution is to use the opposite approach – simplicity and rigorous division of structures in our reality, in accordance with their time duration, importance and senescence.

Of course, we do not wish to describe all evolutionary structures in the lifecycle of a city. Hence we try in this article to use a point of view of one aspect of decision-making process – decisions in the field of land-use planning: How the structure of blocks and types of building can influence the building and running cost. Our goal is to find

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a simple and understandable relationship which can be finally used as a basement for city land use policy. We are convinced that our approach can serve also as a guideline for other researches in this field as well as for decision makers.

2 State of art: Evolutionary standpoint on city forming structures

Before we begin to apply our findings in a specific way, it is necessary to unify the terminology on the most elementary level. The evolution of all types of systems, from the simplest to very complex ones (e.g. social, geographical, economical), is, on one hand, relatively autonomous and, on the other hand, almost in every small step in the course of the process of evolution the stochastic decision takes place. As we have mentioned at the beginning, we can use the word "will" when trying to find the most general meaning. Moreover, this word does not sound badly when making decisions in complex socio-geographical systems. Similarly, regarding the knowledge of natural sciences where the ability of the matter to organize itself (self-organization) is arising, when the amount of energy/information flowing into the system exceeds the breakpoint, we can find the same principles in everyday human activities and decisions (Mitchell & Newman 2002). 30 years ago, famous researches in chemistry and biology termed it a "dissipative structure" (Prigogine & Stengers 1984). However, in the following text we are going to call it more generally, just "a structure" or, if you like, "an evolutionary structure".

These evolutionary structures could be logically categorized by their stability in time. Analogously, we can use the words "older" and "younger" or "newer", even though there is a little difference in the meanings. In the example from our reality, the concentration of people in cities, their need to share more and more means and institutions, is an older and a more stabilized structure than e.g. the choice of means of transport for commuting. Many research papers have been written on the means of transport and people´s choice of transport vehicles (e.g. Hudeček 2010) and it is easy to find practical examples of these measures in different European cities. On the contrary, it is very difficult to set some regulations against the concentration process of inhabitants and even though there did exist some ideas, the influence of these policy measures were usually short-termed and not so effective in the long run (Blažek & Uhlíř, 2011).

Another example of the stability of evolutionary structures which is also important for our research is a long-term aspect of the structure of the city. By the term "structure of the city" we mean localization of streets, public spaces and buildings. Frequent changes in the functions of buildings stand in opposition to this structure (Hnilička 2005, Koucký 2006). Houses were almost always built with a clear goal of their utilisation but because of economic cycles or changes in their ownership their use altered quite frequently. These days, hardly anyone knows where a blacksmith or a butcher were. The original houses have been reconstructed probably many times but very certainly there is some other building standing at the same place which respects the shape of the street and the same border of public spaces.

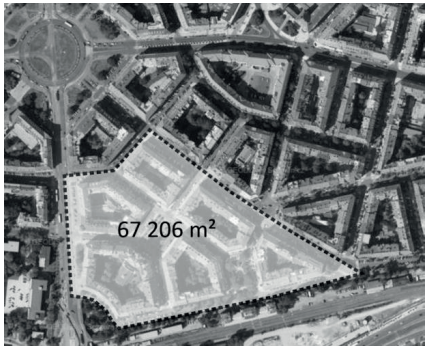
This division of structures resulting from the aspect of their stability has, outside of the theoretical framework, also extreme impacts on the city economy. In this sense, we want to quantify the impacts of the decisions of the city self-government. It makes a big difference whether the decisions on the level of the city council in the field of land use planning "attack" some sTable (stabilized, older) structure or some unsTable (newer, younger) structure. The main goal of this preliminary research described in this paper is the relationship between building and running costs of public spaces on one side and, on the other side, the population density, the number of inhabitants using these public spaces. We are not taking into account the impact of the "inner life" of the buildings/houses because their function is considered as a young and not sTable structure. UnsTable structures should be more left to their own natural evolution and stochastic processes. They are not fit for wide regulations or, if really necessary, only for small or general ones and preferably not on the level of the city government. Our attention is focused on more stabilized structures – the concentration process and population density (e.g. Hampl 1998). Moreover, there is a big advantage of the stability and its easiness of quantification.

The relationship between population density and costs per person is an old but not so frequent topic of scientific research papers (e.g. Janák 1929, cited in Hnídková 2009, Troger 2014). However, a related relationship between mobility of people and population density was calculated precisely almost 20 years ago and written down by Newman & Kenworthy (1999). While the population density oscillates around 30 inhabitants per hectare, the optimal means of transport used for serving the location is a car. Greater population density – more than 50 p/ha – allows in economic terms for the usage of public transport, buses. The authors say that if the city density is greater than 100 p/ha, the "city of short distances" arise and everyday moving around the inner city can be done on foot. This perspective is quite well founded on our division of evolutionary structures which we have described above. Now we are ready to go deeper into our specific issue and we can try to find, with the help of this approach, some better solutions for city decision-makers.

3 Relationship between population density and costs of public spaces

A common city quarter – Dejvice – in the sixth city district of Prague was chosen for our analysis. It is situated in the centre but not in the historical centre of the city of Prague. The well-known square, Vítězné náměstí, and its surroundings were planned and mostly built in the first half of the 20th century. The structure of city blocks, a common type of used urbanism, other characteristics like street line, compactness of houses, ecological suitability – the existence of two small local parks, all these aspects could be perceived as typical for the outer centre of Prague. Our chosen quarter is 67,206 m^2 large, out of which 25,273 m^2 are taken by the houses – atrium blocks. The rest of the quarter consists of public spaces which a) belong to the city, b) the city is responsible for their construction and maintenance, c) are divided into a park area and other public areas and streets. You can see the present structure of the blocks, streets and public spaces in Figure 1.

Figure 1: Selected quarter of the Dejvice district in the City of Prague



Source: Hnilička (2014)

Now, our approach has to be divided into two directions. Firstly, based on the data from Institute for Spatial Development (Šimková & Vlk 2015) and on the long-term work experience of authors (Hnilička 2014) have counted building and running costs which have to be covered by the city council for this quarter in accordance with the size of the area. The size of the space covered by infrastructure or parks and greenery were precisely measured with the use of the same sources and calculated on digital datasets of the City of Prague. Aggregate prices are logically resulting from the fact that fixed costs of the construction of sewerage or water pipes are almost the same, no matter how big the diameter of the pipes is. Running costs would show up anyway. In addition, the less densely populated area the smaller size of public spaces in comparison to the built-up area. We embodied this fact in this paper, too. We surely ignore some other details, however, the results described further in text justify our approach because the differences are too big to be influenced by these details. The estimation of total costs in 10 years is shown in Table 1.

Table 1: Estimated total costs

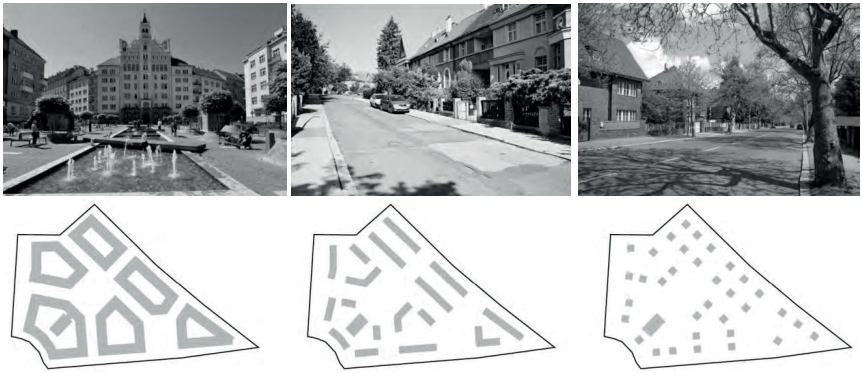
Building costs (CZK)		
streets + infrastructure	3,000 CZK/m^2	CZK 83,556,000
greenery	300 CZK/m^2	CZK 805,000
Total		CZK 84,361,500
Running costs (CZK)		
upkeep	25 CZK/m^2/yr	CZK 763,425
Total costs per 10 years (CZK)		
building costs	84,361,500/70 yrs	CZK 12,051,643
running costs	250 CZK/m^2/10 yrs	CZK 7,634,250
Total		CZK 19,685,893

Source: Hnilička (2014)

Secondly, in our quarter, we consider three types of buildings. Atrium blocks, semidetached houses which we call row houses and the less densely populated single houses. We could provide a long description of exact meanings of each of these categories but for the sake of simplicity these types of buildings are shown in Figure 2. On the left side there is displayed the actual state of the quarter. Our draft of distribution of row and single houses

is shown in the middle and on the right side of the Figure 2. We have left two small local parks in the quarter at the same place as they are in reality.

Figure 2: Types of houses



Source: Hnilička (2014)

The results of our analysis of the number of inhabitants and the population density are shown in Table 2. Last two lines of this Table show the difference between the total cost of the building and running costs in 10 years per person. As a reference, for comparison with other two categories in this value, we have chosen the category of atrium blocks. From the last line of the Table it is obvious that planning and constructing single houses consumes nearly four times more public expenditures that are necessary for building and running public spaces by the city. The two outer categories differ at least 15 times.

Table 2: Estimated total costs

	Atrium blocks	Row houses	Single houses
area (m^2)	67,206		
public spaces (m^2)	30,537		
built up area (m^2)	25,273	11,605	4,896
number of floors (m^2)	6	3	2
gross floor area (m^2)	151,638	34,815	9,792
number of inhabitants	2,166	497	140
density (pop./ha)	322	74	21
total cost per 10 Years (CZK)	19,685,893		
total cost per 10 Years per person (CZK)	9,088	39,581	140,728
ratio (Atrium blocks = 1)	1	4	15

Source: Hnilička (2014)

4 Conclusion and discussion

On a very simple yet a real example we have shown that if we changed the types of buildings in a city quarter with the size of 67,000 m^2, the city expenditures would be many times higher. And we should state we have omitted a lot of details which could surely diminish our results.

The differences between the building and running costs in our three categories of buildings are very big which inspires us to go deeper into this issue. If we prove our conclusions by using more detailed analyses, it can lead to a new attitude towards land use planning of our cities. The present state of art of the city land use planning is naturally formed by national laws and financial systems of shared taxes in respective regions. The only type of tax in the Czech Republic – property tax – is suggestible by the cities. Results of our preliminary research show that municipalities should be strongly motivated to increase their population density – in the centre or in all. If it is done e.g. by changing property tax into poll tax and clearer separation of municipal, regional and national taxes is a political question. Poll tax is reflecting, in a better way, the relationship between population density and city expenditures. We believe that our research brings not only a new piece of knowledge to improve the land use

planning in our cities, e.g. appropriate development of brownfields, but it will also trigger a discussion of the desirable change in the Czech legislation in the same field.

On the general level of our research it is apparent that awareness and articulation of structures in the evolution of complex systems can free the hands not just to researches but also to city planners and decision-makers. Such a problematic and complex issue can be thus split off into a binary decision process. Impacts of these decisions are quite easy to quantify and decision-makers can use them as a simple and intuitive tool. In the words of this paper, a good decision could save the public expenditure about 15 times in comparison to a bad decision. Municipalities should be so careful when allowing semidetached or single houses according to the future expenditures.

Of course, we can discuss a lot of other issues, as if greater density of a city and smaller expenditure per capita were not from the perspective of a different scale – region or country – at the same time the cause of bigger expenses on part of the whole unit. In complex systems everything is in a way connected to everything else. We are even convinced that not even this question should be preferred to the possibility of saving money during the planning and decision-making processes.

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Volatility of growth of public expenditures on education and its impact on economic growth

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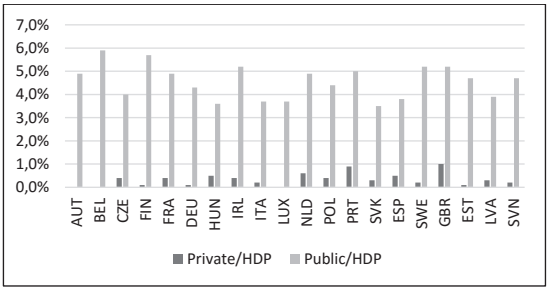
Abstract. The goal of this paper is to analyse whether a volatility of growth of public expenditures on education negatively influences economic growth. The analysis is done on new data for years 1995 – 2014 with cross-country regression on selected EU countries. This method revealed that aforementioned hypothesis is valid, and that variance of these expenditures inhibits growth of GDP. Therefore I suggest restrictions on random and short-term expenditures and recommend, contrariwise, long-term strategy and in advance planned changes in expenditures.
Keywords: cross-country regression, economic growth, education, EU, volatility.
JEL Classification: H52, I25

1 Introduction

Education as an activity increasing a stock of human capital is example of mixed good (Brown and Jackson, 1990). Therefore it can be financed either way from private, or public sources. The dominant source in European Union are public expenditures as we can see on Figure 1. Importance of education for economic growth is explained due to existence of the above-mentioned stock of human capital. Human capital positively affects economic growth (Lucas, 2015, Manuelli, and Seshadri, 2014), although opinions about the strengths of this relationship differ (Mokyr, 2013, Bils, and Klenow, 2000). But if we accept this positive relation, then the question is how a state can influence human capital? The answer is through education (Becker, 1993). And one of the ways for a state to change education is through financing system, a change of volume of resources.

Figure 1: Share of expenditures on education in 2012



Source: OECD (2016a, 2016b), own processing.

Increase in resources of publicly financed educational institutions (further only "institutions") is obviously a positive change for these subjects. Another option is decreasing resources which is negative for institutions. From the perspective of risk we can assume that the institutions are at the similar position as investors on a financial markets. Increasing in resources is the same as increasing in price of stocks (capital return), and vice versa (capital loss). Investor has two main options, first he or she can maximize return for given risk, or minimize risk for given return (Markowitz, 1952). If the institution is fully financed from public resources, its abilities to maximize "return" are limited. Therefore only possible option left is to minimize risk for given return (given by a state).

From this point of view the risk has only negative dimension. Mathematically it can be approximated as variance of change in public resources given to these institutions. But suppose that they can drive the risk only for outputs because only outputs are under their control. It means that institutions constrict their activities which may have negative effect on stock of human capital.

On macroeconomic level decrease in stock of human capital will decrease long-term economic growth. The possible transmission can be shown as: higher volatility of growth of public resources → lower activities of educational institutions → lower stock of human capital → lower GDP growth. And this is main hypothesis of this

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paper that the volatility (approximated as variance) of growth of public resources for education has negative impact on GDP growth.

The paper is divided into two parts. First part explains the methodology and used data from European Union countries in years 1995 - 2014. The second part shows with help of cross-country regression empirical evidence that main hypothesis is valid.

2 Methodology and data

Methodology was taken from Gong and Zou (2002). They did similar analyses on sample of 90 countries for years 1970-1994. For every variable was calculated its mean rate of growth (% change), and its variance of growth, for this period. Economic growth approximated as growth of GDP is dependent variable and from Gong and Zou (2002) we know that it can be expressed as equation (1).

$$\varphi = \varphi(\mu_{g1}, \mu_{g2}, \dots, \mu_{gn}, \sigma_{g1}^2, \sigma_{g2}^2, \dots, \sigma_{gn}^2, Z), \tag{1}$$

where φ = rate of economic growth,
μ_{gi} = mean growth rate of i-th item of public expenditures by their function where $(i = 1, \dots, n)$,
σ_{gi}^2 = variance of growth rate of the i-th item of public expenditures by their function where $(i = 1, \dots, n)$,
Z = other variables affecting growth.

Theoretical basics for equation (1) are shown in equations (2), (3), and (4). In equation (2) change of output in time can be split into two parts: deterministic and stochastic (Turnovsky, 1993). The deterministic component $f(k)$ is represented by the mean rate of output per unit of time. The stochastic component represents random effects which influence output. Equation (3) is telling us that this division on deterministic, and stochastic, components is also valid for governments (public) expenditures. More detailed and complete mathematic derivation of model is in Gong and Zou (2002), final equation is equation (4). The importance of equation (4) for this model is clear when we differentiate it with respect to σ_{gi}^2, respectively with respect to μ_{gi}. The results are again in Gong and Zou (2002), and in nutshell the derivative is positive when gamma is greater than one and negative when gamma is between zero and one.

$$dY = f(k)dt + h(k)dy, \tag{2}$$

where dY = change of output,
$f(k)dt$ = deterministic component (mean rate of output per unit of time),
$h(k)dy$ = stochastic component (stochastic shock).

For purposes of this paper it's important to interpret these conclusions that the overall effect of change of public expenditures and their volatility depends on elasticity of intertemporal substitution (inverse gamma). Lower elasticity of intertemporal substitution, and higher volatility of public expenditures, lead to increase in savings (decrease in consumption) and then to increase in investments. Finally it increases economic growth. On the contrary higher elasticity, and higher volatility, lead to decrease in economic growth. In a similar way it works for mean growth of public expenditures.

$$dg_i = \mu_{g_i} g_i dt + \sigma_{g_i} g_i dz, \tag{3}$$

where g_i = i-th government expenditures where $(i = 1, \dots, n)$,
μ_{g_i} = mean of the growth rate of i-th item of public expenditure where $(i = 1, \dots, n)$,
σ_{g_i} = volatility of the growth rate of the i-th item of public expenditure where $(i = 1, \dots, n)$.

What is valid for public expenditures is also valid for educational institutions. Higher volatility leads to decrease in investments which in case of these institutions lowers the stock of human capital, and at last it decreases long-term economic growth.

$$\varphi = E\frac{dw}{w} = \left[(1-\tau)An_k + r_b(1-n_k) - \frac{c}{w}\right], \tag{4}$$

where w = total wealth where $(w = capital\ stock + government\ bonds)$,
τ = rate of income tax,
A = constant where $(dY = Ak(dt + dy))$,
n_k, n_b = holding shares of capital and bonds where $(n_k + n_b = 1)$,
r_b = deterministic return on government bonds,
c = consumption where $\left(\frac{c}{w} = [\delta(1-\gamma)]^{-\frac{1}{\gamma}}\right)$.

Data are from three sources. The first one is database TED (Total Economic Database, 2015), where information about GDP were obtained (GDP is converted in Geary Khamis PPP). Next source is Eurostat (2016) for information about shares of each government expenditures on GDP according to COFOG (Classification of the Functions of Government) classification. The third source is OECD (Organisation for Economic Co-operation and Development, 2016c) for population numbers. These data are input variables in this empirical model. Summary is in Table 1. Every explanatory variable from Eurostat was recalculated for estimation. The taken percentage value of these expenditures was multiplied by GDP from TED to get adjusted absolute values for each year. In next step, the mean value of each variable was obtained as average of year on year ratios of calculated annual values for each variable. Finally, the variances are calculated for these annual means values.

Table 1: Variables and theirs abbreviations in the model

Variable name	**Model (mean, variance)**	**Source**
Gross domestic product per capita,	GrowthMean,	TED, OECD,
General public services,	GenMean, GenVar,	Eurostat,
Defence,	DefMean, DefVar,	Eurostat,
Public order and safety,	PubMean, PubVar,	Eurostat,
Economic affairs,	EcoMean, EcoVar,	Eurostat,
Environmental protection,	EnviMean, EnviVar,	Eurostat,
Housing and community amenities,	HousMean, HousVar,	Eurostat,
Health,	HealMean, HealVar,	Eurostat,
Recreation, culture and religion,	RecMean, RecVar,	Eurostat,
Education,	EduMean, EduVar,	Eurostat,
Social protection,	SocMean, SocVar,	Eurostat,
Population,	Pop,	OECD,
GDP in 1995,	GDPinit,	TED.

Source: TED (2015), Eurostat (2016), OECD (2016c), own processing.

Data coverages years 1995 – 2014 and concerns these countries: Belgium, Bulgaria, Czech republic, Denmark, Germany, Estonia, Ireland, Spain, France, Italy, Latvia, Lithuania, Luxembourg, Hungary, Malta, Netherland, Austria, Portugal, Romania, Slovakia, Finland, Sweden, United Kingdom, and Norway. The rest of countries from European Union were discarded for missing data for more than 3 years. Countries with missing data up to three years were included (Bulgaria is missing 3 years, United Kingdom 2 years, and Norway 1 year), and their missing values were replaced by average value of the rest of their values.

3 Empirical Evidence

For empirical analysis was chosen cross-section regression, specifically cross-country regression. It is straightforward linear model as can be seen on equation (5).

$$\varphi = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_{n-1} X_{n-1} + \beta_n X_n + u, \qquad (5)$$

where φ = rate of economic growth,
X_i = value of i-th variable from Table 1 where $(i = 1, \ldots, n)$,
β_i = parameter to estimate where $(i = 1, \ldots, n)$,
u = other factors.

The result of first estimation are in Table 2. We can see that the coefficient for volatility is negative which supports the hypothesis about negative influence of volatility of public expenditures on education growth on economic growth, but it must be stressed that statistically the results are insignificant as can be seen due to T-test and F-test. For the both tests the p-values of all variables are higher than 5 %, which is level of significance, hence the zero hypothesis is not rejected. Therefore, with backward selection was estimated statistically significant model in Table 3. In each step variable with the highest p-value (lower t-ratio) was removed, until the model was significant. Then the removed variables were one by one again included into the model and tested.

Table 2: OLS1, dependent variable: GrowthMean

Variables	Coefficient	Std. Error	t-ratio	p-value
const	0.0177712	0.0433239	0.4102	0.7522
DefMean	0.189742	0.359333	0.5280	0.6907
DefVar	0.0883236	0.631245	0.1399	0.9115
EcoMean	0.006325	0.560934	0.0113	0.9928
EcoVar	−0.00691779	0.105005	−0.0659	0.9581
EduMean	0.669129	0.584971	1.1439	0.4573
EduVar	−1.95594	4.2471	−0.4605	0.7252
EnviMean	0.00406899	0.0955266	0.0426	0.9729
EnviVar	0.00903861	0.0481047	0.1879	0.8818
GenMean	−0.13324	1.81678	−0.0733	0.9534
GenVar	0.0118675	0.517237	0.0229	0.9854
HealMean	0.313479	1.28635	0.2437	0.8478
HealVar	−0.576219	4.31492	−0.1335	0.9155
HousMean	0.11978	0.186056	0.6438	0.6359
HousVar	−0.0330108	0.1009	−0.3272	0.7987
Pop	−0.873107	1.85116	−0.4717	0.7194
PubMean	−0.416286	1.12105	−0.3713	0.7736
PubVar	0.295237	0.292808	1.0083	0.4974
RecMean	−0.262892	0.303741	−0.8655	0.5458
RecVar	0.171166	2.20088	0.0778	0.9506
SocMean	0.123566	1.85419	0.0666	0.9576
SocVar	1.69255	4.69463	0.3605	0.7797
GDPinit	−4.01773e-07	1.1556e-06	−0.3477	0.7870
R-squared	0.995978		Adjusted R	0.907500
F(22, 1)	11.25673		p-value	0.231541

Source: TED (2015), Eurostat (2016), OECD (2016c), own estimations by GRETL.

Table 3 on next page shows final estimation where all important tests are satisfied. All variables in Table 3 are statistically important on 5 % level of significance (Wooldridge, 2006). T-test rejects null hypothesis that independent variables have zero effect on economic growth. F-test confirms significance of model. Determination coefficient is above 90 % but for this type of analysis it's not important value. White's test does not reject null hypothesis about presence of homoscedasticity, and also residual normality test doesn't reject null hypothesis about normal distribution of residuals. For model in Table 2 with higher number of inputs the collinearity is typical problem. In case of model in Table 3 the collinearity is low. This information is obtained from VIF (Variance Inflation Factor). For each variable from model applies VIF lower than 10 which is critical value, while the highest value of VIF is for volatility of social expenditures where VIF is equal to 2,569.

$$\widehat{GrowthMean} = 0{,}009 + 0{,}190 \times DefMean + 0{,}442 \times EduMean - 0{,}448 \times EduVar - 0{,}890 \times Pop + 1{,}39 \times SocVar. \quad (6)$$

Results from Table 3 can be rewritten as equation (6). We can also see positive effect of expenditures on defence, and expenditures on education, negative effect of population growth, and surprisingly positive effect of variance of social protection expenditures. This can be explained by character of expenditures recipients (different behaviour) and therefore different intertemporal substitution. But this question is for another paper. Relatively high estimated coefficient for this variable and also relatively high overall determination coefficient can be explained by this variable. It probably holds more information than only about variance of social protection expenditures. In another words that it is correlated with never in model included variables.

Table 3: OLS2, dependent variable: GrowthMean

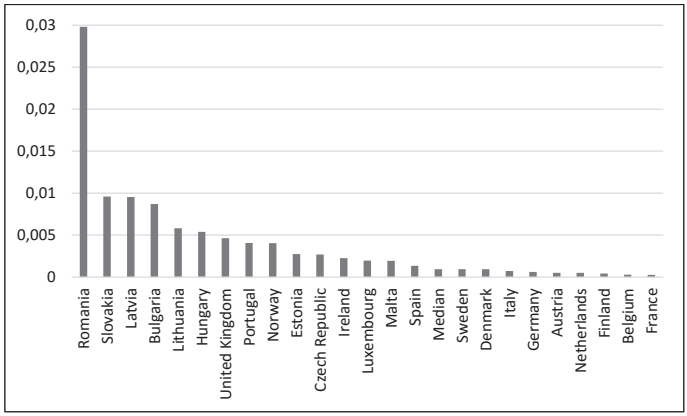
Variables	Coefficient	Std. Error	t-ratio	p-value	
const	0.00930085	0.0023932	3.8864	0.0011	***
DefMean	0.190309	0.0621672	3.0612	0.0067	***
EduMean	0.441696	0.116242	3.7998	0.0013	***
EduVar	−0.448484	0.205855	−2.1786	0.0429	**
Pop	−0.88964	0.18557	−4.7941	0.0001	***
SocVar	1.39128	0.555285	2.5055	0.0221	**
R-squared	0.923265		Adjusted R	0.901950	
F(5, 18)	43.31466		p-value	2.04e-09	
White's test	22.7467		p-value	0.301402	
Test for normality	1.56992		p-value	0.456137	

Source: TED (2015), Eurostat (2016), OECD (2016c), own estimations by GRETL.

4 Conclusion

The goal of this paper was to verify hypothesis whether volatility of education public expenditures inhibits the economic growth. Junction between both variables is possible to find in stock of human capital, which has positive effect on growth generally represented by growth of GDP, and education is one of the means how the stock of human capital can be increased. Empirical analysis in this article confirms hypothesis that the volatility of education public expenditures lowers growth of GDP. Gong and Zou (2002) achieved the same result for this variable in their paper.

Figure 2 Variance of public expenditures on education in EU (1995 – 2014)



Source: TED (2015), Eurostat (2016), own processing.

From this point of view it's necessary to recommend keep the lowest possible volatility of these expenditures. On Figure 2 is displayed variance of public expenditures on education in countries from EU. The Czech Republic is the fifth country above the median value. So from this comparison we can see that there is a space to lower the value. Of course it would be nonsense, if we did not change public expenditures on education at all. On the contrary from empirical part of this paper we know that there is positive relation between GDP growth and mean growth of these expenditures. So positive changes can be helpful, but they have to be connected with long-term strategies which enable educational institutions these changes predict, count on them, and therefore effectively work with them. If these conditions are not met, the changes are short-term, and random, then they are risky for institutions and therefore have negative impact. Restriction of this risk and its change into positive factor should be a goal for political representation, if the ultimate goal is the economic growth.

At the end of the paper, it has to be said that this conclusion is not definitive. There are at least two important things that must be mentioned. Firstly, in case of educational institutions the elasticity of intertemporal substitution (inverse gamma) is not important. Effect of higher elasticity is clear. Effect of lower elasticity means that the

consumption is lower, this means for educational institution lower activity and hence lower human capital and lower product growth. In other words, for education institutions there is no difference between consumption and investment. Therefore, the analytical model presented in the paper needs to be adjusted for this specificity. Secondly, the reverse causality is also possible. That the countries with lower mean growth rate of GDP have higher volatility of educational expenditures. But interpretation of this causality is not easier. For that reason, we stick to our hypothesis.

Aknowledgements

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Risk and risk management in public services delivery: a Slovak case study

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Abstract. This paper is focused on range of approaches to risk in innovation in public services in the field of healthcare. By using qualitative analysis it identifies and evaluates current approaches for relevant stakeholders to engage in discussions about levels of risk for public service innovation in mental healthcare. The goal of this paper is to present the partial analysis of an international research project on risk definition and risk management in public services delivery in Slovak republic. Results indicate that mental healthcare innovations are rather limited and most innovations are based in non-profit non-governmental sector as an alternative public services provider.
Keywords: Risk. Risk management. Public service. Mental healthcare.
JEL Classification: H41, I18

1 Introduction

Apart from Brown and Osborne work (2013) on risk and innovation in public services, there is a lack of current literature that would adequately deal with risk and its role in public service and innovations in public services delivery. Yet, it is undoubtedly clear, that more attention should be paid to the risks in public sector as it is funded with public finance and by appropriate risk management the public sector should aim to minimalize potential losses. Harman (1994) and Vincent (1996) point out the negative impact of risk management on public sector accountability, or stress that public sector activities are carefully watched which leads to increased risk management as a means of avoiding the blame of other officials and the wider public. Bhatta (2003), Wolak-Tuzimek & Duda (2014) and Michalski (2014) argue that success, unlike in the private sector, cannot be judged "on average": even if the majority of a public organization's service decisions turn out to be beneficial and successful, there is still little tolerance for any sort of even occasional 'failure'.

Therefore we focus on risk management in public services provided by both public and non-governmental organizations. The goal of the paper is to present the partial analysis of an international research project LIPSE (Learning from Innovation in Public Sector Environments) on risk definition and risk management in public services delivery in Slovak republic.

2 Theoretical and methodological framework

The main risk management tool in public policy is regulation at a high level (Hood and Nicholl, 2002). Risk management follows a top-down direction. It encompasses technocratic and rule/regulation-driven risk management set at a higher policy-level (Table 1). Standards of behavior are set and guide actions at the implementing organizations. This provides a higher level of standardization in how risks are managed, but also leaves little room for personal decisions and risk evaluations at implementation level. This is so called hard risk management.

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Table 1: A typology of risk approaches

Type of Risk Approach/Innovation	Technocratic Risk Management	Decisionistic Risk Management	Risk Governance
Evolutionary	X	X	X
Expansionary	---	X	X
Total	---	---	X

Source: Fleming, Osborne et al., 2015.

Technocratic risk management is based on the minimization of risk through expert decision-making. Risk, in this view, can be defined objectively and minimized through scientific evidence but the flaw of this view is that risk is more often socially constructed than it is objectively defined. Decisionistic risk management extends technocratic risk management by including into the process the possibility of discourse on the evaluation of identifiable risks. On the other hand decisionistic risk management is still limited to politicians, excluding a vast number of other stakeholders. This leads to a limited point of view from which risk is being analyzed. Transparent risk governance is the core of a genuine engagement with the nature, perceptions and contested benefits of risk in complex situations; it includes all key stakeholders and uses help of information and communication technologies to connect stakeholders in public services (Brown and Osborne, 2013).

The LIPSE research project focuses on studying social innovations in the public sector and consists of 7 work packages (WPs). One of the packages, WP4 aims to identify the current range of approaches to risk in innovation in public services across European countries in two policy sectors (mental healthcare and environment). The goal of the paper, as already mentioned, is to present the partial analysis of an international research project on risk definition and risk management in public services delivery in Slovak republic. Partial due to the fact that we present only analysis for Slovakia (the complete comparison of four European Union countries can publish only the research project leader) and we focus on one of the analyzed area and that is the mental healthcare.

The methodology of study is fully consistent with the LIPSE research project methodology as set by the WP 4 research leader, University of Edinburgh. In mental health, the risks involve vulnerable adults, and directly focus on people. It is also a field where risks and benefits are invariably contested among users, citizens and professional groupings. This makes risk management a vital aspect in any innovation. The research analysis aims to provide a representative sample of different types of risk and risk approaches across state systems and societies, in the paper we present only risk definition and approaches to its management in Slovakia.

The following three variables have been identified through the literature review as most important in terms of providing a range of variation across the selected cases:

- **Risk Locus** - mental health services address vulnerable user groups. There is thus a clear risk to service users, which, in many cases, extends to service staff. Environmental sustainability poses operational risks mostly on the level of the wider community and the environment. Both share common traits of financial, reputational, and political risks.
- **Risk Timing** - whereas mental health services deal with the status quo of patients and evoke more immediate risks, environmental sustainability projects often work on a far longer timeframe. This increases risk as uncertainty of outcomes and is likely to affect both reputational and financial risks for environmental sustainability organisations.
- **Organisational/Operational Differences** - whereas mental health services are mostly embedded into a network of statutory bodies, in environmental sustainability area single issue groups and private sector actors are often taking the lead. There is also an increasing commercialisation in operation that again translates into risk potential at the level of, amongst others, an organisation's reputation (Flemig, Osborne et al., 2015).

A multi-method research design was adopted. We identified 10 case studies in the mental healthcare (MHC) policy area. We have followed a case study where all types of involved stakeholders were interviewed (10 respondents per case, i.e. 100 interviews) in following institutions:

- Two public MHC hospitals.
- Two non-profit organisations active in MHC.
- Two public mental departments at regional hospital.
- Four private specialist medical practitioners' surgeries as MHC establishments (in a private ownership with public financing via health insurance).

Stakeholders were interviewed using a semi-structured interview protocol containing both open (inductive) and closed (deductive) questions. The size and structure of key stakeholders are in Table 2. We achieved 100 % response rate because we used a direct approach, the research team in Slovakia visited all abovementioned

institutions and the selection of respondents was based on the following principle (the final structure of respondents is characterised by the Table 3):

- Top managers.
- Medical doctors.
- Nurses (not in NGOs).
- Other stakeholders – patients, local public administration, citizen.

Table 2: Size and structure of key stakeholders in case studies

Area	Type of Organization	No employees (0)	Grassroots (1-5 employees)	Small (6-20 employees)	Medium (21-50 employees)	Large (51+ employees)	Unspecified
MHC	Public Sector	0	0	0	2	2	0
	Non-Profit	0	5	1	0	0	0

Source: Authors.

Table 3: Final structure of respondents

Role in Organization	Number of Responses
Management positions	11
Employee positions (doctors and nurses)	39
Clients	18
Citizen	17
Municipal hall	4
Other	11
Total	100

Source: Authors.

The document analysis was conducted in parallel to both survey and case study analyses. It entailed national policy documents relating to the MHC policy area as well as internal documents on the respondents, such as websites, brochures, or sector guides. At the stage of the case study analyses, some case study partners also provided internal documents regarding risk management practices.

3 Research results and discussion

In the first phase, the respondents were asked to identify recent innovations that have taken place in their organisations. Only two types of innovations are mentioned in questionnaires:

- New treatment methods and new drugs – this is dominant answer from professional staff (almost 100% of interviewed doctors mentioned this).
- Improved organizational quality of care (reconstructions, patient's management – especially the possibility to be appointed for concrete time (this is dominant answer by patients).

The answers indicate that the innovation potential in the Slovak mental healthcare is rather limited. Many respondents, including staff in management positions, were not able to mention any innovation realised during recent years. And the most frequently mentioned innovation, new drugs and treatment methods, is not so much innovation from the point of view of modern MHC. The focus should not be on new and more expensive treatment, but integration and de-stigmatisation.

Concerning the risk definition in general and risks connected with innovations, from all responses two types of risks dominate: aggressive patient and financial risks.

The issue of aggressive patient is the core problem for public MHC hospitals. They have to serve not only the patients recommended for treatment from general practitioner (GP) or specialist medical practitioners, but also the criminals with ordered MHC treatment. Both management and staff are very afraid of these groups of patients that are more dangerous.

Financial risks are mentioned by all organisations involved in the research. This type of risk is dominant for non-profit ambulatory MHC care. Usually, the doctors are owners of their offices which shall be self-financed on the base of health insurance companies' payments (direct cash payments in MHC are very rare). For health insurance companies MHC ambulatory care is low priority (there are some studies showing very low share of MHC expenditures on total health care expenditures in Slovakia – for example Scheffler and Potucek, 2008) and

specialist medical practitioners' surgeries have real problems with strict regulations. Also patients mentioned that in many cases they cannot get some drugs because insurance companies do not pay for them. Financial risks are not so crucial for MHC hospital and MHC specialist medical practitioners' surgeries in public hospitals, because of "soft-budgetary constraints" (Bjorkman and Nemec, 2013) - the state always saves them from bankruptcy.

Few other types of risks were mentioned – escape of a patient, self-damage (both patient and staff), lack of qualified staff, but also some non-relevant answers. The structure of answers is characterized by the Tables 4-7.

Table 4: Structure of risks according to the type of organization (number of answers)

Type of Organization	Direct Risk to Service Users	Risk to Service Staff	Risk to Organization	Risk to wider community
Public Sector	19	19	25	11
Non-Profit	31	11	26	9

Source: Authors.

Table 5: Structure of risks according to the type of respondent (number of answers)

Role in Organization	Direct Risk to Service Users	Risk to Service Staff	Risk to Organization	Risk to wider community
Management positions	8	6	9	1
Employee positions (doctors and nurses)	23	22	23	12
Clients	17	1	0	1
Citizen	3	2	6	3
Municipal hall	2	0	0	1
Other	2	1	6	2

Source: Authors.

Table 6: Ranking types of risk (opinion of respondents)

Type of Organization	Direct Risk to Service Users	Risk to Service Staff	Risk to Organization	Risk to wider community
Public Sector	1st	2nd	3rd	4th
Non-Profit	1st	3rd	2nd	4th

Source: Authors.

The most important fact it that respondents did not see any real link between risks and innovations (innovations are rather scarce and risk management is not institutionalized). Also, all responses clearly document the non-existence of systemic ex-ante risk management for general risks. The structure of responses to this question is presented in the Table 7.

Table 7: Responses to the question: "In my line of work/organization there are systems in place to identify any risks involved in innovative service development."

Type of Organization	Agree	Disagree	Don't Know/NA
Public Sector	5	6	30
Non-Profit	7	0	11

Source: Authors.

The results concerning the issue of ex-ante risk management are slightly better in some institutions, e.g. the most progressive Slovak MHC hospital in Hronovce. Thanks to navigation from our side, one concrete ex-ante risk management tool was identified in Hronovce: the hospital uses standard templates to assess risks connected with work therapy and other progressive therapies for each patient involved. The hospital also indicated that they are aware about this weakness and plan to develop risk management system as the part of their application for new ISO certificate.

The paper indicates in mental healthcare, the innovations are rather limited and most innovations are based in non-profit non-governmental sector (so called third sector). The main findings for this policy field are as follows:

- Rather limited innovativeness in the Slovak mental health care: almost all responses from MHC inpatient and outpatient care establishments were similar – "we use new drugs and treatments". Only in the second phase, during detailed interviews, other important innovations were also mentioned (with focus on

integration and not treatment). This situation indicates that "formal" MHC sector is rather conservative and motivated to treat, not to integrate.

- The core initiators of important MHC innovations in Slovakia are semi-external non-governmental organisations – and all of them have large funding problems to maintain existing activities.
- Already general risk management is almost absent in MHC system in Slovakia (only one most progressive MHC hospital plans to start to implement systemic risk management from 2016 as the part of adaptation to new ISO norm). The risk management of innovations is "terra incognita". Formal establishment do not deliver innovations and do not have risk management systems, NGOs may propose innovations, but do not have internal capacities for risk management implementation (e.g. see Osborne 1998, Vaceková, 2013).

4 Conclusion

Findings suggest that innovation in mental health is largely a top-down process, i.e. innovation impulses are set by central governments and/or national organisations, such as insurance providers (with the exception of specific activities by non-profits, outside of the main system).

Respondents mostly struggled to define risk in their work context (and sometimes even to identify specific examples of innovations), managerial staff was far more likely to be aware of risk and risk approaches, e.g. reputational risks to the organisation, actuarial/financial risks, regulatory/bureaucratic risks (such as failure to report or a change in the existing regulatory environment). The latter is connected with risks based on public funding when with use of public finance some also public control and many regulations.

As for the risk management, almost all responses clearly document the non-existence of systemic ex-ante risk management for general risks (so also ex-ante risk management for innovations does not exist). There was only one concrete ex-ante risk management tool (use of standard templates to assess risks connected with work therapy and other progressive therapies for each patient involved). For all respondents, the biggest barrier to implement any system lies in the limited capacity - both financial and human capacities constraints disable to adapt an approach for risk management.

Organizations are mostly stuck at the level of decisionistic risk governance: trying to involve various stakeholders and deliberate the risk management process, but at the moment it almost impossible to address uncertainty as opposed to risks that can be identified ex ante. Given the current state of risk perceptions and approaches, organisations have trouble addressing risk as a strategic component and almost entirely disregard uncertainty, describing it as unable to plan in their actions.

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Public Procurement Market and the Municipal Waste Management

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Abstract. Public procurement market behaves differently in various sectors. Special case is public procurement market in the municipal waste management, because there is relatively small number of firms and the supply side has rather oligopolistic structure. Additionally, we can find here significant evidence of regional monopolies, which are often supported by ownership of important capital goods - landfills. The result is that the number of bids in the tenders is very limited, which does not bring enough pressure on the tendered prices and thus negatively affects budgets, especially in small municipalities.

The paper presents the first results of the analysis of a large sample of contracts for municipal waste collection awarded in the period of 2005-2014 (more than 400 observations). The results of our calculation show, that the situation in the regions is very far from perfect competition. For example, three major companies have on average more than 80% of the market in each region and in only three regions hold at least 10% more than three companies. Moreover, the intensity of the competitive effect is significantly higher than in other procurement markets.

Keywords: Czech Republic, Municipalities, Public Procurement, Waste Management.

JEL Classification: H57, Q53.

1 Introduction

Public procurement market behaves differently in various sectors. Special case is public procurement market in the municipal waste management, because there is relatively small number of firms and the supply side has rather oligopolistic structure. Additionally, we can find here significant evidence of regional monopolies, which are often supported by ownership of important capital goods - landfills. The result is that the number of bids in the tenders is very limited, which does not bring enough pressure on the tendered prices and thus negatively affects budgets, especially in small municipalities.

The main aim of the article is to analyze the market concentration in the public procurement market in the field of municipal waste management. Another aim is to analyze the degree of competition on the supply side and to estimate the intensity of competitive effect. The analysis is performed on a data sample, which contains the information about the contracts for municipal waste collection awarded in the period of 2005-2014 (more than 400 observations).

2 Current state of knowledge

The issue of the influence of the rate of competition on the efficiency of public service delivery at the local level (including waste management) is addressed in numerous works. It is possible to mention for example Bel and Warner (2008), Meričkova-Mikusova et al. (2014) or Soukopova and Ficek (2015). These studies identified that the competition is one of the most significant factors influencing the efficiency and the cost of service delivery. Moreover, the competition prevents the exploitation of the dominance on the market and represents important background for the benchmarking of prices and service quality between municipalities. The role of competition in waste management is deeply discussed in OECD publications (1999, 2006), which highlight especially the problem of collusive cartels and the need to choose the correct procurement method.

Important role in the results of individual procurement procedures plays the intensity of competition in the individual tenders approximated by number of bids submitted. It is documented in a series of papers (e.g. Kuhlman and Johnson, 1983, Li and Zheng, 2006), which are dealing with so-called competitive effect (indirect relationship between the number of bids submitted and prices tendered).

3 Source data

The data used in our analyses are based on the information, which contains the Information System on Public Contracts (www.isvz.cz). We work with the information about the results of the tenders for services in the field of

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municipal waste management. The sample has 416 contracts awarded in the period of June 2005 - October 2014. The total volume of the analyzed contracts is CZK 10.8 billion without VAT. However, it is important to note that the Information System on Public Contracts doesn´t contain the information about the so-called small scale contracts, this means contracts with the estimated prices lower than CZK 2 mil. The reason is that they are not regulated by the Public Procurement Law. It must be mention that these small contracts create important part of the total municipal waste management market, which can be documented by the total amount of public expenditure allocated on the municipal waste management which is every year around CZK 8 billion with VAT. The analysis thus covers in particular the situation in the larger municipalities.

4 The intensity of market concentration and the impact on the number of bids submitted

As mentioned in the introductory chapter, the procurement market in the area of municipal waste management shows significant signs of regional monopolies. This is confirmed by the data presented in the following Table, where the individual regions are characterized by few indicators that are related to the intensity of market concentration. The first is the biggest market share, the second sum of the three largest market shares and, finally, the third is the number of companies with at least 10% market share. Data show that the Karlovy Vary Region and Prague are dominated almost exclusively by one company (share of around 90%) and in Liberec and Olomouc Region the biggest company operated significantly more than 50% of the market. The degree of market concentration is more obvious when looking at the other two indicators. Three major companies have on average more than 80% of the market in each region and in only three regions hold at least 10% more than three companies.

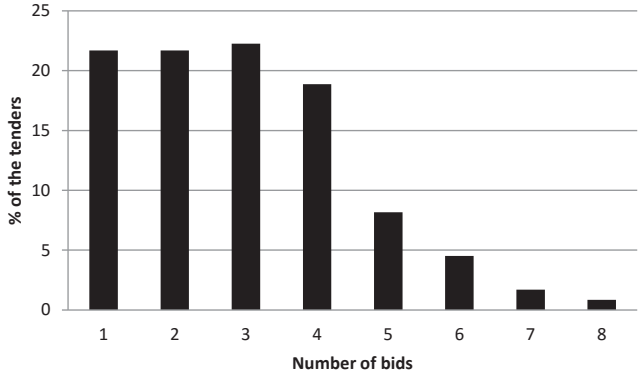
The above strong market concentration clearly indicates the oligopolistic structure of the sector. All this is reflected, for example, in the low number of the bids in the public tenders where the mean (after exclusion of non-competition methods) is only 3. Moreover the presented histogram shows that the share of contracts awarded on the basis of one or two bids is almost 45%.

Table 1: Main Indicators Describing the Situation in the Czech Regions

Region	Average number of bids	Ratio between the tendered price and the estimated price	The largest market share	Sum of the three largest market shares	Number of companies with at least 10% of market share
Central Bohemian	**2.9**	**0.88**	**33.1**	**75.6**	**2**
Hradec Kralove	**2.1**	**1.04**	**49.9**	**79.3**	**3**
Karlovy Vary	**2.9**	**0.87**	**89.8**	**97.1**	**1**
Liberec	**2.5**	**1.14**	**79.0**	**96.4**	**1**
Moravian-Silesian	**3.7**	**0.82**	**36.1**	**72.6**	**3**
Olomouc	**3.0**	**0.79**	**61.9**	**97.8**	**2**
Pardubice	**2.6**	**0.95**	**26.9**	**64.9**	**4**
Plzen	**3.8**	**0.92**	**47.4**	**84.4**	**4**
Prague	**2.3**	**0.94**	**94.6**	**97.2**	**1**
South Bohemian	**2.6**	**0.94**	**46.8**	**81.1**	**3**
South Moravian	**4.5**	**0.84**	**47.8**	**76.5**	**4**
Usti	**2.6**	**0.93**	**37.7**	**83.5**	**2**
Vysocina	**4.3**	**0.73**	**53.9**	**86.0**	**3**
Zlin	**3.3**	**0.75**	**28.0**	**62.2**	**3**

Source: ISVZ, own calculation.

Figure 1: Distribution of the Number of Bids Submitted



Source: ISVZ.

Low number of the bids is of course also reflected in the tendered prices, because in the logic of the competitive effect there is no sufficiently pressure on the supply side. Tendered prices reached in average 90% of expected prices, while in a number of regions it is close to 100%. The link between indicators of market concentration, the number of bids and procurement procedures results are shown in the following Table containing the values of correlation coefficients. In line with expectations, the market concentration indicators show positive correlation with the results of public tenders and negative with the average number of bids submitted.

Table 2: Correlations between the Main Indicators

Number of bids	Ratio between the tendered price and the estimated price	The largest market share	Sum of the three largest market shares	Number of companies with at least 10% market share	
1.0000	-0.6699	-0.2568	-0.2151	0.5237	Number of bids
	1.0000	0.2841	0.2503	-0.2748	Ratio between the tendered price and the estimated price
		1.0000	0.8868	-0.7244	The largest market share
			1.0000	-0.7084	Sum of the three largest market shares
				1.0000	Number of companies with at least 10% market share

Source: Own calculation.

5 The intensity of market concentration and the impact on the number of bids submitted

Beyond the degree of market concentration, which is reflected in the low number of the bids, it is also necessary to deal with the intensity of competitive effects, i.e. how big is the reduction of the price, where there is another additional bid. For the estimation we have created regression model, which construction is similar to the model used in the papers which have dealt with the same problem but in different sectors (e.g. Kuhlman and Johnson, 1983 or Li and Zheng, 2006). The descriptive statistics of the data used are shown in the following Table.

Table 3: Descriptive Statistics of Main Non-Binary Variables

Variable	Mean	Median	Min	Max	Standard deviation
Ratio between the tendered price and the estimated price	0.9	1.0	0.1	2.1	0.3
Trend	2632.8	2913.0	379.0	3995.0	1008.4
Bids	3.0	3.0	1.0	13.0	1.7

Source: Own calculation.

Diagnostic tests relating to fulfilment of condition of the least squares method were performed in accordance with the recommendations presented in Wooldridge (2009). Besides economic variables such as the number of bids submitted, we work with the variable of trend, which takes into account the price development in the sector during the relatively long period and with dummy variables related to individual regions. The variable trend takes the value of one in case of contracts awarded in July 2004 and with each passing month is increased by one.

The model was due to problems with heteroscedasticity estimated by the method of weighted least squares, where the weight was the number of bids submitted. Results of reduced model, where they are left only statistically significant regression coefficients, are presented in the following Table.

Table 4: Regression Model, Dependent Variable is Ratio between Tendered Price and Estimated Price

	Coefficient	Standard deviation	p-value	
Const.	1.0426	0,1076	<0,0001	***
Bids	-0.1414	0,0216	<0,0001	***
$Bids^2$	0.0141	0,0019	<0,0001	***
Trend	0.0002	8,3356e-05	0,0276	**
$Trend^2$	-5.0036e-08	1,7687e-08	0,0049	***
Plzen (binary)	0.0926	0,0470	0,0498	**
Hradec Kralove (binary)	0.1424	0,0699	0,0425	**
F test (p-value)	1.83e-16			
Adj R2	0.2049			

Source: Own calculation.

The estimated regression coefficients indicate that the intensity of the competitive effect is quite strong, but gradually fades. Reduction of the tendered price in the case of the second bid is on average 10% of predicted price, while in the case of third bid it is 7%, and finally in the case of fourth bid it is 4.2%. This is significantly more than for example in the construction works (see Pavel, 2010), where the average is 3.3 % of predicted price. Polynomial form identified in the case of variable trend indicates that up to February 2009 prices across the sector grew and then probably in connection with the economic crisis began to fall. Regression model indicates as well, that substantially higher are prices in the Hradec Kralove Region and Plzen region, where the tendered prices are higher of 14, respectively 9 pp. Regression coefficients for other regions proved to be statistically insignificant.

6 Conclusions

Preliminary analysis of data confirms the high market concentration in the sector of municipal waste management, which is reflected in the low number of the bids submitted. The situation in the Czech regions clearly shows oligopolistic structure, which does not bring enough pressure on prices. This is confirmed by the relatively high value of the intensity of competitive effect especially in comparison with the sector of construction works (moreover there is also substantially greater competition).

The above presented findings should be further developed. Notably the regression model, where, because there are known the winners of each tender, will be possible in the future to analyze possible differences in the prices of individual suppliers. Furthermore, it seems appropriate to link this information with the data from public budgets and to analyze the impact on the per capita costs in individual municipalities. These are, however, issues that go beyond the scope of this paper.

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The Czech Military Expenditures as a Government Failure, a Social Problem, and Cultural Conflict within 1993-2016

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Abstract. The Czech Republic joined the NATO PfP Program in 1994 and later on, in 1999, it became a NATO member. In order to prevent NATO from free riding as well as to ensure convergence in military capabilities, each NATO country ought to spend on defence 2% GDP at least. However, that has never happened. In 2016, the Czech military expenditures ware only 1% GDP. The goal of this article is to explain such development by cultural theory of budgeting, so the article deals with the evolution of the Czech military expenditures as a government failure, a social problem and a cultural conflict emerging in the last 20 years. An explanation is provided why more than ten Czech governments have not yet coped successfully with the problem of a raise of military spending required by NATO. In fact, this failure was caused by: (i) interference of political cycle with budgetary one, (ii) inferior quality of defence ministers as fiscal agents in comparison with the finance ministers as the fiscal principals, and (iii) plentiful changes of governments. Thus that changed the question of a raise of military expenditures from the crucial political agenda to the routine technical issue sort out by ministerial bureaucracy.

Keywords: military expenditures, government failure, budgetary and political cycle, cultural conflict, principal-agent-devil´s advocate model
JEL Classification: F52, H12, H56, H60

1 Introduction

As a member of the Warsaw Pact, communist Czechoslovakia sacrificed 5-7% of the national income to defence during the Cold War (Fučík, 2000). The fact that Czechoslovakia bordered on the Federal Republic Germany, a NATO country, imposed a burdensome economic and social burden. Thus Czechoslovakia was forced to contribute to the Warsaw Pact with 10 divisions in peace time. In addition, it used to be obligated to mobilise its own group of armies, in case of war (Sadykiewicz, 1988, 12). The end of the Cold War in 1990 and, later on, the break-up of Czechoslovakia in 1992 reduced that burden significantly. However, such a new acquired statehood begged the question: *"How much is enough for national security now?"* In fact, such kind of questions used to be answered to Soviet satellites states by Moscow. Now, the Czech government should answer the question itself. In order to avoid falling to Russian influence again, the right wing government of V. Klaus made decision to enter the NATO Partnership of Peace Program in 1994, and later on, in 1999, the question raised originally by McNamara (Enthoven-Smith, 2005) seemed to be answered definitely when the Czech Republic joined NATO.

In accordance with The North Atlantic Treaty, article III, each NATO member is obligated to take care of its defence and military capabilities is such a manner to avoid being a free rider. Hence, NATO countries should not relied on article V solely but they ought to develop their military power as though they would not be in the Alliance. In order to prevent from considering of military expenditures as unbearable social burden and to ensure a common convergence in military capabilities as well, NATO has developed a rule of thumb that military expenditures should be 2% GDP. Therefore, NATO countries ought to invest into modernization their armed forces, training and retention of military personnel continuously. On that account, the Czech government adopted a resolution as early as in 1996 that military expenditures should exceed 2% GDP in 2000 already (__, 1996); on the other hand, that fiscal objective has never been achieved so far. Moreover, the left wing government of M. Zeman decided in 1999 that defence spending should excide 2.2% GDP in 2001 and beyond (__, 1999). In such a way, a paradox comparable with some Parkinson's Law was born: the bigger percentage of GDP should to be devoted to defence in accordance with governmental promises the tinier percentage of GDP was spent on defence in fact.

This paradox might not be caused by flagging political will only. Moral hazard with the Czech national security may have other roots; for instance, interference between political and budgetary cycle, a specific feature linked to national culture, or suchlike. The goal of this article is to explain the above mentioned paradox by alternative theoretical frameworks such Wildavsky´s (2006) cultural theory of budgeting. In order to explain the paradox, rather sociological approach is applied; in particular, social constructivism and theory of social conflicts (Blumer 1971, Ross – Staines, 1972, Spector – Kitsuse, 1973). Taking into account that sociological approach, author tries to avoid using of quantitate methods which are not typical for cultural theories. By contrast, whenever there are time series on public opinion or economic development they are confronted mutually in order to emphasize the

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contrast between official political promises and the reality. In addition, the analysis focuses on characters of actors and their mutual relationship within both political parties and the government.

2 Economic (ir)rationality of military expenditures

Regarding military expenditures, we have to bear in mind that public spending on defence, likewise on public service, and R&D should not be considered as contributing to individual living standard (Rozsypal et al, 1981, 181). Besides, rising of military expenditures causes militarization of both economy and society. Despite a deal of studies published in the last 60 years and scrutinizing a positive impact of military expenditures on economic growth, e.g. Alptekin – Levine (2012), Dune – Tian (2013), Awaworyi – Ling Yew (2014), from point of consumer´s preference theory view, allocating more money for defence means giving less money on non-defence (civilian) purposes. Furthermore, money given to the military does not bring a profit for all economy but only a significant profit and powerful influence to a small group of actors called military-industrial complex (Mills, 2000).

Besides, this relationship between investment in national security and civilian goods reflects illustratively guns versus butter model. The relationship is displayed as a simple production–possibility frontier. In fact, the concept of guns versus butter model was formulated as a newspaper headline by the U.S. public press during the WWI and became a part of American culture (Kohler-Hausmann, 2015). From such a point of view, the gun versus butter model is an excellent metaphor referring to utilization of Chilean saltpeter as the principal substation in both chemical fertilizers and gunpowder. Quantity of nitrate is determined and it can be allocated either for civilian use in farming or for military use in defence industry. Comparing an impact of allocation of nitrates into economy, the usage of nitrates in agriculture has a more substantial impact than in national defence. In comparison with artillery ammunition demanded only by government for a very specific use, foodstuffs, such milk, cheese, and butter as products of farming are demanded by all population as vital goods.

In particular, a raise in military expenditures in peace time may be considered as a social problem (Blumer, 1971) with its natural history (Ross – Staines, 1972; Spector – Kitsuse, 1973); after all, the governments limited by budgetary ceilings always have to *"...make a judgment on how much is enough"* (Enthoven-Smith, 2005, 197). That is closely linked to ideology and to a conflict of values represented by parties in the government and personalities of both defense and finance ministers. Any decision on military expenditures made by government is decision on individual welfare of taxpayers, citizens, and voters who are lumbered with the bills for military spending. Military expenditures are to cover either by compulsory service as a kind of non-financial tax or by imposed financial contributions, i.e. taxation (Friedman, 1967). And yet, each government has to make such a decision; nonetheless, a democratic government should decide in the most responsible manner without taking into account any particular benefit to any particular group, in particular, military-industrial complex. The military-industrial complex usually follows its own interests only (Mills, 2000). **Table 1** shows the typical attitudes to a raise in military spending in the Czech Republic gathered by opinion polls.

Table 1: Opinion polls on attitudes to national security matters in the Czech Republic, 1996-2011 (% of affirmative answers)

	1996	1997	1998	1999	2000	2001	…	2007	2008	2009	2010	2011
State sovereignty has to be defended at all cost.	81.4	77.1	75.8	81.4	85.0	84.8		79.0	83.3	83.8	82.1	84.0
In case of war, I would get a defender of nation.	-	-	-	-	39.9	36.4		39.2	43.8	41.2	39.8	37.5
Military spending are really a burden; they are useless.	50.1	49.6	45.6	51.7	49.8	52.8		42.0	41.5	48.1	49.7	55.1
In case of emergency, we could not defeat as a nation.	56.9	55.3	60.5	57.7	58.7	61.0		60.7	57.3	58.2	56.6	65.0

Source: *MOD (1996-2012)*.

Although a significant majority of nationals is always conscious of importance of national security for statehood, hence for their citizenship, the public opinion on a raise in military expenditures is usually negative. That conflict might be explained by principal-and-agent model (Leruth – Paul, 2008). As a *homo economicus*, taxpayers as citizens do not wish reducing their well-being; ergo, they engage politicians as their agents with the task to do their best for general well-being but not to raise military expenditures. In general, the easiest way how to accomplish this task/wish is the general disarmament which has never happened so far. Another option would be to pre-empt any war by warfare. However, that has come in light as absolutely impracticable without military power and military expenditures. The McNamara´s question *"How much is enough?"* is getting a legitimate question in both public economics and public finance. From such point of view, willingness to invest into defence increases in proportion with sense of in/security, i.e. it is corresponding with sufficiency of information on menaces. Nevertheless, pondering the inevitability of escalating of military expenditures within a system of

collective security, initially easy concept is getting more complex. There is asymmetric information about dangers and, in addition, there is a cultural conflict. The risk of war differs among members of alliance. What is more, the risk is perceived differently by both citizens and governments and nations (Manigart–Marlier, 1993, Mandel, 1997, Canan-Sokollu, 2012). Focusing more on the Czech Republic, this fact is to demonstrate unambiguously by Table 2.

Table 2: Opinion polls on attitudes to NATO and the Czech Armed Forces (% of affirmative answers) and the national contribution to NATO, 1993-2015

	1993	1994	1995	1996	1997	1998	…	2011	2012	2013	2014	2015
Public confidence in NATO	-	44	-	-	52	56		53	55	51	55	-
Public confidence in the Czech Armed Forces	49	48	44	-	43	44		-	65	68	73	68
The Czech military expenditures as % GDP	2.33	2.28	1.84	1.73	1.66	1.83		1.15	1.09	1.03	0.99	0.98
Strength of the Czech Armed Forces**	107	88	73	64	59	58		19*	19*	19*	18*	18*

Source: STEM (1993-2015), SIPRI (2016)
Notes: *… All-Volunteer Force, **… thousands of soldiers at Jan 1

In confrontation with the Table 1, NATO is believed to be the best choice for the Czech national security; nevertheless, the majority of Czechs is rather sure that the Czech contribution to the system of collective of security is still sufficient enough. The confidence in NATO and Czech Armed Forces is inversely proportional to military expenditures measured by their share on GDP and spending on defence in accordance with The North Atlantic Treaty, article III. But there is no free lunch in the Alliance. NATO HQ can rely neither on "rational" decision of governments made on the basis of political preferences nor tolerate vivid free riding so Secretary General holds benchmark up to nations at least. In particular, equiTable burden sharing is computed on regular basis (Cooper–Zycher, 1989, Hillison, 2014) and becomes as consequential agenda for ambassadors to NATO as well as for NATO summits. Nonetheless, evolution of burden sharing between the U.S. and the rest of NATO has been disturbing for decades. In spite of fact that NATO is composed of 28 member countries, about 75% NATO military spending is spent by the U.S. (SIPRI, 2016) In fact, the NATO Secretary General works as principal to non-U.S. governments in order to preventing their free riding. Having legitimacy and support from the Secretary General acting as a devil´s advocate, they should ensure a raise of national military expenditures.

3 Disorders in Budgetary Cycle and Cultural Conflict within the Czech Government

According to Georges Benjamin Clemenceau quote *„War is too important to be left to the generals"*, political leaders have to raise military expenditures in peace time in order to avoid being not prepared on war. In addition, if they should decide in accordance with opinion polls, no raise of military expenditures will happen. But that is no answering the question why the Czech government has still failed in stepping-up military expenditures? Author believes that this failure—apart from other things—is caused by (i) interference of political cycle with budgetary one, (ii) inferior quality of defence ministers as a fiscal agents in comparison with the finance ministers as the fiscal principals, and (iii) plentiful changes of governments, ministers of finance, as well as, ministers of defence.

Firstly, analysing the interference between political and budgetary cycle, we should be aware of fact that budgetary cycle focused on a raise of military expenditures is based on negotiation among NATO Secretary Generals, Prime Minister, defence minister, and finance minister who are technically supported by bureaucracy of Ministry of Defence and Ministry of Finance. Furthermore, such a budgetary cycle is very complex. Besides, in comparison with the political cycle, the national budgetary cycle enjoys more legal regulation. In addition, the budgetary cycle is operated by ministerial bureaucracy rectified by the government but it does not enjoy such stability as ministerial bureaucracy due to both rotating governments after election and casual replacing of incompetent ministers by Prime Minister.

In order to get an analytical framework, a periodization of budgetary cycle—in particular its preparation stage—is needed. This study uses a segmentation of preparation a National Budget Bill into three terms following each to other: 1: technical term (January-April), 2: bargaining term (May-September), 3: legitimizing term (October-December). The last term (legitimizing) starts by delivery of the National Budget Bill into the Parliament and ends either by the end of December or by authorization the National Budget Bill as National Budget Act. Such a periodization is based on the budgetary regulation being in force since Jan 2001. Besides, the periodization of the calendar year into three terms reflects growing legitimation of budget as product of the state bureaucracy approved by executive power in the second term and, subsequently, by legislative power in the last term in order to get force of law to the traditional national budget (Wildavsky, 2006a). Each preparation term has a predominant

actor. Bureaucracy at Ministry of Finance is the significant participant in the technical term when a mid-term financial framework is set. Government is the most distinct actor in the bargaining term because they are responsible for co-ordination of work on the bill in accord with both political and governmental preferences set by coalition settlement and the programmatic declaration promulgated at the beginning of ruling term.

In the second budgetary term, political legitimation of the National Budget Bill is limited by parties representing in government only. In third term, all legislators in the first Chamber of the Parliament play their democratic role when a bill passes into an act. From a technical point of view, preferences regarding military expenditures told by the devil´s advocate (NATO Secretary General) could be incorporated into the bill in each term following the technical one because both government and all lawmakers are certainly positive on the Czech membership in NATO and on the significance of NATO for the national security. A linkage between the national political and budgetary cycle and financial outcomes visible to NATO are shown in Table 3 which makes a few important things visible.

Firstly, the bargaining term—the most crucial term for any positive budgetary outcome in military expenditures—was the most lasted term by political cycle. Six elections took place in the bargaining term within 1992-2013. Secondly, noun of thirteen governments ware changed in the bargaining term in the last 25 years. Hence, preparation of a National Budget Bill was bothered substantially by rotating the political parties and person in power. Besides, a shift from a right-wing government to a minority left-wing government happened in the mid of 1998 caused right of provisional expenditure in 1999. Finally, finance ministers have been changed noun times (in 13 governments) in the bargaining term so far as well as ministers of defence have been changed eight times in this term hitherto. In addition, defence ministers (16 people since 1993) are—after ministers for public health and ministers of transport—the third frequent group of political experts rotating in the Czech governments.

However, interferences between the budgetary and political cycle constitute just a technical feature of government failure in allocation of military expenditures in the last 20 years. Moreover, this technical deficiency could be eliminated by a shift of election into the third term which happened in 2013. Focusing on military expenditures more as a social problem, a product of social constructivism (Spector – Kitsuse, 1973), roots of the government failure may be a little bit deeper. After all, each government is lasted more or less by a cultural conflict based partly on coalition relationship among ruling political parties, partly, on virtues of personalities holding ministerial offices. The first conflict of values is to analyse in Table 3, too, by specifying shifts in governments and offices. Moreover—in linkage with political parties which were responsible for nominees' casted in ministerial offices—Table 3 presents both frequent shifts in the office of Prime Minister and even more frequent shifts in the office of finance and defence minister. In addition, there are stated both governmental commitments—declared as governmental resolutions—determining the desired allocation of military spending and significant strategic documents which have been adopted by national governments for purpose of building-up reliable military power. Similarly to other NATO countries, e.g. the United States (Jones – McCaffery, 2008, 95-109), those documents are needed for evaluation of the national budget by legislators and by governmental auditing bodies. Such strategic documents are demanded for multiple-year-budgeting. Thus, they are elaborated carefully by civilian and military clerks at the Ministry of Defence because they are always intended as the essential input for appropriation of money to Ministry of Defence.

Since joining the NATO Partnership for Peace Program in 1994, five crucial governmental resolutions on military expenditures have been adopted. According to national documents (__1996, 1999, 2002, 2003, 2007), the government made its decision in: (i) 1996 (no less 2% GDP as spending of the Czech Armed Forces in 2000), (ii) 1999 (no less 2.2% GDP as appropriation for Ministry of Defence since 2000), (iii) 2003 (guaranteed appropriations for 2005-2010 not as share on GDP), (iv) 2007 (no less 1.4% GDP after 2008), (v) and 2015 (1.4% GDP in 2020). In comparison with the first four governmental resolutions made explicitly, the last one was adopted implicitly, just as the paragraph 93 in *The National Security Strategy 2015* (__2015).

Table 3: The Czech Military Expenditures in Connection with the National Budgetary and Political Cycle and with NATO Summits, 1992-2016

Military spending as		Term			Prime Minister	Finance Minister	Defence Minister	Gover commit
		1: technical	2: bargaining	3: legitimizing				
% GDP[b)]	CZK Md[c)]	Jan—Apr	May—Sep	Oct—Dec				
-	-		**e1:** G1/MF		1 ODS	1 ODS	-	
2.33	23.0	MD	**o**		1 ODS	1 ODS	1 KDU-ČSL	joining N
2.28	26.8			MD	1 ODS	1 ODS	1 KDU-ČSL	Program a
1.84	27.0				1 ODS	1 ODS	2 KDU-ČSL	19
1.73	30.5		**e2:** G2/MD, *		1 ODS	1 ODS	3 KDU-ČSL	2% GDI
1.66	32.0	**o**	MF, +		1 ODS	2 ODS	3 KDU-ČSL	
1.83	36.9	G3/MD	**e3:** G4/MF/MD		3 ČSSD	3 ČSSD	5 ČSSD	
1.94	41.5	+, *	MF, *, **o**		3 ČSSD	4 ČSSD	5 ČSSD	
1.97	44.0				3 ČSSD	4 ČSSD[e)]	5 ČSSD	2.2% GD
1.84	45.1	MF	MD		3 ČSSD	5 ČSSD	6 ČSSD	since
1.91	47.5		**e4:** G5/MF	+, **o**	4 ČSSD	6 ČSSD	6 ČSSD	
1.98	52.3		MD	*, **o**	4 ČSSD	6 ČSSD	7 N	2005-201
1.79	50.7		G6/MD, +	*	4 ČSSD	6 ČSSD	8 US-DEU	spending
1.88	53.0	+, G7			5 ČSSD	6 ČSSD	8 US-DEU	GDP but
1.65	55.7		**e5:** G8/MF/MD	+	7 ODS	7 ODS	9 N	of CZK
1.50	53.9	G9/MF/MD		*, **o**	7 ODS	8 KDU-ČSL	11 KDU-ČSL[e)]	1.4% GD
1.29	54.2	+			7 ODS	8 KDU-ČSL	11 KDU-ČSL[e)]	beyon
1.38	56.0	+	G10/MF/MD		8 N	9 N	12 N[e)]	
1.26	48.9		**e6:** G11/MF/MD	+	9 ODS	8 TOP 09	13 ODS	
1.15	43.9		**o**		9 ODS	8 TOP 09	13 ODS	
1.08	43.5		+	MD, MD	9 ODS	8 TOP 09	13 ODS	
1.03	42.1		G12/MF	**e7:**	10 N	10 N	15 N	
0.99	42.0	G13/MF/MD	+		11 ČSSD	11 ANO[e)]	16 ANO	
0.98[d)]	43.8	*		**o**	11 ČSSD	11 ANO[e)]	16 ANO	1.4% GD
1.03[d)]	47.8		+		11 ČSSD	11 ANO[e)]	16 ANO	

*right of provisional expenditure; b)… pct of GDP according to SIPRI penditure database; c)… appropriations in the National Budgetary Act at estimation based on the Fiscal Outlook of the Czech Republic (April election to the 1st Chamber of Parliament, G… a change of government, ging of the minister of finance, MD… changing of the minister of … NATO Summit, *… gov. resolutions on an raise of military es, **o**… strategic documents focusing on armed forces development*

e)… Deputy of Prime Minister

***ODS**…Civic Democratic Party (right-wing party), **TOP 09**… Conservati Democratic Party (right-wing party), **ČSSD**…Czech Social Democratic P wing party), **KDU-ČSL**… Christian and Democratic Union – Czechoslov People's Party (left-wing centrist party), **US-DEU**… Freedom Union–De Union (right-wing centrist party), **ANO**… Action of Dissatisfied Citizens wing centrist party), **N**… non-party man.*

Source: SIPRI (2016), Sbírka zákonů (1993-2016), www.vlada.cz

Table 3 shows all events and partners applying outcomes visible to NATO. For instance, we can recognize that there have been 13 governments but only 11 prime ministers since 1993. Likewise, there was a person served as minister of finance in three governments (B. Sobotka) and a person hold the office of minister of finance in two governments but nominated by two different political parties (M. Kalousek). Coincidentally, those two politicians are the only two finance ministers who have never been graduated in finance and economics.

Being aware of the Czech life and institutions, staffing of governmental offices by political parties is agreed at the beginning of ruling term with a so-called coalition settlement. In case of interim government, there is not a coalition settlement and PM is a non-party man. Such governments ought to rule the county till legitimate election (in 1998, 2009, and 2013). Besides, non-party people can be nominated to ministerial offices as well. That became typical for the office of defence minister which was casted by two times by former generals and flag-officers (in 2003, 2013) and once by a civilian expert in defence studies (in 2006) who later became Deputy Secretary-General of the North Atlantic Treaty Organization (J. Šedivý). In comparison with any political nominee, such non-party people cannot rely on political support needed for policy of increasing of military spending. The only support they may count on is their self-confidence in his/her own professionalism. Regarding Table 3, furthermore, two finance ministers and two defence ministers became deputy prime ministers, i.e. persons being closer to prime minister as other members of government. Nevertheless, that may not be considered as beneficial for enforcing a raise of military expenditures due to fact that such an extra status in government is usually reserved for leaders of political parties forming the government and they have had often no interest on pushing NATO agenda of a raise of military expenditures trough.

Going more into details, parties wining election staffed usually not only the PM office, but the office of minister of finance as well. In other cases, this office got the second strongest party in government. Although ministry of defence is as a powerful office as ministry of finance, election winners considered it as inferior and either they usually let it to the most minor coalition partner (KDU-ČSL within 1993-1997, LIDEM in 2012) or they utilized this office for tackling their internal party problems. That was most apparent when V. Parkanová (KDU-ČSL within 2007-2009) and A. Vondra (ODS within 2010-2012), deputies their party leaders, acted as defence ministers. Such an attitude to division of labour in coalition government reduces any prospect for a substantial raise of military expenditures to minimum. – The ministry of defence is considered in the Czech Republic as an inferior office as good as the Jim Hacker´s fictional Department of Administrative Affairs in the *Yes, minister* sitcom.

4 Conflict in personal values professed by fiscal principals and agents

From a particular point of view, the lowest level of conflict of values is represented partly by internal relationship within coalitions, partly by conflict of personal values based on civilian profession and experience of the minister. Due to fact that prime minister plays an arbiter in government when his/her ministers are in odds each to other, we will focus on personality of minister of finance and minister of defence only. Table 4 presents substantial features considerable in an analysis of conflict in personal values. Information presented in Table 4 is based on curriculums vitae accessible either on governmental homepage or in Wikipedia.

Focusing on conflict of value rooted in different environment and background legible from Table 4, there are a few facts being worth noticing. Firstly, people nominated to the office of finance minister seem to be more homogeneous group in comparison with the group of people holding the function of minister of defence. The difference in group homogeneity is caused neither by different number of ministers holding the office, nor by fact that as a minister of defence have acted two females so far. Ministers of finance are a much more compact group than ministers of defence due to their education background. From this point of view, only two ministers have not get professional training in economics (B. Sobotka, M. Kalousek). Unfortunately, those two personalities belong to record holders in holding of the finance minister´s office. Although government shifted three times within the term 2002-2006, B. Sobotka leaded the ministry of finance from July 2002 to October 2006 continuously. Besides, M. Kalousek acted as finance minister two times altogether, from Jan 2007 to May 2009 (KDU-ČSL) for the first time and once again from July 2010 to July 2013 (TOP 09). On the contrary, the group of defence ministers should be considered as "multicultural". This group is composed of people having various civilian professions. Moreover, a majority of such professions is applicable in his/her office only with difficulties, for instance, dramatic profession (M. Stropnický). As matter of interest, M. Stropnický translated the comedy Yes, minister from English to Czech and produced the play in the Na Vinohradech theatre, the former Theatre of the Czechoslovak Armed Forces in 1950´s.

Table 4: Attributes of the Conflict in Personal Values in the Czech Government, 1993-2016

	Minister of finance	Minister of defence
age	average age 47.5 years	average age 49.1 years
generation gap (conflict)	1997: I. Philip vs. M. Výborný 1999-2000: P. Mertlík/J. Rusnok vs. V. Vetchý **2007-2009: M. Kalousek vs. V. Parkanová** **2014-2016: A. Babiš vs. M. Stropnický**	2001-2002: J. Tvrdík vs. J. Rusnok **2002-2003: J. Tvrdík vs. B. Sobotka** 2009-2010: M. Barták vs. E. Janota 2012: K. Peake vs. M. Kalousek
gender	11 males, 0 females	14 males, 2 females
education	1 graduated from faculty of law (B. Sobotka) and chemical faculty (M. Kalousek); 9 graduated from economical faculty, 6 of them Prague School of Economics (VŠE)	4 graduated from faculty of law; 5 graduated from natural sciences faculty (geology, mathematics and physics); 3 graduated from military academy, 1 of them graduated in economics (J. Tvrdík); 1 graduated in machinery (A. Baudiš), medical science (M. Barták), dramatic arts (M. Stropnický), and defence studies (J. Šedivý)
born in	1 Slovakia (A. Babiš); 3 Moravia; 9 Bohemia, 2 of them Praha	3 Moravia; 13 Bohemia, 10 of them Praha
experience with illicit activities	accused of committing economic crime: 1 (I. Svoboda), sentenced: 1 (I. Svoboda), suspected of anti-social behaviour: 6 (I. Philip, P. Mertlík, B. Sobotka, V. Tlustý, M. Kalousek, A. Babiš)	accused of committing economic crime: 2 (V. Parkanová, M. Barták), sentenced: 0, suspected of anti-social behaviour: 2 (A. Baudyš, A. Vondra, P. Nečas)

Source: www.vlada.cz, Wikipedia

From particular point of view, it seems that the most advantageous education for nomination to ministerial office is education in natural sciences, in particular, in geology (M. Lobkowicz, A. Vondra). Gaining a master degree from a Faculty of Law seems to be advantageous as well but it does not mean that you could not be accused of committing economic crime in the office (V. Parkanová). Generally, both defence and finance ministers in the Czech Republic are often accused by media serious anti-social behaviour, such star divination (A. Baudyš), excessive drinking in public and corruption (M. Kalousek), abuse of intelligence service (P. Nečas), misapplication of public money (P. Mertlík, I. Philip), overcharging of public contracts (A. Vondra), mismanagement (B. Sobotka, V. Tlustý), siphoning of EU money (A. Babiš), etc. Unlike ministers of finance—coming often into office from academic environment—ministers of defence are usually someway connected with Ministry of Foreign Affairs and Diplomatic Corps. They have usually experience from diplomatic service (V. Holáň, M. Kostelka, K. Kühnl, J. Šedivý A. Vondra, M. Stropnický) and their presence at Ministry of Defence was usually a part their career path in public service. In addition, acting as minister is rarely issue of people born in Moravia or Silesia. Therefore, ministerial values are predominantly "values of Prague and Mid-Bohemia" environment.

However, Table 4 presents a much more significant conflict of values. It is a conflict resulted from age gap or generation conflict. Only for purpose this article, we define as a generation gap a situation when a minister is either older or younger by 7 years then his/her counterpart. As a generation gap we call a situation, as well, when both a finance and defence minister is from the same political party—may be the same age group—but one of them is a senior politician. In such a case, mental and moral immaturity of a minister implicates rivalling within the political party. Hence, general social prosperity is scarified by one of the ministers to individual profit, e.g., individual prestige. Such a situation occurred when J. Tvrdík, defence minister, re-enforced the governmental resolution on no less 2.2% GDP spent on defence in November 2002. Nonetheless, his social democrat colleague B. Sobotka, finance minister, supporting that resolution in November 2002, curbed military expenditures for 2004 fiscal year suddenly when the preparation of National Budget Bill of 2004 started.

Likewise, M. Kalousek as minister of finance and member of KDU-ČSL capitalized his relation to his female party colleague V. Parkanová when he decided to re-allocate 5.7 Md CZK from ministry of defence funds onto restoration of main roads in 2007 and he succeeded in restriction of military expenditures, too, emphasizing—identically as B. Sobotka in 2003—the need of restoring public finances. Today, as leader of TOP 09 in parliamentary opposition, he is a zealous proponent of a raise of military expenditures to 1.4% GDP in 2020; although, he—as Finance Minister of the Year for Emerging Europe 2011—pushed forward a cut of military expenditures in 2014 to 35.6 Md CZK in 2011. (__, 2011)

A similar conflict in values is to observe in relationship between A. Babiš (ANO), minister of finance, and M. Stropnický (ANO), minister of defence, since 2014. On the one hand, M. Stropnický was declaring savings in

defence budget when he entered his office in Jan 2014; on the other hand, he got a moderate proponent of a raise of military expenditures when NATO Secretary General visited Prague in April 2014. He was forced to ask for increasing of military expenditures in 2015; nonetheless, his political boss (A. Babiš) as finance minister turned down a raise of military expenditures by 2.2 Md CZK during the legitimization of the National Budget Bill of 2016 in parliament. This raise has been demanded by Parliamentary Defence Committee which is composed by all parliamentary parties and that body propounded such a resolution first time in its history (Kopecký, 2015). Due to cultural conflict within coalition government and political parties, the raise in military expenditures still remains a serious social problem.

5 Conclusions

In spite of keeping issuing resolutions on increasing of military expenditures at not less 2% GDP, the NATO benchmark of 2% GDP on defense has never been achieved so far. Also, the Czech defense spending remains just an half of 2% GDP 15 years after joining the Alliance. The government keeps failing in its policy of increasing of military expenditure, hence, the Czech Republic is suspecting being a free rider and a raise of military expenditures is considered as a social problem. On the other hand, confidence in both NATO and the Czech Armed Forces has been growing inversely proportional to curbing the military expenditures.

The Government failure in increasing of military expenditures is to explain partly by the inference of the national budgetary cycle with political cycle, partly, by cultural conflict inside of the governments. Such a conflict of values covered not only values within political parties forming a coalition government but values related to personalities in office of finance minister and defence minister as well. Since 1993, governments, defence ministers and finance ministers have been rotated in the bargaining term when preparation of National Budget Bill for the coming year ought to be in full swing. That watered down significantly governmental influence on ministerial bureaucracy. The state budget has been prepared rather under direction of ordinary bureaucrats than distinguished political leaders who take care of national security and welfare dutifully. As a logical consequence of flagging political management, ministerial bureaucracy—at ministry of defence and ministry of finance—denied to carry out the governmental resolutions on increasing of military expenditures quietly.

In addition, crucial actors in the process of stepping up military expenditures—finance minister and defence minister—set conflicts in his/her political parties in order to get his/her political points. Some powerful ministers of finance in his parties (B. Sobotka, M. Kalousek, A. Babiš) presented themselves as national heroes struggling for stabilised public finance which should to bring the Czech Republic into an so-called elite club of countries. Regardless reducing military expenditures, public debt was raising during their time spent in the office. Due to fact that this conflict of values continuous, it is questionable if military expenditures will have exceeded 1.4% GDP in 2020 what is the last governmental resolution and a national promise to NATO to date.

When election shifted from the second to the third term of National Budget Bill preparation in 2013, and forming of government shifted to the first term consequently, the interference between budgetary and political cycle diluted. On the one hand, expectation of increasing of military expenditures expanded slightly because influence of political leaders and NATO as devil´s advocate on the National Budget Bill has raised; on the other hand, the Czech political spectrum still suffers from the fact that the office of defence minister—as a formal agent struggling for increasing of military expenditures—is used for dumping of politicians. At least in 2016, the conflict of values between the finance minister and defence minister (both ANO) is remaining.

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PART C – PUBLIC FINANCE AND FINANCE

National Debt and Risks Associated with Sovereign Exposures

Naďa Blahová*

Abstract. This contribution deals with the links between the banking and government sectors and their outcome in the form of sovereign risk exposure. The aim of this paper is to test the hypothesis that the size of sovereign exposures in the banks' balance sheets related to the regulatory requirements with respect to these banks. The method presents closer description of the current state of the Czech banking sector and the government sector. The main areas are examined, based on the qualitative analysis, with focus on links between both sectors, as well as regulatory requirements to banks that relate to sovereign exposures. They discuss the principles of the methodology of the stress test of public finances and sovereign risk indicator. The current situation is illustrated by graphic comparison of the share of government bonds in total assets of banks in the V4 countries, Austria and the Eurozone. If no change in regulatory rules, then we can´t expect a significant reduction of sovereign exposures in the banks' balance sheets. This implication was verified and the hypothesis was confirmed.
Keywords: national debt, government bonds, banks, sovereign risk.
JEL Classification: H6, G21

1 Introduction

Sovereign risk is a risk of potential loss from sovereign exposure caused by default in payment of counterparty liabilities or by breaking other contract agreements. The major part of sovereign risk is the credit risk. Sovereign risk of the Czech Republic can be evaluated as very low. It is the risk of a country, which finds its picture in above-the-average external rating given by major rating agencies with international field of activity. The Czech Republic has the highest rating of countries of middle and east Europe and its rating is above-the-average of state members of the euro area. Experience from debt crisis in Europe shows that in case of small open economy it is impossible to entirely exclude transmission of negative phenomena from foreign countries (Diebold a Yilmaz, 2010) and that it is impossible to prevent upcoming negative change of sovereign rating only by stabilizing public finance. There always exist factors which are impossible to have under control from the perspective of a given country and which even under strong assumptions of effective country management and quality management of national debt may increase sovereign risk. There exists the possibility of over the boarder contagion to credit premiums of national debt funding that can manifest itself as an increase of debt service costs.

Banking sector in the Czech Republic can be evaluated as highly sTable, equipped with required capital and liquidity, with relatively low level of financial claims in default and required volume of provisions. Banks' capital is almost by 100 % formed by capital Tier 1, which is the capital of the highest quality that has the highest ability to absorb losses. Usage of capital Tier 2, which is represented mostly by subordinated debt is decreasing in long-term. The central bank as a supervision institution applies in scope of macroprudential policy concerning banks also capital reserves (security reserve, reserve to cover systemic risk and since the year 2007 also anticyclical capital reserve) that increases their stability. It is required to respect that our banking sector is highly interconnected with international financial groups and under specific conditions it can have an impact on the independence of decision making of Czech banks, for example in the area of asset allocation. Foreign owners have under direct or indirect control over 90% of the Czech banking sector assets, the owners are mostly from other EU countries.

In this article I will try to verify the hypothesis that the size of sovereign exposures in the banks' balance sheets related to the regulatory requirements with respect to these banks. The method of description and qualitative analysis will be used primarily. I will discuss the principles of the methodology of the stress test of public finances and sovereign risk indicator. I will illustrate the current situation through a graphic comparison of selected countries.

2 Holding of National Debt or Sovereign Risk Exposure

Even though both sectors, government as well as banking sector, are rated as relatively sTable, their common interconnectedness is perceived as important and potentially risky. Reasons are associated with many interconnections and their possible causes on stability of both sectors and not in the last row emerge from international comparison (Caruana – Avdjiev, 2012). Interconnection of Government and Banking Sector

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Banks as Creditors, Traders, Market Makers

Banks are the most significant creditors of government sector (creditors are to a lesser extent also other financial market entities such as pension funds, insurance companies, but this paper does not concern with them). Banks hold in their assets short-term treasury bills as well as medium-term and long-term government bonds. If banks buy this financial instruments to their trading books, they declare that it will be held short-term, thus no more than one year and are obliged to overvalue the instruments by market prices on a daily basis. Any losses would be reflected in the regulatory capital calculation. If banks declare that they will keep the purchased national debt in the long term, respectively until its maturity, they value it by amortized costs and the negative change of the value would be registered only if the extreme situation of default occurred. But both of these strategies (categorization into trading and investment portfolio) have one thing in common. If the market begins to perceive sovereign debt quality deterioration or determines that a bank (respectively banks) holds a disproportionate amount of national debt in their portfolios, it will restrict this banks' access to funding sources, respectively the sources will become less cost favorable for the banks.

Banks in relation to the national debt are not only in a position of the major creditor. Selected banks also have a key position on the primary government bond market as primary dealers. Banks are in a role of a trader and market maker. In a situation of imbalances on the sovereign debt market they work by their transactions towards equilibrium. But during larger imbalances in terms of higher supply of national debt over the demand for national debt, banks can respond with spread expansion, which would not contribute to stabilization of the market. The rule that mandatory spread bid and offer prices is based on relative basis against market average of all primary dealers contributes to the stabilization of the market and low level of price spread bid and ask. This enables the necessary adaptation to the difficult to predict market environment.

Government Bond as Collateral

Banks hold in their balance sheets government bonds also for needs of hedging their operations. The conservative attitude of our central bank emphasizes the use of these bonds for refinancing operations, during realization of repo trades. Should the sovereign risk increase, this situation would be reflected in decreased eligibility of the collateral. The current situation in the Czech Republic characterized by liquidity excess on the part of commercial banks makes the situation unlikely to happen, but it cannot be ruled out. It is also necessary to respect probable attitude of the central bank, which must manage its credit risk.

Government's Assistance to Banks

Before the outbreak of the global financial crisis and in its initial stages it was still assumed that in the case of bank's problems, especially the ones, which were covered by the rule „too big too fail", the domestic government would be the place that would provide assistance in the form of guarantees or recapitalization of public means. The underlying assumption of this procedure is high budget income in proportion to the size of the banking sector respectively endangered groups of banks. For example, regarding a relatively small country with a relatively large banking sector, in the case of problems of large part of the banking sector affected by materialization of systemic risk it is impossible due to the size of the public budget to provide adequate assistance without collapse of public finance. Then, the solution can only be an assistance on multinational level.

In response to the debt crisis in Europe, a mechanism was searched for, that would, if necessary, help to solve endangered banks in any other way than the one till that time prevailing when the rescue of banks was funded by public funds. The access to the use of public funds had gradually changed. At the ECOFIN meeting in October 2008, the European leaders agreed that the decisions about public interventions would be realized in a coordinated manner. Public funds were intended to recapitalize systemically important banks. Member states were expected to respect taxpayers' interests. In 2013, there was a major revision of the rules on country aid, greater cost sharing by the private sector was enforced. It was evident that granting of public aid may cause national debt crisis. The result of the efforts of a bond between the government and banking sector is an establishment of a fund for dealing with crisis (resolution fund) into which banks are beginning to contribute and which should finance possible solution of banks' problems in the future (MREL 2015) . The establishment of the fund is going to replace the institute of lender of the last resort. Therefore, this bond between government and banking sector should be discontinued.

3 Banks' Motivation for Holding National Debt Due to Regulation

Banks have had strong incentives for holding government bonds. For a long time, it has been associated primarily with regulatory rules. Since the first concept of capital adequacy at the end of the eighties, today known as Basel I (1988), claims toward government and claims secured by government called zones A, which were member states of OECD, were evaluated by risk weight 0. That meant that banks did not have to hold capital towards this kind of assets. From nowadays point of view, the regulatory rules were very simplified and risk weights were assessed to assets only according to the counterparty type, the ability to repay was not taken into consideration, probability

of default. There was established disproportion, which persists in principle until nowadays. Banks are encouraged to favor funding of national debt over funding of private sector, which mostly had as a counterparty assigned risk weight 100 % in Basel I. This approach has been in principle transferred into the regulatory process of Basel II (2006) and continues until nowadays, when the Basel III (2011) regulation is gradually implemented.

Currently, banks can choose from two options of investment portfolio credit risk capital adequacy calculation. When applying the simpler so called standardized approach, the risk weight is derived from external rating of rating agency. In the EU area, risk weight 0 is assessed to government bonds if it is issued by domestic government in domestic currency. A more sophisticated IRB approach works with internally determined counterparty rating and is based on estimate of three parameters. Probability of default, exposure at default and loss given default. Here is also not very large space for more sensitive estimation of sovereign risk, when the PD parameter is not subjected to minimal value of 0,03 %. With IRB approach, we do not meet with implicit setting of zero risk weight, but it can be used. To remove sovereign exposures from IRB approach and apply towards them standardized approach is also a possibility. In practice it means that banks use risk weight 0 for both of these approaches.

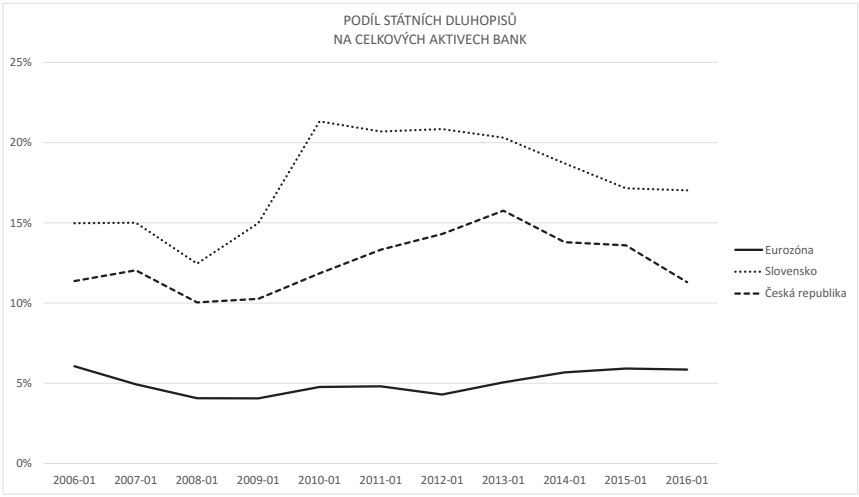
Another regulatory rule applies to exposure. Banks must sufficiently diversify their portfolios and thus prevent the risk of excessive concentration of the portfolio. Basic exposure limit is set at 25 % of regulatory capital of bank towards one of the counterparties or economically connected groups. This limit does not apply to banks' assets that represent claims toward central government.

The motivation of banks to prefer holding of national debt newly strongly supports Basel III in area of liquidity regulation, when introducing two quantitative requirements. Net STable Funding Ratio and Liquidity Coverage Ration. In its final form, the LCR is in principle a stress test of short-term liquidity, which banks must comply continuously with. For the LCR indicator is required holding of highly liquid assets that are subject to demanding requirements: low risk, certain and transparent valuation, low correlation with risk assets, acceptability by central bank under the deposit facility. Parameters correspond to government bonds that are included in the highest quality group of assets called Level 1 assets. NSFR is supposed to limit maturity transformation and we can find the privileged position of government bonds even here, when assigned with the lowest possible factor 5 % of required sTable source of funding. In the area of liquidity can be found another confirmation of the preference for national debt in connection to the calibration of 2 basic banks' financial health indicators. The indicator of liquid assets to total assets and indicator of liquid assets to short term liabilities include bonds issued by government institutions between preference liquid assets. Thus, in order for banks to comply with regulatory rules, they must hold government bonds.

Graphic comparison

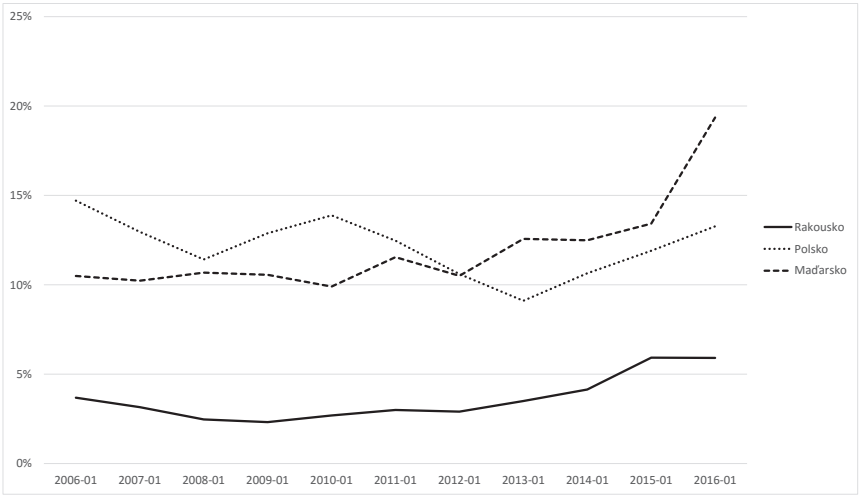
For illustration it is possible to see ratio of government bonds to total assets on graphs below. If we are evaluating aside from the situation in the Czech Republic also progress of the ratio of government bonds to all assets of banks in neighbors' countries – Slovakia, Poland, Hungary and Austria and compare it with average in the euro area then only Austria with its results is under this average, in the year 2015, it got to the same level. Amount of exposure around 5 % does not represent important concentration of assets and is possible to perceive it as adequate. In contrast, banking sector of V4 countries is with its volume of sovereign exposures above the average of the euro area and from this point of view, the latest progress is relatively positive for the Czech Republic. According to the international comparison the ratio of government bonds to banks' balances is still high above-the-average in the Czech Republic, notably higher than the euro area average is.

Figure 1: Ratio of Government Bonds to Total Banking Sector Assets



Source: ECB, processed and adjusted by the author

Figure 2: Ratio of Governant Bonds to Total Banking Sector Assets



Source: ECB, processed and adjusted by the author

4 Risk of Excessive Concentration of Sovereign Exposure

The Czech National Bank as an authority supervising the financial market created a tool that intend to control risks of systemic concentration towards the significant sovereign exposures. Relying on the directive and decree CRD IV/CRR, the relevant guidelines of the European Committee for Banking and Recommendation ESRB/2013/1.

Methodology Principles of Public Finance Stress Test and Sovereign Risk Indicator

The procedure for evaluation of public finances through a cost-benefit analysis has been demonstrated, for example, by Izák (2008). One of the goals of the study, which has been created under the patronage of the IMF is to identify indicators of vulnerability of the sovereign entities towards a bank run (Serkan A. - Takahiro T. 2014). The initial point of this approach is public finance stress test, which has been performed on the horizon of three years since 2015. The output is an estimated value of sovereign risk indicator (SRI), which can range from 0 % - 100 %. IRS acts as a probability of the default parameter, which in cause of a country acquire form of writing off a part of the exposure, restructuring of national debt, assistance of multinational institution. IRS is calibrated on basis of statistical analysis of historical observations of debt crisis (Arslanalp - Tsuda, 2014) and selected variables, which are set a critical value (their list is presented in Table 1). The stress test uses several interconnected simulation models that represent economic sectors and their impact on management of government sector and progress of its debt. The scenario is defined for three-year period and includes the unfavorable development of key macroeconomic variables and materialization of the associated risks including market risks. The action of these negative phenomena is reflected in the degraded conditions of national debt service. Estimates of GDP, inflation and wages enter the model. One of the models stimulates the labor market. It uses demographic projections of CSO, on which legislatively formulated parameters and expected development of household sector economic activity are applied. Management of government sector is simulated in accordance with the components of its income and expenditure. Even the model of financial markets, where unfavorable market conditions for issuing of new national debt are set in three year horizon, enters the test. Involved is also a model simulating profitability of the new debt, where as explanatory variables enter: dollar yield curve, total national debt, money market interest rates, expected inflation. The stress test works with a possible response of a debt issuer to possible increase in debt service costs.

Table 1: **Explanatory variables of sovereign risk indicator**

	Macroeconomic variables	Critical limit		**Fiscal variables**	Critical limit
1	Real GDP growth (in %)	< - 2,3	1	National debt (as % GDP)	>64,7
2	Balance of payment in relation to the current account (as % GDP)	< - 1,8	2	Primary balance (as % GDP)	<-3,2
3	Gross national savings (as % GDP)	< 19,3	3	Yield of 10 year government bond (in %)	>10,8
4	External debt of economy (as % GDP)	>99,6	4	National debt falling due within 1 year (in %)	>19,0
5	Difference between real return SD and real growth GDP (in p.p.)	> 6,3	5	Share on national debt payable within 1 year (in %)	>21,7

Source: CNB, IMF, custom processing

The initial element is the total volume of sovereign exposures in banks' balance sheets. Using SRI as a probability of default parameter, the exposure is divided into limit part and over-limit part (ČNB 2015). If SRI increases, the sovereign exposure limit decreases, which at the same time causes increase of the over-limit part of the exposure. Banks are expected to treat the limit part of the exposure in accordance with the applicable regulation, which means that commitment limit does not apply to it and its risk weight is evaluated zero. For the over-limit part bank must create additional capital to cover the excessive concentration risk, but only provided that three year outlook of SRI will be higher than 8 %.

5 Conclusion

The paper pointed out the close connections between government and the banking sector, which even in the situation of favorable development in both sectors are mainly by the central bank perceived as significant and potentially risky. The hypothesis, which was formulated at the beginning of the article, was confirmed. The size of sovereign exposures in the banks' balance sheets associated with the regulatory requirements that have been analyzed in this article. Central bank highlights a risk of excessive concentration of sovereign exposures in the banks' balance sheets. At the same time, the Bank does not indicate that it is aware of the regulatory burden that banks must respect, and that is one of the principal causes holdings of sovereign debt. There are other reasons,

such as overpressure of liquidity, the size of the demand for loans and more, which, however, this article does not address.

Even in the international comparison, the banking sector of the Czech Republic is strongly involved in the role of creditor of the government sector. If interventions in regulatory procedures are not made, it is impossible to expect significant changes in banks' attitude towards this kind of asset. Although there exist objections against regulation applying positive discrimination of national debt even on the multinational level, there is not a political will to push the changes through. It is a procedure that is due to their indebtedness convenient for the countries.

When evaluating the sovereign risk it is impossible to monitor only current level of debt, but also predict its dynamics and register potential reform measures that have not yet been realized in the public finance, even though the realization is highly probable if not ineviTable (reform of the pension system). Czech population is aging, the progress that is analogous to progress of other developed countries. Higher state spending on health and higher volume of pensions are associated with that. There are other areas, where growth in requirements can be expected – for example security spending.

The Czech National Bank declares that since 2015 it has been carrying out stress test of public finance and its results will be introduced in the Financial Stability Report, which will be published at the end of the first half of 2016. Currently CNB merely states, that conducted stress test of public finance shows that the current fiscal situation in the Czech Republic is not a threat to financial stability. Therefore, in the upcoming three years, CNB will not enforce additional capital requirements on banks as holders of national debt.

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The Role of State Budget in Environmental Protection: The Case of European Union Countries

Kornélia Beličková* – Matej Boór**

Abstract. Environmental protection begins to receive more and more attention as more countries are recognizing the link between quality of life, socio-economic development and a well preserved life environment. This paper deals with the issue of environmental protection, focusing on the roles and functions of the state budget in its provision. Budgetary theory, which attributes to the state budget, the role of protector of the environment, is also called environmental or ecological budgetary theory. We pay special attention to the various types and forms of economic instruments in budgetary theory of the environmental protection and environmental policy. In the second part of the article we deal with trends in the growth or fall in the use of economic instruments in environmental policy and de facto budgetary theory of environmental protection in the budgetary process itself. Based on statistics collected by Eurostat and OECD institutions, we can claim that the use of the current budgetary theory has increasing trend, its significance is growing, and we expect a greater use of its applications in future periods.

Keywords: budgetary theory, environmental protection expenditure, environmental policy, environmental taxes.
JEL Classification: H23, H61, O13, Q58, Q50

1 Introduction

Necessity to deal with issues of environmental protection has been brought forward to the economic thinking, but so far it is not paid as much attention from the side of experts and economists as it is in the case of other economic disciplines. Many countries are aware of the economic and social impacts of environmental pollution and took their part in adoption of number of measures and commitments to mitigate the negative impacts of economic production on the environment.

Many companies in the private sector did not admit environmental devastation and degradation of quality of life, while pursuing high profits and reducing costs of production are willing to continue environmental pollution. However, there are few companies which are well aware of its negative impact on the environment and decided to take adequate steps to repair the damage caused and reduce environmental impact of the production of own goods and services. In the protection of the environment, the private sector is not alone and can be involved together with the state in the protection of ecosystems.

In recent time the budgetary theory of environmental protection, also known as environmental or ecological budgetary theory, is gaining prominence. Budgetary theories are economic theories that deal with opinions and ideas of economists on the status and role of the state budget in the national and worldwide economy. On one hand, budgetary theories are focusing on how to raise funds for the state budget and on the other hand, on spending of funds from the state budget in order to achieve macro-economic fiscal objectives, which are consequently affected by the cash flows.

Environmental budgetary theory can be classified as an interventionist budgetary theory, because of influence on the national economy and it also expands the scope and role of the state in the economy. Environmental budgetary theory is also a secondary budget theory, given the fact that it does not reflect all the main roles of the state and supports the status of the primary budgetary theory. Fulfilling the main aim of environment protection is possible through revenue and expenditure side of the state budget. The revenue side of the state budget consists mainly of sanctions and fines imposed to the private sector for use of obsolete non-ecological technology in the production of goods and provision of services that are not environmentally friendly and are imposing sanctions and penalties for transgressions against the environment (incorrectly disposed waste that harms the environment and is set free in nature, for example sewage released into the adjacent river). Specific group of public revenues which are focusing on the environment are environmental taxes and will be discussed further in the next chapter. On the expenditure side, we can find mainly grants and subsidies to the private sector for the acquisition of modern technologies with eco-friendly label. The present issue also will be explained in more detail in the following chapters. To achieve the main goal, it is necessary to combine both types of instruments and thus create an effective

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economic policy mix, while ensuring environmental protection. But we must not forget the important role of the state in the field of environmental protection, which is state regulation, also referred as silent side of state activities. The aspect of state interventionism is extremely difficult to quantify and the objective of this article is not to deal with this issue. The significance of environmental protection is clear from the objective of improving the quality of life and maintaining favourable surroundings for the development of human potential and capital for future generations. (Beličková, K., Boór, M. 2013)

2 Tools and instruments of state budget and environmental policy in the area of environmental protection

Environmental policy is one area of economic policy, through which the state using its budget is correcting the environmental aspects of manufacturing output in the country. To achieve the objectives, state uses a whole range of economic and non-economic instruments and its classification is based on influencing the behaviour of economic agents. Classification distinguishes direct and indirect environmental policy instruments. Direct instruments of environmental policies affect the behaviour of economic agents in the economy; the group of direct environmental policy instruments can include orders, prohibitions, and limitations on the permissible amount of pollution and a ban on the certain production which damages the environment (Romančíková E. 2004). On the contrary, indirect instruments as the name implies, indirectly affect businesses in the form of taking measures to reduce the environmental consequences of the economic activities. Indirect instruments include environmental taxes and levies, duties, retaliation, user fees, management fees, customs duties, not-tradable emissions, grants, subsidies, grants and backup systems (Válek, J. 2013). In our article we will focus just on indirect instruments of environmental policy.

3 Trends in environmental taxes and environmental expenditure protection in European Union

Many countries of EU shifted their focus to environmental taxes to achieve better life quality for inhabitants; these efforts are evidenced by several tax reforms in recent years (mid-2013 and mid-2014). These tax reforms meant in general increasing indirect and reducing direct taxes, while 18 countries of EU reduced their tax bases, but on the other hand 15 countries increased environmental taxes, which means increase in financial importance of environmental taxes. The biggest financial impact of environmental taxes expressed by GDP ratio for 2013 was achieved in Denmark (4,23%), Slovenia (3,87%), Italy (3,49%) and Croatia (3,45%). (Hodžić, S. – Bratić, V. 2015)

Environmental taxation in EU is mainly composed by energy taxes (75% of revenues from environmental taxes – more than three quarters are represented by transport fuel taxes), non-fuel transport taxes (21%) and followed by pollution and resources taxes (4%). Directorate-General for Taxation and Customs Union noted increasing overall trend in environmental taxation (expressed by % GDP) after falling between 2002 and 2008. The overall trend is sTable in recent years (around 2,4%), while in Eurozone is slightly lower (2,3%) in 2012. (Taxation trends in European Union, 2014).

Chivu, M. R. – Blăjanu, E. A. – Popescu, D. L. – Chivu, M. (2011) estimated and describe trend in environmental taxation (expressed in % GDP) from 2000 to 2008, with confirmed the negative trend in the revenue from environmental taxes. This fact authors described as a consequence of global environment and financial crisis, but they expressed confidence, that this phenomenon will turn upward due to high potential of new member states.

Increasing trend in environmental taxation can be observed since 90s years, when revenues from environmental taxation has been larger than the growth from taxes on labour in EU15 (1990-1997) and the highest increase was achieved in Finland, Greece and Netherlands, but the trend for Ireland and Portugal decreased. (European Environment Agency, 2000).

Based on previous research studies we can conclude that importance of environmental taxation is generally increasing in the long term horizon, despite the negative effects of last financial crisis.

Opposite to environmental taxes there is the topic of environmental protection expenditure, which represents the opposite side of public budget. Environmental protection expenditures are defined as the amount of money spent on all purposeful activities directly aimed at the prevention, reduction and elimination of pollution or harmful substances resulting from production processes or from the consumption of goods and services. (Broniewicz, E. 2011) This definition is reflecting entire environmental protection expenditure spends by any economic subject, but our article is focusing only on public sector.

Environmental protection expenditure is composed of two main categories: current expenditure and investments. Broniewicz, E. (2011) observed increasing trend in environmental protection expenditure (in million euro) in 25 countries of EU in 2002-2007, however this fact was achieved due to increasing current expenditure, (investments remains almost on the same level).

Beliczay, E. (2009) in her study is focusing also on the issue of ,,harmful subsidies", which have been analysed by OECD and European Union since last decade. Author defined the as subsidies, that destroy market principles and contribute to inefficiency of spending.

Interesting findings on the topic of environmental protection expenditure were found by Ada, A. A. (2014). He estimated the correlation relationship between economic growth and volume of environmental protection expenditure for selected EU countries and time period covers years from 1996 to 2011. The main finding was that economic growth is negatively correlated with the volume of environmental protection expenditure for almost all countries (only in Luxembourg this relationship was positive). Author pointed out that that economy policies are determined without taking environmental protection expenditure into consideration and the increase of GDP means that share of environmental protection expenditure is decreasing.

4 Trends in changes of the volume of public expenditure and public revenue relating to the environmental protection in member states of European Union

For purposes of determining the use of environmental budgetary theory and its trends, we used data reported through the *Joint OECD / Eurostat Questionnaire on Environmental Protection Expenditure and Revenues (EPER)*, gathered and reported from the auspices of the OECD and Eurostat. In this statistical database are reported several indicators concerning environmental protection, and one component is environmental public revenue and expenditure by public sector. In our article we will deal with both categories separately, focusing on describing trends in the use of economic tools of environmental policy and thus the role of the budgetary theories of environmental protection. As first we will focus on public environmental protection expenditure, and the statistical database identifies five types of environmental protection expenditure:*

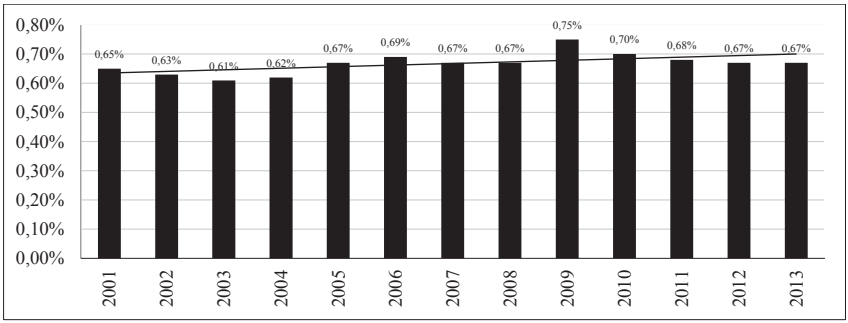
- investments for environmental protection
- pollution treatment investments,
- pollution prevention investments,
- current expenditure for environmental protection,
- subsidies/transfers given for environmental protection activities

The Eurostat statistical databases are reported dynamic aspects of public expenditure on environmental protection as a ratio expressed through two indicators:

- amount of funds in public expenditure for environmental protection per capita.
- percentage of public expenditure spent on environmental protection in relation to GDP.

For better visual representation of trends in the use of environmental budgetary theory, we took advantage of a graphical representation of the second value. Figure 1 shows trend in public expenditure of environmental protection as a share of GDP.

Figure 1: The volume of environmental protection public expenditure as a share of GDP



Source: EUROSTAT

From the Figure 1 we can observe that there has been upward trend in the volume of environmental protection public expenditure. Paradoxically, the largest volume of funds expended in the volume of environmental protection public expenditure quantified by % GDP was held in 2009, when the world was fully raging by financial crisis. In

* The current classification concerns not only environmental protection expenditures arising from the state budget, but also from the budgets of households and firms. In our case, however, we will focus only on cash flows from the state or public budget in general

year 2009 was also a highest peak in overall general government expenditure in terms of percentage share of GDP (50,3%). The determinant of the peak of both categories is influenced also by evolution of GDP in EU, however in the year 2009 the real growth of GDP took value – 4,4%, which is the lowest value achieved for last decade in European Union for this indicator. Environmental protection public expenditure did not returned to the volume 2009 to the present time, the lowest values were observed in 2003. The trend line represents a growing trend, which leads us to conclude that, despite the low or sporadic fluctuations in the volume of funds the elements and ideas of budgetary theory of environmental protection is implemented into the budgetary process and its significance is growing even today.

On the contrary, in terms of the revenue side of the state budget, the most important component in terms of environmental protection consists of ecological taxes, so we focused on them during the analysis of the issue when examining trends in the use of budgetary theory of environmental protection in the budget process. Eurostat Statistical collects and reports statistics in which the environmental taxes are divided as follows:

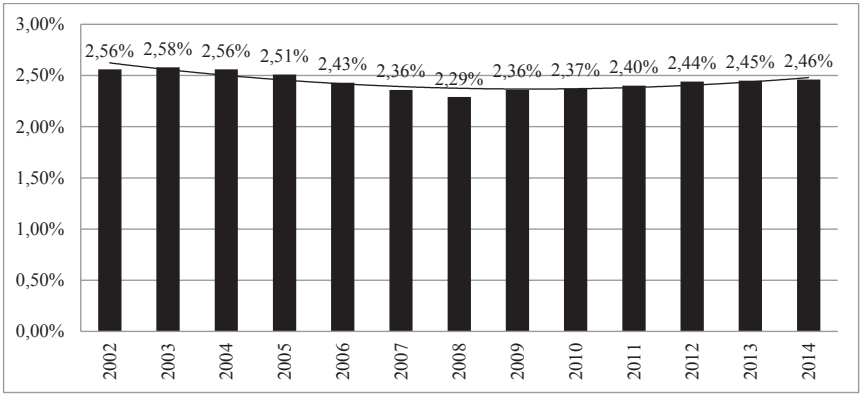
- energy taxes (including fuel for transport);
- transport taxes (excluding fuel for transport)
- pollution taxes;
- resource taxes;
- taxes on pollution/resources;

For our purpose the indicator of overall environmental taxes, which are represented by the sum of the partial environmental taxes, appears to be the most relevant. Compared to statistical reporting of expenditure on environmental protection, environmental taxes are recognized not only as common indicators, but as well as the nominal indicators as follows:

- million euro;
- million units of national currency;
- percentage of total revenues from taxes and social contributions (including imputed social contributions);
- percentage of total revenues from taxes and social contributions (excluding imputed social contributions);
- Percentage share of gross domestic product (GDP).

Given the fact that we examine trends in the European Union as a whole, we exclude indication of the overall environmental taxes in millions of national currency, statement of the percentage of total revenues from taxes and social contributions (including imputed social contributions) and millions of euro. A representative sample of countries consists of countries like in the previous case, all European Union member states (EU28), but the time period over the previous case has been slightly modified and in this case covers the years 2002 to 2014. Information regarding to the total environmental taxes we bring in the following charts.

Figure 2: **Revenue from environmental taxes (% GDP)**

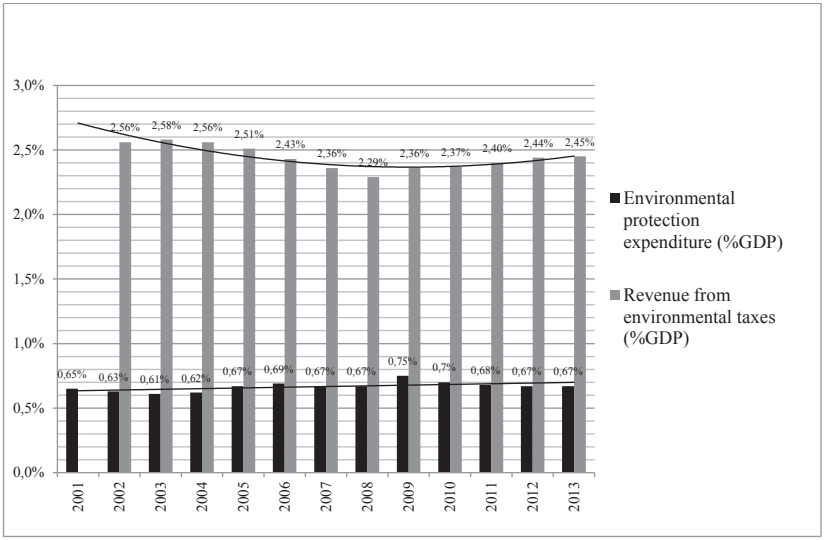


Source: EUROSTAT

The previous Figure has already been addressed to the revenue from environmental taxes in mutual terms, while the trend is not linear through growing line but by a slightly polynomial trend line. In our case the selected indicator from 2002 to 2008 achieved downward trend (in 2008, the profit from environmental taxes was the lowest), and from this year the situation is reversed and the profit are gaining a growing trend that is significantly more noticeable and pronounced if the profit from environmental taxes is quantified as % of GDP.

In the last Figure 3 we can see environmental protection expenditure and revenue from environmental taxes in one graph.

Figure 3: Comparison between the values of environmental protection expenditure and revenue from environmental taxes (%GDP) by public sector



Source: EUROSTAT

As we can see from the Figure 3, there is gap between revenue from environmental taxes and environmental protection expenditure. Despite the fact, that taxes do not state the purpose for which they are spend, we have opinion, that these two values should be at least more or less equal. Similar research was done by Jeffrey, C. – Perkins, J. D. (2014), when they estimated the relationship between energy taxes and environmental protection expenditure focusing mainly on business sector on EU data from 2001 to 2008. Their results proved that energy taxes are effective in motivating business spending on emissions abatement.

In comparison with other studies and authors we confirm negative trend in revenue from environmental taxes to the year 2008, which match with conclusions of Chivu, M. R. – Blăjanu, E. A. – Popescu, D. L. – Chivu, M. (2011). On the other hand, we prolong the time period and observed the negative trend from the year 2009 turned and now we can see upward trend for this indicator. We incline with the observations made by Hodžić, S. – Bratić, V. (2015), who presented the opinion that financial importance of environmental taxes is increasing.

On the side of environmental protection expenditure, we can also see the upward trend which was also observed by Broniewicz, E. (2011), but only for shorter time period excluding recent years. For the purpose of deeper investigation, there is a need to split environmental protection expenditure into two main subgroups (current expenditure and investments) and estimate the evolution of each for better capture the trend.

5 Conclusions

The issue of environmental protection was brought up to the economic thinking, but so far it does not pay as much attention experts by economists as is the case with other economic disciplines. At the time of the ongoing financial crisis, however, environmental protection is not given adequate attention in comparison to more important high priority economic issues. The paper deals with the use of environmental budgetary policy in the budget process and its importance in the national economy, and in each chapter the different instruments of environmental policy are presented, with particular attention being focused on economic instruments in environmental policy, namely public expenditure and public revenue in the form of environmental taxes. In the practical part we will discuss trends in the various categories of budgetary theory of environmental protection and environmental policy in terms of revenue and expenditure in the environment. Based on the findings, we can say that the use of budgetary theory of environmental protection in the budget process is on an upward trend and its significance continues to grow.

An interesting finding is that during the financial crisis (2007 - 2009) public expenditure environmental protection and environmental taxes showed features of an expansive economic policy, while public spending reached the highest values and public revenues the lowest values. Finally, we would like to express the conviction that there is a need to pay more attention to the protection of the environment, and it is necessary to adopt adequate actions.

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Impact of shared taxes on the financial situation of Slovak municipalities

Lukáš Cíbik*

Abstract. The aim of paper is to analyze the impact of shared taxes on the financial situation of Slovak municipalities in the period 2010-2014. The impact of shared taxes on municipalities and cities of Ilava district will be analyzed on the basis of two selected indicators – financial autonomy and financial strength and their modified versions. This provides a space for comparison of individual values. Development trends of selected indicators and the derivative effect of shared taxes on the financial situation of towns and municipalities will be then examined.
Keywords: shared tax, municipalities, financial autonomy, financial strength.
JEL Classification: H21, H71, H77

1 Introduction

The aim of this paper is to assess the impact of shared tax on the financial situation of the surveyed municipalities on the basis of two selected indicators. The impact of the single shared tax will be analyzed on the basis of two main financial indicators and their two modified versions. We can demonstrate the impact of shared taxes on financial autonomy and financial strength of a selected group of municipalities by comparing the results of selected indicators. Based on the learned lessons, a space is opened to assess the appropriateness of establishing the single shared tax in Slovakia.

After 10 years, since accession to fiscal decentralization and reform of the tax system in Slovakia, a space was created for analyzing the impact of the introduction of a single shared tax on the financial situation of local governments. There was a significant change in the funding and management of local governments in Slovakia by applying fiscal decentralization in 2004-2005. There has been a reform of the tax system and the reallocation of powers of taxation and tax determination between the various levels of local government and central level.

Multiple targets were monitored by assessment of personal income tax (PIT) as the only shared tax. Firstly, a dynamic growth in revenues from this tax was expected. In the case of personal income tax the choice is relatively evenly distributed during the calendar year. At the same time, the tax is locally determinable and the system of redistribution of funds between different levels of government has been simplified by introducing a single shared tax. As one of the last reasons thereof, explanatory statement defines change of determination of a specific amount accruing to municipalities and transition to a redistribution of tax revenue using a predetermined coefficient according to certain variables on the basis of statistical data, which eliminates subjectivity in deciding while eliminating potential political influence.

2 Shared tax in the Slovak Republic

The arrangement of the tax system where there is a redistribution of tax revenue in the vertical plane among levels of government (central and decentralized) and horizontal distribution among lower levels at the same time is called tax sharing (Oates, 1969). It represents a significant way (in which there is a horizontal fiscal equalization) for implementing transfers to decentralized levels of government.

The system of shared taxes is used around the world, because the central government retains certain decision-making powers through this system (McLure, 2011). This especially applies to the determination of what taxes will form a group of shared taxes and the determination of shares of decentralized levels of total return. The most often used shared taxes include personal income tax, corporate tax and value added tax.

There has been a substantial change in shared taxes by applying fiscal decentralization in Slovakia in 2005. Instead of having three shared taxes on the proceeds of which Slovak municipalities and the central level participated in, a variant with the single shared tax has been adopted, the revenue from which is distributed among all three levels of government on the basis of statistical criteria through redistributive coefficient. Slovak legislation ranks the share of personal income tax to the group of own income. The funds derived from the redistribution of the proceeds of this shared tax represent a significant part of the revenue of the general budget.

Shared tax is an income to the state budget and a proportion of its revenue, according to a predetermined percentage, is allocated among the budgets of municipalities and higher territorial units. The central level and local self-government within a specified proportion participate in revenue derived from personal income tax. Since the

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introduction of the single shared tax in 2005 the local government share in total revenue has changed. Changes in the allocation of funds from personal income tax are captured in the Table1.

Table 1 Distribution of personal income tax revenue under legislative definition over years in percentage (%)

The period	Local level Municipalities	Regional level Self-Governing Regions	Central level State
2005 – 2011	70,3	23,5	6,2
2012 – 2013	65,4	21,9	12,7
2014	67,0	21,9	11,1
2015	68,5	29,2	2,3
2016	70,0	30,0	0,0

Source: Own elaboration.

The amount, which each municipality will obtain from the share intended for the local self-government depends on several criteria. The specific situation of each municipality is taken into account when distributing funds and the total amount obtained reflects the population of the municipality, as well as age structure of inhabitants, size category of the municipality and the altitude of the municipality. The Government Ordinance no. 668/2004 Coll. on the distribution of the income tax revenue to local governments determines the exact proportion of municipality on tax revenue.

3 Data and methods

Municipalities and towns of Ilava district (21) represent a selected group. From the perspective of the article it was appropriate to capture values of individual indicators across different sized towns and municipalities at the same time. This is prevented only by partial comparison of different sized groups of municipalities and towns and we focus on specific administrative and territorial unit. The unit consists of a heterogeneous set of towns (3) and municipalities (18), which are significantly differentiated with respect to their population (25 085-527), which is ultimately responsible for fragmented settlement structure of Slovakia.

The data used come from the final accounts of municipalities and towns for the period 2010-2014. If these data were not in the final accounts, the article works with values derived from multi-annual budgets of municipalities. Only the actual values derived from te real implementation of the budgets as of 31.12. were taken into account.

Two indicators were chosen: financial autonomy (1) and financial strength in order to fulfill the primary objective of analyzing the impacts of shared tax revenue on the financial situation of municipalities.

In the article, the financial autonomy (FA) of municipal budgets is surveyed as a share of own municipal income and the total income of the general budget. This indicator is often used for the evaluation and comparison of the financial situation of the municipalities within each state as well as in international comparison for the whole segment of local government (Jilek, 2008; Pekova, 2004; Horvathova, 2009).

$$FA = \frac{OMI}{TMI} \text{x } 100 \tag{1}$$

where FA = *financial autonomy,*
OMI = *own municipal income,*
TMI = *total municipal income.*

The paper works with a number of key terms of which a clear definition is a priority for the overall result and fulfillment of the objective. Total municipal income (TMI) consists of all funding obtained in the municipal budget for the financial year. Total income consists of current income, capital income and income from financial transactions for that financial year.

The income that is explicitly included in this category by Slovak legislative amendment will be considered own municipal income (OMI). These include the current tax and non-tax revenues selected. Each municipality as a basis for self-government has a range of own income defined by Act. No. 583/2004 Coll. on budgetary rules of local governments and Act.No. 582/2004 Coll. on local taxes and local fees for municipal waste and minor construction waste. Municipal own in-come consists of funds from local taxes and levies, non-tax revenues from the ownership and transfer of ownership of municipal property and municipal budgetary organizations, proceeds

from municipal funds, sanctions for violations of financial discipline imposed by municipality, voluntary donations and revenues from voluntary collections to the municipality, the share of taxation in the administration of the state under a special regulation (share of PIT) and other re-venues set by special regulations. Overall, the research will be designed based on the definition of own income that includes current tax and non-tax revenues, in addition to capital grants and transfers. E. Zarska (2009) similarly defines municipal own income, according to her, municipal own income consists of all current revenues, excluding subsidies, grants and transfers.

Net own income or net income in short, represents own revenues of the municipal budget for the year reduced by the amount corresponding to the municipality's share on revenue from personal income tax in a particular year. In this way, we can compare the total value of financial autonomy as well as its modified version, adjusted for the share of municipalities on personal income tax.

An indicator of net financial autonomy (NFA), which can be considered as an adjusted indicator of autonomy of the municipal budget, was constructed in order to demonstrate the impact of shared taxes on financial autonomy of municipalities. We can obtain its value as a share of municipal own income reduced by the proportion of personal income tax revenue and total municipal revenue (1A).

$$NFA = \frac{OMI - PIT}{TMI} \text{x } 100 \tag{1A}$$

where *NFA* = *net financial autonomy,*
OMI = *own municipal income,*
PIT = *personal income tax,*
TMI = *total municipal income.*

The selected indicators for measuring the autonomy of local budgets represent a modified version for the expression of fiscal autonomy of municipalities. However, the original model does not adequately reflect the nature of municipal own income and does not sufficiently take into account the resulting effect of funds from the PIT, because it takes into account only one part of own income and that is tax revenue. Adjusted indicator, in addition to own tax revenue, takes into account municipal own non-tax revenues. Conviction, according to which own non-tax re-venue is an integral part of own income is the reason for this. Revenue from handling own property or business income of municipalities are the evidence of municipalities own activities, including taxation, by which municipalities seek to mobilize additional resources by using their property or doing business. These activities and opportunities of individual municipalities differ with the respect to the amount of own property and the amount of activity of municipal representatives in its recovery (Nenkova, 2014). In this regard, it was necessary to include the municipal budget as a comprehensive whole and not just pursue the research of autonomy degree in tax revenues, to expand and specify the currently popular form of surveys on the share of own tax revenue to total revenue of municipal budgets.

We can find out the value of the financial strength of municipal budgets (FS) on the basis of the average population (AP) of each municipality. The second data for analyzing the impact of the PIT to the municipalities, which has significant informative value, is obtained to percentage values in this way. The resulting values represent the amount of income per capita in euros. The advantage of comparison of towns and municipalities using given indicator is its independence on the amount of total income, the amount of which for each year often reaches very different values, which is inevitably reflected in the distorted resulting percentage of own income, and consequently, in the degree of financial autonomy in that year. The higher the amount of own revenue per capita, the more independent is the municipal budget and it receives significant funds from own tax and non-tax resources without transfers and subsidies. At the same time this indicator can be considered as more resistant to interannual fluctuations and more sTable due to its construction, which takes into account relatively sTable variables – own income and population. The financial strength (2) is calculated based on the revenues from local taxes, shared taxes and other own revenue in relation to the population size of the administrative unit (Steytler, 2009). The calculation was done on the basis of a formula:

$$FS = \frac{OMI}{AP} \tag{2}$$

where *FS* = *financial strength,*
OMI = *own municipal income,*
AP = *average population.*

A modified version of the previous indicator was constructed in order to determine the impacts of shared taxes on this area. Net financial strength of the municipal budget (NFS) appropriately reflects inherent activities of municipalities and their tax situation which could be distorted by the share of municipalities on PIT due to the fact that its amount is detemined by the population and age of inhabitants. We will obtain the final value as the share of own income reduced by the shared tax revenue and the average population of the municipality (2A).

$$NFS = \frac{OMI - PIT}{AP} \tag{2A}$$

where NFS = *financial strength,*
OMI = *own municipal income,*
PIT = *personal income tax,*
AP = *average population.*

The primary aim of the article is to examine the impacts of the shared tax revenue on the financial situation of municipalities of Ilava district over the period 2010-2014. We can analyze the impact of shared taxes on the financial situation of local self-government in Slovakia by determining two main indicators and their modified versions. Key indicators (FA and FS) are a typical representation of selected aspects of financial situation of municipalities. Their modified versions (NFA and NFS) are the final values adjusted for the share of PIT. It is possible to demonstrate the effects of shared taxes on the financial situation of municipalities by locking the resulting maximum and minimum values of the individual indicators. We can analyze the impacts of shared taxes on the financial situation of the municipalities in Ilava district for 2010-2014 thanks to subsequent comparation of basic and modified indicators.

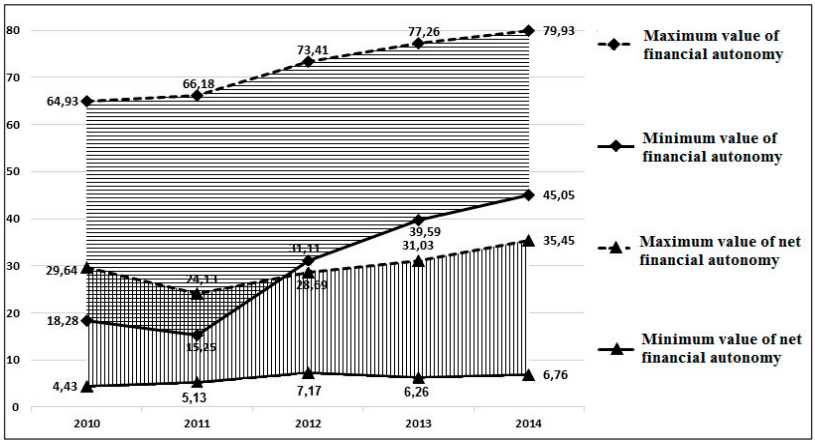
When analyzing the impact of personal income tax on municipalities we will observe the positive or negative effects from our point of view. We will positively assess the growing volume of financial autonomy and financial strength because it creates more space for original powers. It forms one of the pillars of any self-government that is independent management of own resources. On the contrary, we will consider reducing financial independence and financial strength as a negative impact. The local self-government is becoming more dependent on funding from the state budget by reducing the rate of financial independence and financial strength, thus becoming only the extended arm of the state administration, with limited scope to exercise special powers.

Research on the impact of individual income areas of the municipal budgets using more detailed comparison is absent in Slovak Republic. In our research, we did not meet a similar examination of the effects of shared tax on the financial situation of Slovak municipalities. The cause can be found in the fact that the actual examination of the financial area of Slovak municipalities is at a low level compared with other European countries. Domestic authors elaborate the issue of financing municipalities in terms of different fields (law, public finance, local economics, public policy) and based on data for the whole autonomous segment of public administration (nationwide level) or regional (provincial, NUTS 3) terms. In these cases, they do not take into account differences between individual districts, between individual municipalities and towns within the area surveyed. Simultaneously, individual works are devoted only to local taxes in the vast majority and neglect research of grants or funds from shared tax on the financial situation of Slovak municipalities. At the same time, works comparing several indicators of the financial situation of municipal budgets are a rarity.

4 Results and discussion

After finding the necessary data, we calculated the first monitored indicator and its modified version for individual municipalities. As a result, we can compare the values FA and NFA (Fig.1) and capture their dynamics and development trends. The impacts of shared taxes on the first two indicators of the financial situation of municipalities are clear thanks to a graphical record of maximum and minimum values.

Figure 1: The maximum and minimum values of financial autonomy and net financial autonomy of municipalities in the years 2010-2014 in percentage (%)



Source: Own calculation based on final accounts of municipalities of Ilava district in the years 2010-2014.

When calculating the financial autonomy, we have included the proportion of municipalities on shared taxes in the formula. Thanks to this, the indicator showed a relatively significant interannual increase of both the maximum and minimum values. The maximum value had a rising trend of the interannual average rate of +3% and it increased from the original value of (64,93%) to 79,93% during the monitored period. The minimum value of financial autonomy of surveyed municipalities recorded an even more dynamic interannual increase. It increased from the initial value of 18,28 % to 45,05 % in the last year of the period under review. This represents an average interannual increase of +5,44 %.

Reducing disparities between absolute values and a sharp interannual increase at the same time is typical for this indicator, which includes the share of municipalities on PIT. The difference was 46,65 % at the beginning of observation. In the next year it rose slightly, but then we have recorded a permanent reduction of the difference between absolute values until the end of the measurement in 2014. In 2014, the difference amounted to 34,88 %, which is a decrease of 11,77 % compared to 2010.

The indicator, in which shared tax was not included, showed a significantly lower interannual increase. In the case of the maximum value it increased by 5,81 % over the period examined, representing an average interannual increase of 1,16 %. We recorded even lower values in the case of minimum values of the net financial autonomy, where the average interannual increase reached less than + 0,5 %.

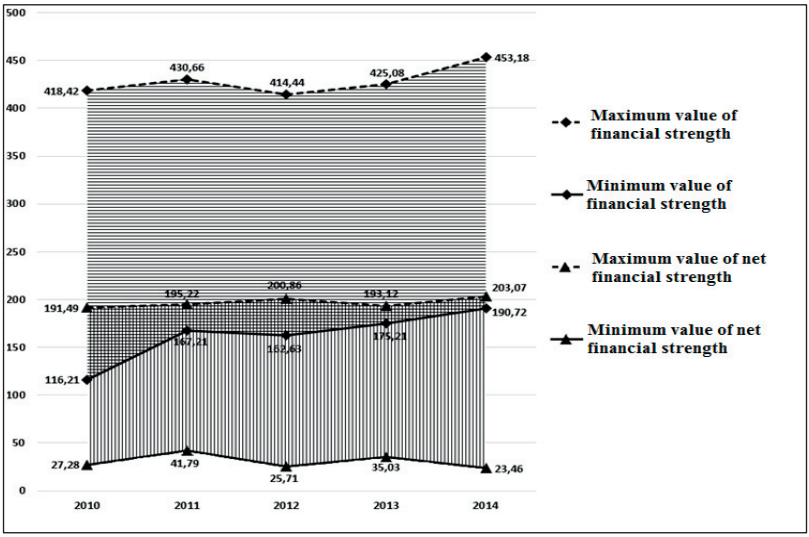
An inequality has been increased for 5 years in the case of comparison of maximum and minimum values of modified indicator. When adjusting the indicator of shared taxes there was the difference of 25,21 % at the beginning of observation and at the end the gap between the absolute values was increased to 28,69 %, which is an increase of 3,48 %.

If we focus on the comparison of mean (average) value we will find out that the indicator of financial autonomy, in which the shared tax was included is three times higher than the value of the indicator adjusted for the shared tax.

In this case, the shared tax significantly increases the financial autonomy of local budgets. It is also attributed to the significant interannual increase of financial autonomy, and it leads to the mitigation of differences between the maximum and minimum values.

We then investigated the resulting values for the second selected indicator and its modified version for individual municipalities. As a result, we can compare the values FS and NFS (Fig. 2) and capture their dynamics and development trends. The impacts of shared taxes on the second two indicators of the financial situation of municipalities are clear thanks to a graphical record of maximum and minimum values.

Figure 2: The maximum and minimum values of financial strength and net financial strength of municipalities in the years 2010-2014 in Euros (€)



Source: Own calculation based on final accounts of municipalities of Ilava district in the years 2010-2014.

When calculating the financial strength, the share of municipalities on PIT has been included in the formula. Thanks to this, when comparing the initial and final values the indicator showed an increase of both the maximum and minimum values. The maximum value increased by € 34.76 from the initial value (€418.42) until the end of the reporting period, representing an average interannual increase of nearly € 7. The minimal value of the financial strength of the municipalities surveyed recorded an even more dynamic interannual increase. At the beginning of the measurement it amounted to € 116.21 per capita and it was rising vigorously in a subsequent period. In the last year of the period under review it rose to € 190.72, representing in absolute terms an increase of € 74.51 and the average interannual increase of almost € 15 per capita.

Reducing disparities between absolute values concurrently with the interannual increase is typical for this indicator, which includes the share of municipalities on PIT. The difference was € 302.21 at the beginning of the observation. Subsequently, we recorded a permanent reduction of the difference between absolute values until the end of the measurement in 2014. In 2014, the difference amounted to €262.46, which is a decrease of € 39.75 per capita compared to 2010.

The indicator, in which the shared tax was not included showed again a significantly lower interannual increase. In the case of the maximum value, it increased by €11.58 over the period examined, representing an average interannual increase of only a little more than 2 Euros. Even worse values were observed in the case of minimum values of the net financial strength. When comparing the initial and final values, we even recorded a total decline of € 3.82 for 5 years.

In the case of the difference between the maximum and minimum values, we can confirm a very slight increase in inequality. When adjusting the indicator of shared taxes, there was the difference of € 164.21 at the beginning of observation and at the end the difference between the absolute values increased to € 179.61, which represents the difference between the maximum and minimum values of € 15.4.

If we focus on the comparison of mean (average) value we will find out that the indicator of financial strength, in which the shared tax was included is three times higher than the value of the indicator adjusted for the shared tax.

In this case, the shared tax significantly increases the financial strength of municipal budgets. It is also attributed to the higher interannual increase of financial autonomy, and it leads to the mitigation of differences between the maximum and minimum values. Even the comparison of results of financial strength confirmed similar results of the impacts of PIT on municipal budgets as a comparison based on the indicator of financial autonomy.

The selected indicators represent two methods for assessing the financial situation of the municipalities. Financial autonomy and net financial autonomy capture relative value (%), based on which individual levels of government are most often compared internationally. Due to the construction of indicators, the resulting values can be difficult to interpret. The problem of the indicator is mainly the immediate dependence of the total amount of revenue which mostly influences the final amount of financial autonomy. Financial strength and net financial strength are used to capture the absolute values (€ per capita). This indicator was chosen because of its stability, as it focuses on two very sTable variables – population and the level of own revenues. However, the process has reached its limits when comparing the financial situation of levels of government between countries. A fundamentally different system of financing the local self-government as well as the different classification of individual income areas given by national legislation are the reasons for this.

Selected indicators and their modified versions belong to basic indicators for measuring the financial situation of the lower levels of government. At the same time we run into some limitations. The paper deals with only two indicators and their modified versions, since we think that it is possible to properly analyze the impact of personal income tax on the financial situation of Slovak municipalities on their example. But there are other indicators (eg. tax power, self-financing, debt service, etc), that can be used and combined in assessing the impact of personal income tax on the budget of Slovak municipalities. However, we would exceed the prescribed extent of the contribution by incorporating other approaches and assessment methods.

In processing we chose this approach because of its clarity. Ambition for a more comprehensive comparison of several indicators and a large number of municipalities faces a number of complications. The first complication is choosing other relevant additional indicators the value of which we want to find out. However, the biggest obstacle is obtaining the necessary information directly from municipalities, since there is no central electronic registration where municipalities publish their final accounts. This is connected with problems in communication with municipalities and with the request for access to the necessary information, even if municipalities are obliged to provide this information in accordance with applicable laws.

5 Conclusions

The aim of the paper was to analyze the effects of the introduction of the single shared tax on the financial situation of Slovak towns and municipalities in 2010-2014. Thanks to the analysis of two typical indicators (financial autonomy and financial strength) and their modified versions, we managed to demonstrate the positive impact of personal income tax to municipalities.

In analyzing the impact of shared tax, we focused on selected income areas of which the most important were own income and net own income. We considered only the income that is set by Slovak legislation as own income. This mainly includes local taxes, shared tax and selected non-tax revenues. When we deducted from them the amount of resources from personal income tax, the resulting value represented net own income.

First of all, funds from the shared tax account for a significant part of the income component of municipal budgets. At the same time, funds from the shared tax triple the values of financial autonomy and financial strength. Both indicators in which the share of personal income tax was included, showed a higher overall growth for limits. Resources from the shared tax have a very positive impact on reducing disparities between the maximum and minimum values of selected indicators of financial situation of the municipalities surveyed.

The results are based on analysis of impacts of shared tax from the perspective of one district, that is why a selected sample does not constitute a representative selection. On the other hand, this act can be considered a kind of impulse to explore the financial area of budgets of the Slovak municipalities since there is no comparable research in Slovak Republic. The present contribution proves opportunity to compare the results of several indicators at the level of districts or different size groups of municipalities. For a more detailed view it would be appropriate to leave the nationwide perspective and to explore the differences between the lower levels of each other, thus underlining the regional or local disparities. At the same time there is a need to choose suiTable indicators for comparison and to laboriously obtain relevant information directly from municipalities.

Generally speaking, it was appropriate to elect the personal income tax as shared tax, due to the above mentioned positive impacts analyzed. These impacts are considered positive because the degree of their financial autonomy as well as the value of their financial strength increased thanks to the share of municipalities on personal income tax. It evokes an increase of autonomy degree in the financial sector and an increase of their own independence when conducting their own original self-governing powers. Since its introduction the shared tax represents one of the cornerstones of financing Slovak municipalities and it strengthens their position as the administrative unit with its own sphere of income by the annual increase in funds flowing to municipalities. These funds are not pre-committed for any purpose and their use is specific to each municipality, thus fulfilling one of the basic conditions of local self-government – management of their own resources and their independent use within the law.

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Performance of the Czech Health System: An International Comparison with Health Systems of Four Neighboring Countries

Martin Dlouhý*

Abstract. The objective of this study is to evaluate performance of the Czech health system in a comparison with national health systems of neighboring countries: Austria, Germany, Poland, and Slovakia. We can assume that these countries of Central Europe share similar social, economic, and cultural characteristics. An important question for the Czech health policy makers as well as health researchers is how to improve the Czech health system to the level of the Western Europe. One way for an improvement is to compare the Czech health system with health systems of the countries with similar characteristics: why is my neighbor able to provide health services better than me? The health system performance of these countries is evaluated by six different measures and by the data envelopment analysis model. In spite of the fact that methodologies and time periods differ, we may observe very similar findings: better results for Austrian and German health systems in comparison to Czech, Slovak, and Polish health systems.

Keywords: health system performance, DEA, Czech Republic.
JEL Classification: H51, I11

1 Introduction

Since the fall of communist regimes in Central and Eastern Europe in 1989, the national health system of the Czech Republic went through many changes: health financing out of taxation was replaced by public health insurance; state structures of health care delivery were replaced by public health insurance institution(s) and independent public or private health care providers; pharmaceutical markets were liberalized; many patient-oriented advocacy groups were formed; rights of the patients became an important issue (Dlouhý, 2010).

The objective of this study is to evaluate performance of the Czech health system in comparison with the health systems of its neighbors: Austria, Germany, Poland, and Slovakia. One can assume that these countries of Central Europe share similar social, economic, and cultural characteristics. However, the countries differ, for example, in the level of economic performance and the level of health care financing measured as a share of total health expenditure on the gross domestic product (Table 1). In case of both indicators, the values for the former communist countries (Czech Republic, Poland, and Slovakia) are lower than the summary value for the European Union. This means much lower sources of health financing in comparison to Austria and Germany.

Table 1: GDP in purchasing power parity in USD per capita and total health expenditure (THE) in 2013, life expectancy at birth in 2010

Country	GDP	THE as % GDP, 2013	THE in PPP$ per capita, 2013	Life expectancy at birth, 2010
Austria	45 082	11.03	4 885	80.88
Germany	43 887	11.30	4 812	80.64
European Union	35 295	9.52	3 379	80.16
Czech Republic	29 018	7.24	1 982	77.81
Slovakia	26 497	8.21	2 147	75.66
Poland	23 994	6.66	1 551	76.58

Source: European Health for All Database.

An important question for the Czech health policy makers as well as health researchers is how to improve the Czech health system to the level of the Western Europe. One way for an improvement is to compare the Czech health system with health systems of the countries with similar economic, social and cultural characteristics: why is my neighbor able to provide health services better than me? It means that health researchers and analysts need to have at disposal reliable and objective measures of health system performance. In order to describe and compare

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national health systems, various methodologies can be used. We introduce only some of them in this article. In the following section we describe a selection of such methodologies.

2 Methods

Evaluation of health system performance is both theoretical as well as practical problem with specific characteristics. For example health (output of the health system) is hard to measure and hard to express in monetary values; the causality between health inputs and health (output) is not always certain; apart from efficiency, equity is also one of the objectives.

If a researcher does not want to rely on methodology developed by others, he or she can use its own performance indicators. The available sources of data on European health systems that enable international comparisons are the databases of OECD, Eurostat, and World Health Organization. The choice of performance indicators is in hands of a researcher and depends in particular on the objective of a given study. We will not discuss here, which indicator is the best one. We will use the traditional health indicator, life expectancy at birth, which was obtained from the European Health for All Database. The 2010 data were available for 40 countries of the European WHO region. The data on life expectancy at birth for five countries included in this study are shown in Table 1.

The World Health Report 2000 (World Health Organization, 2000) is one of the most comprehensive attempts to evaluate performance of national health systems. Drawing from a range of experiences and analytical tools, the World Health Report 2000 traces the evolution of health systems, explores their diverse characteristics, and uncovers a unifying framework of shared goals and functions. The World Health Report 2000 breaks new ground in presenting an index of national health system's attainment and an index of performance relative to potential. These measures are based on five goals: the level and distribution of health, the level and distribution of responsiveness of the system to the legitimate expectations of the population, and fairness of contribution to financing the health system. An important objective is to see what one can learn from the best. The World Health Report 2000 aims to stimulate a debate about better ways of measuring health systems performance and thus finding a successful new direction for health systems to follow. If only outcomes of the health system are considered, we talk about attainment. The second question is what the health system should be able to achieve with the same level of resources - performance. The resources are measured as per capita health expenditure in international dollars.

In their paper, Mackenbach and McKee (2013) reviewed the national health policies in ten different areas (for example, tobacco, alcohol, food and nutrition, cancer screening, child health) in 43 European countries. Mackenbach and McKee selected 27 process and outcome indicators and developed a summary score indicating the overall performance of the country in implementing effective health policies. In exploratory regression analysis they related these indicators to six background factors: national income, survival/self-expression values, democracy, government effectiveness, left-party participation in government and ethnic fractionalization. Mackenbach and McKee (2013) found striking variations between countries in process and outcome indicators of health policies. According to results, survival/self-expression value and ethnic fractionalization were the main predictors of the health policy performance summary score.

The Euro Health Consumer Index 2014 is the eighth study made by Health Consumer Powerhouse (2015) on health systems in 36 European countries. The number of evaluated health systems is 37, because health systems of England and Scotland are evaluated separately. Since 2006 this comparison of key values in healthcare, taking the patient and consumer point of view, has improved the understanding of European healthcare, empowered patients and helped addressing weaknesses. The Euro Health Consumer Index 2014 sets standards for what could and should be achieved by modern, well-serving healthcare. A record of nine countries, all Western European, are scoring above 800 points of the maximum 1000. These are followed at some little distance by three more affluent countries (Austria, France, and Sweden) "not quite making it" for different reasons. After those, there is a clearly visible gap to the next group of countries, where the first Central and Eastern Europe and Mediterranean countries start appearing.

The objective of the Special Eurobarometer "Patient Safety and Quality of Care" survey (European Commission, 2014). is to review changes that have occurred since the previous survey in September-October 2009, in the following areas: whether EU citizens are now better informed about patient safety measures; the likelihood of experiencing an adverse event and the circumstances and characteristics of this experience; the types of redress available if EU citizens suffer an adverse event in their own country or another Member State, and where they can turn for help; and EU public perceptions of the quality of healthcare. This survey was carried out in the 28 Member States of the European Union between 23 November and 2 December 2013. The Special Eurobarometer question no. 2 asks a respondent: "How would you evaluate the overall quality of healthcare in your country?" A majority of EU citizens (71%) say the overall quality of healthcare in their country is good. However, there are still considerable differences between countries. Such indicator is of course quite simple, but overall satisfaction of

citizens (users and payers) with the national health system is, at least in our view, a very important measure of performance.

Bloomberg decadency index (Bloomberg, 2013) ranked countries on their propensity for vice, measured by alcohol and cigarette consumption, drug use and gambling levels. In fact, these are very important public health determinants. The four variables (total adult per capita alcohol consumption, total adult per capita cigarette consumption, annual prevalence of drug use as a percentage of the population ages 15-64, and total gambling losses as a percentage of gross domestic product) were weighted equally. For alcohol and cigarettes, adult includes all residents ages 15 and older. Drug-use Figures cover five equally weighted categories: amphetamines, cannabis, cocaine, ecstasy and opioids (including prescription opioids). The country with the maximum value in each variable received 25 points for that variable; the country with the minimum value received zero points. All other countries were scored based on their positions within the maximum-minimum band. Points for each variable were summed for a final score, with a range of 0-100. A higher score indicates a higher propensity for vice. Only countries with data for all categories were included (57 countries).

Data envelopment analysis (DEA) is a mathematical method of technical efficiency evaluation that is widely used in many areas, including health services, for example (Dlouhý, Jablonský, Novosádová, 2007, Dlouhý, 2015, Dlouhý, 2016). The relative efficiency score of the unit (e.g. hospital department, hospital, health system) is defined as the ratio of its total weighted output to its total weighted input or, vice versa, as the ratio of its total weighted input to its total weighted output (Charnes, Cooper, Rhodes, 1978). A wide variety of DEA models with many extensions and modifications has been developed (e.g., Cooper, Seiford, Zhu, 2004, Jablonský, Dlouhý, 2015). For each evaluated unit, DEA calculates the efficiency score; determines the relative weights of inputs and outputs; and identifies peers for each unit that is not technically efficient. The peers of an inefficient unit are efficient units with similar combinations of inputs and outputs. The peers serve as benchmarks, which show potential improvements that the inefficient unit can attain.

For this study, we use the data on health systems that comes from the OECD Health Statistics 2015. The sample includes 20 countries of OECD for which all input and output measures are available for year 2011 or 2012. The inputs are the total number of hospital beds per 1 000 population, number of physicians per 1 000, and number of nurses per 1 000. The outputs are the number of inpatient care discharges per 1 000 and number of doctor consultations per 1 000. Since no indicators of service quality or of health outcomes are included, it is purely technical evaluation of health system performance. For efficiency evaluation, we use an output-oriented non-increasing-returns-to-scale super-efficiency DEA model (see, for example, Jablonský, Dlouhý, 2015, Chapter 5), which evaluates each health system by the score of technical efficiency. The DEA model is formulated as:

$$
\begin{aligned}
&\text{Maximize} && \phi_q && && \\
&\text{subject to} && \sum_{j=1}^{n} x_{ij}\lambda_j + s_i^- = x_{iq}, && i = 1, 2,..., m, && (1)\\
& && \sum_{j=1}^{n} y_{kj}\lambda_j - s_k^+ = \phi_q y_{kq}, && k = 1, 2,..., r, && \\
& && \sum_{j=1}^{n} \lambda_j \le 1, && && \\
& && \lambda_j \ge 0, && j = 1, 2,\ldots, n, j \ne q, && \\
& && \lambda_q = 0. && &&
\end{aligned}
$$

where n is the total number of units (health systems) in the sample, q denotes the unit that is evaluated, $\mathbf{X}$ is the matrix of m health system inputs, $\mathbf{Y}$ is the matrix r health system outputs, $\boldsymbol{\lambda}$ is the vector of variables, ϕ_q is the super efficiency score for country q. The super efficiency score $\phi_q > 1$ for inefficient units and $\phi_q \le 1$ for efficient units. The model (1) has to be calculated for each unit (health system).

3 Results

In the previous section, we have discussed several methodological approaches to measurement of health system performance. We have chosen seven indicators that makes ranking of countries quite explicit. For each country,

we present the country ranking from the original study and the relative country ranking among the five selected countries of Central Europe (Table 2).

In spite of the fact that methodologies and time periods differ, we may observe very similar findings. If one takes into account the first five performance indicators, the Czech Republic has the third best performing health system, which is worse than Austria and Germany, but better than Poland and Slovakia. On the other hand, the Bloomberg decadency index shows that the Czech Republic faces serious problems in dealing with important public health determinants like smoking, drinking, drug-use, and gambling. According to the Bloomberg decadency index, the Czech Republic is the world's most decadent country. The case of Poland is also interesting as the indicators based on subjective view of population (Euro Health Consumer Index and Special Eurobarometer) show worse health system performance than other more objectively oriented indicators. It seems that Polish people view their national health system too negatively in comparison with the real performance of the Polish health system.

Table 2: Indicators of health system performance and ranking of countries

Indicator / Country	Czech Republic	Slovakia	Poland	Germany	Austria
Life expectancy at birth 2010 (n=40) European Health for All Database	22 3	27 5	25 4	16 2	12 1
World Health Report 2000 (n=191) Overall health system performance	48 3	62 5	50 4	25 2	9 1
Health Consumer Powerhouse (n=37) Euro Health Consumer Index 2014	15 3	21 4	32 5	9 1	10 2
European Commission (n=28) Special Eurobarometer 2014	12 3	22 4	25 5	7 2	2 1
Mackenbach and McKee (n=43) Health policy performance summary score	22 3	28 5	24 4	13 2	7 1
Data Envelopment Analysis (n=20) Super efficiency score	7 4	6 3	10 5	4 2	3 1
Bloomberg 2013 (n=57) Most decadent country index	57 5	40 4	29 2	21 1	34 3
Total Sum Average Ranking	24 3.4	30 4.3	29 4.1	12 1.7	10 1.4

Source: own calculation.

4 Conclusions

The Czech Republic have gone through social and economic transition in the last 25 years. The burden of totalitarian history still influences many areas of social and economic life, which also has to be taken into account in health policy. One important observation is that the communist past has a longer future than it was initially expected. The health system performance was evaluated by seven different indicators. In spite of the fact, that health system performance methodologies and time periods differed, we were able to observe very similar findings. That is better results for Austrian and German health systems in comparison to Czech, Slovak, and Polish health systems. The only exception is a ranging of Poland in the case of Bloomberg decadency index, according which Poland is better than Austria.

From the three former communist countries (Czech Republic, Slovakia, and Poland), the Czech Republic has the best performing health system in the majority of indicators. However, the Bloomberg decadency index shows that the Czech Republic faces great problems in dealing with important public health determinants like smoking, drinking, drug use, and gambling. According to the Bloomberg index, the Czech Republic is the world's most decadent country. This means that future health reforms of the Czech health system should be more oriented towards public health, health promotion, and health literacy.

Performance or productivity evaluation in health and health services represents a very challenging application field. Researchers are able to compare population health with the help of many health indicators; however they do not have at disposal any universal methodology for evaluating variation in the performance of national or regional health systems (Smith, Mossialos, Papanicolas, Leatherman, 2009, Papanicolas, Smith, 2013, Barták, Dlouhý, 2013, Bojke et al., 2013). The next problem is availability of reliable and internationally comparable data. The possible ways for an improvement are: (a) to take into account the objective of international comparison; (b) not to rely only on a single health system performance indicator; (c) to know the limits of international comparisons (both the data and methodology); and (d) above all to know the social, economic and cultural context of the countries included in the study. The combination of the quantitative data with qualitative information on the health system (how the national health system really works).

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Performance of health systems – the evaluation of selected indicators at the level states of the Visegrad Group

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Abstract. The term "performance" is constantly used especially in the field of business economics, but no less important role this term plays also in the public sector. It is not easy to define the performance, especially in the health markets. This paper is devoted selected approaches to evaluation of the performance of health systems. Specifically, the paper is focused on the evaluation of the performance of health systems, according to the methodology of World Health Organization at the level of "better health". The paper compares the performance of health systems in states of the Visegrad Group.

Keywords: performance, evaluation, indicators, health systems, health, public policy
JEL Classification: H75, H83, I10, I150, I180, 057

1 Introduction

Today, health systems in all countries play a bigger and more influential role in people's lives than ever before. The main goal of health systems is to improve the health of their society. The current health systems have many highly skilled people and better and better technologies systems what give the health system the power and the potential to achieve further extraordinary improvements. On the other hand, the new possibilities in health care sector are not only positive. The many health systems cannot use all of their potential. The health system we can often name as poorly structured, badly led, inefficiently organized and inadequately funded. So it is necessary to manage these systems and evaluate their performance.

The ultimate responsibility for the overall performance of a country's health system lies with government. By reason of this is the fact that health care has many impacts on national economy and it is the very important determinant of economic growth. The health of the people is always a national priority: government responsibility for it is continuous and permanent. Ministries of health must therefore take on a large part of the stewardship of health systems. Health policy and strategies need to cover the private provision of services and private financing, as well as state funding and activities. Only in this way can health systems as a whole be oriented towards achieving goals that are in the public interest (WHO, 2000).

The performance measuring and evaluation play an important role in public policy. It can be concluded that the performance measurement and evaluation policies are interlinked areas (Wouter, Bouckaert, Halligan, 2010). Governments have to effort to improve the performance of their health systems and for this many interesting indicators are used, selected indicators of them are applied in this paper.

2 Methodology, research questions and used data

The aim of this paper is to define the specifics of the performance evaluation of health systems according to use the indicators of World Health Organization at the level of "better health" and apply selected indicators for example states of the Visegrad Group and compare these indicators of health systems in states of the Visegrad Group.

The paper answers mainly these following questions: How can we measure the performance of health systems? What is the position of the Czech health system at the evaluation of performance at the level "better health" in comparison with other Visegrad states? What results bring the selected indicators and how can we explain these indicators? How are these indicators developed in time series? The answers these questions are based on literature review, results calculation of performance indicators and statistics methods.

Two indicators were used for description and comparison of the development of selected indicators over time: (i) relative change, (ii) the geometric mean and furthermore it was graphically demonstrated the absolute trend of individual indicators. Relative change expresses the absolute change as a percentage of the value of the indicator in the earlier period. Relative change also refers to the change in the indicator in percentage terms, i.e. absolute change as a percentage of the value of the indicator in period one. The geometric mean is a measure of mean that indicates the typical value of a set of numbers. The geometric mean is referred to as compounded annual growth rate or time-weighted rate of return and it is the average rate of return of a set of values calculated using the

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products of the terms (see more Arlt and Arltová, 2009). As a data source for empirical part of this paper mainly European Health for All Database (HFA-DB) and data from OECD Health Status on the web were used.

3 Health systems and its performance

Health system

By reason of the fact that health is the important factor of economic growth as a form of human capital as shown in many research studies such as Lucas (1988), Sala-i-M. (1996), it is necessary to solve problems in society which are connected with health and the support of better health systemically and in this case we can talk about health system.

As mentioned Holčík (2004), is necessary for the provision and delivery of health care to calculate with source limitations. The source limitations can be characterized as inputs (finance, personnel, materials, knowledge and skills) and procedural activities which are evaluated as the conversion of inputs to outputs (e.g. provision of health care which support the changes of the value of health indicators). We have to take into consideration not only internal factors specific for health care providers, but also external factors that also significantly affect the health care system, such as social values, traditions and socio-economic aspects of a culture.

There are used many definitions and specifics of the health care system in professional circles. The basic definition is given by the WHO (Nutbeam, 1998), what refers to the health care system as "a formal structure for a current population which is defined by law and state regulation mainly in parts of the funding, management, breadth and content, which is providing services for people and which is helping to the improvement of the their health and is offered a defined set of values for homes, education institutions, workplaces, public spaces, community hospitals and clinics.

Other definition is understood the health system as human resources, institutions and working resources together in accordance with stated policy to improve the health status of the population, which is offered the protection against diseases with help of activities of providing primary targets which are improved health (WHO, 2000).

Every health system should ideally fulfill the basic parameters which are included the availability, quality, financial burden, efficiency, equity and social acceptance. All these parameters cannot be to solve separately, they have to co-exist together in the health system.

From the perspective of the long-term sustainability and development the health system has to have a certain concept. According to Kelly and Hurst (2006) the conceptual framework of current health system has to include the following indicators:

- efficiency - the results of the demonstrable improvement of the health of those who need it and they benefit from it,
- security - an indicator which is showed the extent to which the care process to avoid self-negative and undesirable effects,
- ability to respond - the achievement of satisfaction of the patient and the fulfillment of their legitimate expectations in healthcare,
- availability - the availability of health care with respect to physical, financial and mental levels,
- equity - the equal access and fairness for all recipients of healthcare,
- effectiveness - from the perspective of macroeconomics it means the question of the amount of total health spending; from the perspective of microeconomics it means the connection of implemented outcomes with regard to the value of the inputs.

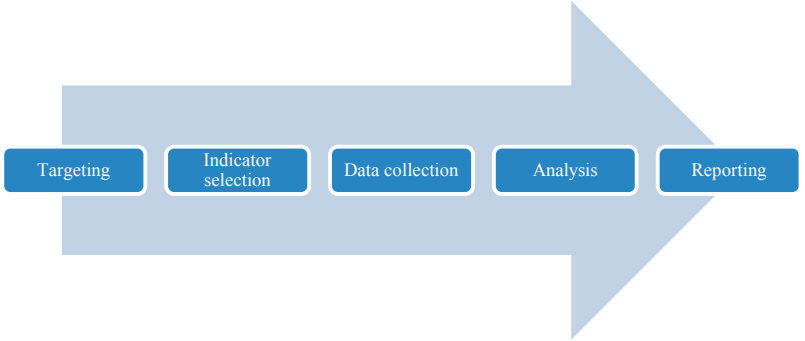
Performance of the health system as the part of the public policy

The performance is a term often solved at the level of corporate management. At the national level, we discussed the relationship of performance and implementation of public values. Hood (1991) puts performance management in the public sector on three pillars: product, process and regime.

As mentioned Bouckaert and Halligan (2008) performance has a potentially broad stretch. It includes micro, meso and macro levels and these authors call it „depth of performance“. The macro level typically includes general discussions on the performance of a country and also OECD countries and European Union. The meso level refers to either the performance of a policy sector (e. g. health care) and micro performance is defined at the level of an individual organizations.

The performance we have to measure. The measurement is the act or proces of assigning numbers to phenomena according rule. (Miller, 2009) As written Wouter, Bouckaert, Halligan (2010) the performance measurement proces is possible to define as a proces in five steps – see Figure 1. But we cannot remember that throughout the proces, quality of measurement is an important point of attention.

Figure 1: The model of the performance measurement conceived by Wouter, Bouckaert and Halligan



Source: own based on Wouter, Bouckaert and Halligan (2010).

The health system is managed and financed from public sector in many countries. By reason of this is necessary for assess a health system, to measure five basic parts: the overall level of health; the distribution of health in the population; the overall level of responsiveness; the distribution of responsiveness; and the distribution of financial contribution (WHO, 2000).

4 Selected indicators for evaluation of performance of health systems

The performance of the health system is an important parameter for evaluating the effectiveness of the processes in the health care. For the evaluation of the performance of the health system we can found some different approaches. According Maaytová (2012), it is possible to use some traditional indicators such as the life expectancy, the spending on health, infant mortality, the costs, the number of physicians, the degree of the patient satisfaction, etc. These are classic indicators which are used the mathematical and statistical methods. Other view of the evaluation of the performance the health system brings WHO (2000), which defines the evaluation of the performance the health system at these three levels: better health, fairness in financial contribution and responsiveness.

The improving the health status of the population should be the primary goal of any health system. As reported the University of Ljubljana (2015), there are two basic types of indicators at the level "better health": indicators of life expectancy by health status which are measured the received or improved quality of life years and health indicators deficit which are measured the lost year of life in comparison with set standards.

Definition of concrete selected indicators

For the definition of some indicators were chosen the following: Life expectancy at birth ("LE"), Potential years of life lost ("PYLL"), Disability-adjusted life expectancy ("DALE").

Life expectancy at birth is defined as how long, on average, a newborn can expect to live, if current death rates do not change. However, the actual age-specific death rate of any particular birth cohort cannot be known in advance. If rates are falling, actual life spans will be higher than life expectancy calculated using current death rates. LE is the one of the most frequently used health status indicators. Gains in life expectancy at birth can be attributed to a number of factors, including rising living standards, improved lifestyle and better education, as well as greater access to quality health services (OECD, 2016).

Potential years of life lost are a summary measure of premature mortality, providing an explicit way of weighting deaths occurring at younger ages, which may be prevenTable. The calculation of this indicator involves summing up deaths occurring at each age and multiplying this with the number of remaining years to live up to a selected age limit (age 70 is used in OECD Health Statistics) (OECD, 2016).

Disability-adjusted Life-expectancy is a measure of healthy life expectancy developed by the World Health Organization. Years of expected ill-health are weighted according to severity and subtracted from the expected overall life expectancy to give the equivalent years of healthy life. DALE was developed to facilitate international comparisons of health and health outcomes (WHO, 2000).

5 Results – analysis of the indicators in states of the Visegrad Group

For the further analysis three indicators and their values in time series were chosen. The selected indicators are: (i) Life expectancy at birth ("LE"), (ii) Potential years of life lost ("PYLL") and (iii) Disability-adjusted life expectancy ("DALE"). These indicators were used to compare and to describe their developments over time and states of the Visegrad Group: the Czech Republic, Hungary, Poland and Slovakia. As a reference period were selected the years from 2000 to 2013, but only for the period 2000 to 2010 were available complete data for all member states of the Visegrad Group. As a data source were used European Health for All Database (HFA-DB) and OECD - Health status. Subsequently, the simple indicators of time series dynamics were calculated.

How show some empirical studies – see for example Preston (1975) the economic growth is contributed to longer life. The so-called Preston curve indicates that individuals born in wealthier countries, on average, can expect to live longer than those born in poor countries. The analyzed indicators could be also affect by many other factors for example health of the elderly can have a positive or negative impact on average life expectancy. A healthy elderly population will contribute to a higher average, while an elderly population in poor health will do just the opposite.

Calculated simple indicators of the dynamics over time are shown in Table 2, there is also graphically expression of Trend 2000-2010 of indicators "LE" and "PYLL" in this Table 2, using these graphs once can monitor absolute evolution of these indicators over time. Relative change in 2010/2000 reflects the overall change indicators in percentage between 2000 and 2010, for indicators "DALE" were only available data for calculating the relative change between 2000 and 2013. Geometric mean shows the average change over years in the values of selected indicators between 2000 and 2010 and therefore is called Growth 2000 - 2010. The calculated values and graphs show that indicators "LE" and "PYLL" grow during overall period. The growth of "LE" a "PYLL" was the highest in Hungary. On the other hand, the values of the indicator "PYLL" declined over the years, the values in all four states fell between 2000 and 2010 by more over than 20 %, and the rate of decline was again the highest in Hungary. The growth and decline of indicators “LE” and “PYLL” were in the Czech Republic the third highest/lowest in comparison with selected countries. The relative changes were in the Czech Republic the third highest in comparison with selected countries except for relative change of “PYLL”, this relative change was the second highest.

The dynamics of individual indicators values were depicted in Figure 2 for better illustration. We can see that the differences between values of Relative changes 2010(3)/2000 are the highest; the max range of difference between indicators of “PYLL” is about 8.1 pp. We can observe the minimal differences between the values of Growth 2000 - 2010 for indicator of “LE”. As mentioned above, we can see Trends in Table 2, the trends of individual indicators of positive growth were expected for indicators “LE” and “DALE”, which is in line with the depicted graphs and with calculated dynamics (relative change and geometric mean). The negative trend was expected for the indicator “PYLL”, graph and calculated values are also consistent with this expectation.

We expected that value of indexes LE were greater than zero; it is meant that life expectancy grew over time. The highest increased was in Hungary and it raised by almost 4 % between 2000 and 2010. The supreme LE was in Czech Republic and reached the amount of 77.81 years in 2010, in Hungary it was 74.78 years. If we look at the average growth over time and, of course, the highest average growth was in Hungary and then in Poland, the smallest average growth was in Slovakia.

We should expect negative values for calculated indexes for indicator PYLL and our expectations are demonstrated in Table 1. We can observe that the highest relative change was in Hungary. In 2010 the absolute value of the PYLL was lowest in the Czech Republic: 3942.2 and the highest one was in Hungary: 5961.9.

The indicator DALE is measured in years as well as LE and again we expected that it should grow over time. The most rapid growth was observed in Estonia and in Slovenia. The same relative change was in Hungary. In 2012 the highest absolute value of DALE was in Czech Republic and the lowest absolute value of DALE was in Slovakia (66.7 years).

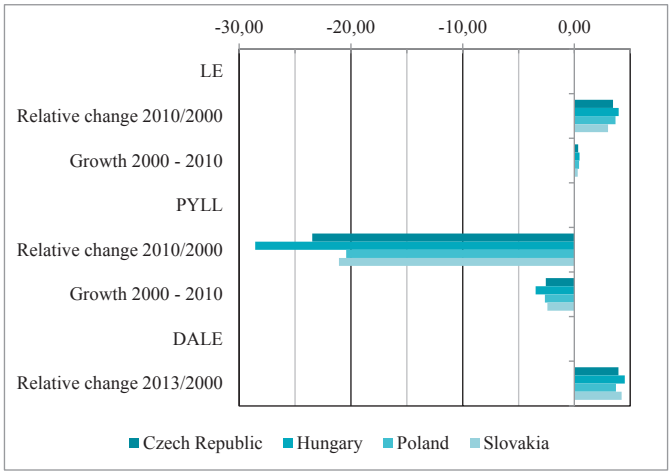
Table 1: Development of selected indicators in time

	Czech Republic	Hungary	Poland	Slovakia	Source
Life expectancy at birth (years)					
Relative change 2010/2000	3,46%	3,96%	3,68%	3,01%	HFA-DB
Growth 2000 - 2010	0,34%	0,46%	0,41%	0,30%	
Trend 2000 - 2013*					
Potential years of life lost					
Relative change 2010/2000	-23,47%	-28,55%	-20,43%	-21,07%	Health status
Growth 2000 - 2010	-2,56%	-3,47%	-2,64%	-2,42%	
Trend 2000 - 2013*					
Disability-adjusted life expectancy (world health report)					
Relative change 2013/2000	3,93%	4,51%	3,72%	4,22%	HFA-DB
Growth 2000 - 2010	NA	NA	NA	NA	

* Note: data for Slovakia were available only for period from 2000 to 2010.

Source: own based on HFA-DB and OECD (2000-2013).

Figure 2: The dynamics of selected indicators (in %)



Source: own based on HFA-DB and OECD (2000-2013).

6 Conclusions

According to WHO (2000) "health is the defining objective for the health system. This means making the health status of the entire population as good as possible over people's whole life cycle, taking account of both premature mortality and disability".

No measure is perfect for the purpose of summing up the health of a population; each way of estimating it violates one or another desirable criterion (Murray, Salomon, Mathers, 1999). There was presented three indicators in our analysis in the analytical part of this paper. These indicators are used for evaluation of performance in health sector at the national level. The indicators were used to compare and to describe their developments over time and

states of the Visegrad Group: the Czech Republic, Hungary, Poland and Slovakia. As a reference period were selected the years from 2000 to 2013.

It can be seen that in the Czech Republic with already quite high LE (77.81 years) and DALE (68.7 years) compared to other countries, these indicators were growing more slowly over time compared to other analyzed countries. We can see that the differences between values of Relative changes 2010(3)/2000 were the highest; the max range of difference between indicators of "PYLL" is about 8.1 pp. We can observe the minimal differences between the values of Growth 2000 - 2010 for indicator of "LE". Based on analyzes results the Czech Republic is performing well in all three indicators. When we observe absolute values, the Czech Republic has the best results.

It would be good for deeper analysis to observe evolution of these indicators in the context of other indicators, for example to compare these indicators with the evolution of public health care expenditure and etc., or to extend this study with other indicators reflecting performance of health systems and compare with other countries.

We recognize that the health systems are not just concerned with improving people's health but with protecting them against the financial costs of illness, support of low-income states and new challenges for public policies. Today in most developed countries – and many middle income countries – governments have become central to social policy and health care (WHO, 2000). The involvement of government into health system is justified on the grounds of both equity and efficiency and this fact is necessary accept to the future.

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Preferential treatment for families with children in the pension insurance system

Martin Holub *

Abstract. Currently, as a response to declining birth rates, the Czech government is seeking measures for the support of families with children through the tax and social security systems. One of the proposals that this paper analyses consists of a specific proposal put forward by the Expert Commission for Pension Reform and a modified proposal from the Ministry for Labour and Social Affairs (MLSA) consisting of the determination of different levels of pension insurance contributions depending on the number of children raised. The paper presents a thorough analysis of these proposals from both the micro-economic and macro-economic perspectives, and considers them in the context of the current theory of pension systems.

On the basis of the analysis performed, it was concluded that the proposed measure is, in relation to the objectives which it purports to fulfil, i.e. support for families with children, both inappropriate and inconsistent and, indeed, results in only marginal effects for families with children, does not include all types of family coexistence and that, in the context of current tax and social policies, more suiTable measures exist that would lead to the achievement of the targets.

Keywords: non-contributory periods, old-age pension, social contributions, family policy

JEL Classification: H55, J26, G22

1 Introduction

In recent years, debate of an unprecedented intensity commenced on the issue of pension reform not only in European countries but other countries worldwide. The social systems of almost all European countries, including the Czech Republic, are facing a range of challenges posed by both the economic and population development of current postmodern societies.

Although the consideration of child care periods in the Czech pension system (as well as that of other countries) enjoys a long tradition, current debate is, in the context of the methods and options available for overall pension reform in the Czech Republic, beginning to consider changing the way in which the raising of children is taken into account in terms of pension entitlement and the amount of pension benefits awarded to the parents (Hyzl 2004, Hampl 2014). Based on a recommendation from the Expert Commission on Pension Reform (ECPR), the MLSA initiated discussions, in connection with the equalising of transfers between families with children and society and the consideration of the investment involved in the raising of children and in the overall context of low fertility rates, on the possibility of introducing the dependence of the amount of pension contributions paid on the number of children raised (Expert Commission on Pension Reform, 2015). These considerations relate on the one hand to efforts to increase the birth rate and to ensure "better" conditions for families with children and, on the other, to efforts to ensure the long-term financial sustainability of the pension system.

The aim of this paper is to present the proposed theoretical concept of the ECPR involving the dependence of pension contributions on the number of children raised in the pension system, the submission of the concept to critical analysis and the identification of its strengths and weaknesses and, further, to compare the proposed concept with a variant of a revised MLSA draft of February 2016. On the basis of this analysis and the setting of this concept in the context of the Czech pension system, this contribution aims to present recommendations for Czech government policy and to add to the ongoing debate on the direction of reforms to the pension system in the Czech Republic.

2 Consideration of child care periods in the EU pension systems

Child care periods are taken into account within the pension schemes of all EU countries, regardless of the respective social security system. Differences exist between countries with regard only to the extent to which such periods are taken into account.

The consideration of child care periods in the pension systems of EU countries exhibits a high degree of variability. The majority take into account child care periods in the early years of a child's life (typically three to four years). Gaps in the pension insurance contribution periods of parents resulting from the raising of children

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may be compensated for by the payment of contributions for such periods from state financial resources or it is possible for the parents to buy pension entitlements on a voluntary basis. Child care periods may partially serve only to fill gaps in the insurance period when determining the right to a pension (supplementing the minimum number of years required to qualify for a pension). Only very rarely is the raising of children taken into account through the counting of replacement (non-contributory) insurance periods, during which no social insurance contributions are paid. Child care periods may be excluded when calculating the amount of the retirement pension, thus diluting the income actually achieved from which the pension is calculated. In some countries, the raising of children is taken into account via the provision of benefits linked to the place of residence, i.e. similar to family benefits; however, in this case, they have a direct or indirect impact on the subsequent determination of pension rights (the benefits may form the assessment basis for the determination of contributions). In those countries with a points system, bonuses are credited for raising a child to the individual account of the insured person or by the increasing of the periods of insurance credited bonuses. Only exceptionally is the statutory retirement age reduced for the parents or only mothers who raise children.

Currently in the Czech Republic child care periods are taken into account as insurance replacement periods and influence both the obtaining of the entitlement to a pension and the amount of the pension. The replacement period is defined as caring for a child aged up to four years. Child care can be counted for the purposes of future pension benefits both by women and men; however, the same care period may not include more than one person simultaneously. Furthermore, in the Czech Republic the lowering of the age of retirement is permitted for women according to the number of children raised. This benefit, however, is gradually being phased out and the current target is to achieve a uniform retirement age of 67 for men and women for generations born from 1977 onwards.

3 The concept of the dependence of insurance on the number of children

In Europe, the idea of taking into account child care periods for pension entitlement purposes or the amount of the pension has been under discussion since the 1980s. In Germany, work continues on the CPAYG concept, expanded upon by Sinn (2013), which addresses the dependence of social security contributions on the number of children and proposes a complementary system of private insurance for childless persons or parents with a low number of children which would consist of higher contributions according to fewer children raised. As a starting value, a zero contribution would correspond to three children raised. The work of another German author, Werding (2014), is devoted to the option of introducing pension contribution rebates or deductions for the purpose of imposing fairer insurance contributions on parents. Here the main starting point consists of the idea that pension security can be achieved either by investing in the social security system (savings) or by investing in human capital (children) or a combination of both.

The differentiation of insurance payment rates according to the number of children in the family can be introduced independently, as happened in a very short period of just two years in Slovakia, or may be introduced along with the CPAYG system e.g. as suggested in studies by Sinn (2013) and Hyzl et al (2004). Slovakia, uniquely in the European context, in the period 1 January 2004 - 31 December 2005 introduced a system consisting of reduced pension insurance contribution rates paid by employees into the retirement insurance system. The level of the contribution rate for employees was set at 4% and employees were entitled to a reduction in the rate of 0.5% for each child raised. In view of the fact that this decision was taken against the will of the government and that it was considered ill-conceived and unfair, it was repealed after just two years and replaced by an increase in the tax credit per child. The dependence of the amount of the insurance contribution on the number of children, both upwards and downwards, was a feature of the reform proposals of the Socialist Party in Portugal in 2005, when the then Prime Minister Socrates proposed a reduction in pension insurance contributions for parents with more than two children and an increase in contributions for childless persons and parents with only one child arguing that “ultimately the wealth created by future generations will guarantee the incomes of future retirees” (Linhas, 2006). This measure was, however, never implemented.

In 2015 the Czech Expert Commission for Pension Reform proposed the introduction of a differentiated pension insurance contribution rate for families with children. The aim of this measure was the partial equalising of transfers between the family and society from the viewpoint of the situation of same-income households and the strengthening of the principle of merit, taking into account the merits of working parents in the raising of future generations of pension insurance contributors. The Expert Commission for Pension Reform suggested that the introduction of such a measure would ease the overall financial burden placed on families with children during the period spent raising dependent children, at which time there is a significant increase in spending on children and consequently a significant drop in income calculated on the basis of number of household members.

In the same year, the Expert Commission suggested that the basic pension rate be increased to 29% from the current 28% with the employee paying 7.5% of the total contribution. The base rate would apply to childless households. Households with one child would pay a rate of 28% (6.5% of the contribution payable by the employee), households with two children would pay a rate of 26.5% (5% of the contribution payable by the employee), households with three children would pay a rate of 24% (2.5% of the contribution payable by the

employee) and households with four or more children would pay a total rate of 21.5% with an employee contribution of zero. For this purpose, a child was to be considered a dependent person living in the parental home up to a maximum of 26 years of age. The reduction in insurance rates would be applied only during the child raising period and not for the duration of the employment of the insured. In order to qualify for reduced insurance contributions both parents would have to be sharing the same household or both parents having a child entrusted to separated care by court order.

Subsequently, in February 2016, the MLSA reworked the proposal in order to make it more advantageous for parents who raised children, i.e. the reduced rate would be maintained even after the end of the child-raising period. The MLSA suggested that those who meet the child care conditions with respect to at least one child for a period of ten years would pay the initial contribution rate of 6.5% even after the end of the child-care period.

4 Micro- and macro-economic analysis of the proposed measures

When assembling the micro- and macro-economic models simulating the original initial differentiation of insurance contributions rates proposed by the ECPR and the MLSA modified variant, the primary input variables consisted of statistical data files which had to be reduced and regulated for the purpose. Data on the number of contributors was taken from Czech Social Security Administration (CSSA) data, and the starting point consisted of a set of the adjusted number of contributors and the number of pensioners in 2013. Based on data concerning the number of actual contributors in a given year, the structure of contributors was classified according to the number and age of children in the (even incomplete) family, the type of household and the economic activity of spouses or partners, based on data collected in the Population and Housing Census of 2011.

With concern to model calculations, only economically active individuals were considered (i.e. those who in the given year paid pension insurance contributions or paid taxes and for whom the test measures could be applied). On the basis of the adjusted data the characteristics of the economically active population (pension insurance payers) were determined classified according to the number of children (0 - 4 and more), which was then applied to the population in 2013. This re-weighting of the calculation of economically active insurance contributors led to the discovery of the model structure of current pension insurance payers. The structure of insurance contributors in dependence with the number of children raised is shown in the following Table.

Table 1: Numbers and structure of pension insurance contributors subject to advantage/disadvantage regarding the pension contribution rate depending on the number of children

number of children taken into account	taking into account the children of both parents	
	% representation	number of contributors (in thousands)
0	36.61	1,545
1	26.63	1,124
2	30.44	1,285
3	5.35	226
4	0.75	32
5	0.15	6.5
6+	0.06	2.7
	Total	**4,219**

Source: own calculations based on CSSA and 2011 Census data

By means of micro-economic models, the micro-economic effects of the measures on the individual income situation of families was computed. The macro-economic effects of the measures, i.e. the impact on the overall balance of the pension system was then examined through the prism of the macro-economic model. An exploration of the micro-economic impacts of the proposed modifications was conducted using the example of a hypothetical individual with an income equal to the average gross wage (taking into account the amount of the general assessment base for 2014 in the amount of CZK 26,357). When evaluating the social impacts resulting from the calculated variant the saving was traced compared with the average costs of raising a child as set out by the Czech Statistical Office (CSO).

5 Micro-economic analysis

Table 2: Differentiation of contribution rates and the amount of pension insurance contributions

number of children taken into account	employee contribution rate	employee contribution payment	employee saving
0	7.5	1,977	-264
1	6.5	1,713	0
2	5.0	1,318	395
3	2.5	659	1,054
4 +	0	0	1,713

Source: own calculations on the basis of existing legislation in 2015

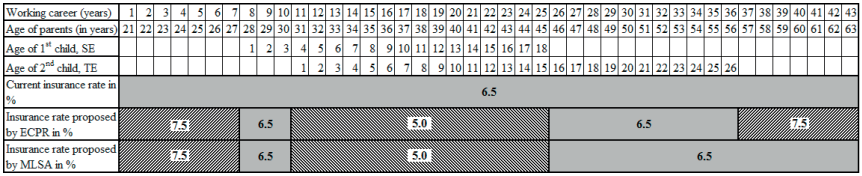
The calculations show that for childless individuals with an income level that of the average wage, the measures would lead to an increase in the basic contribution rate of 1 percentage point thus resulting in an increase to the monthly payment in the amount of CZK 264. For a household with one child, there would be no change in the status quo, i.e. the disposable monthly income would remain the same. For a household with two adults with incomes at the level of the average wage and two children, the proposed measures would raise monthly savings in the amount of CZK 790, representing 6.3% of the costs of a family incurred by having two children (CZK 12,552 - CSO 2003). For a household with two economically active adults with three children the saving due to reduced pension insurance contributions would amount to CZK 2,108, representing almost 13% of the costs associated with having three children in the family (CZK 16,236 - CSO 2003). For a family with four or more children, in which both parents are employed, the savings resulting from a reduction in contributions would amount to CZK 3,426. In the event that only one adult member of the household is employed (which can be reasonably assumed, e.g. in households with 3 or more children where the mother is on maternity or parental leave with the youngest child in the family), then the overall benefit for a 3-child household would be CZK 1,054 and a 4-child household only 1,713 CZK, which represents a marginal part of the family budget and covers less than 7% of the costs associated with the presence of three children in the family.

Moreover, the distribution of benefits across the spectrum of payers makes interesting reading; for 36.6% of insurance contribution payers (childless) the measures would be disadvantageous, 26% of contributors would not be entitled to any support as opposed to the current situation (one-child households) and 30.5% of households with a child in the family (two-child) with both parents in gainful employment would be entitled to a total contribution reduction of CZK 790 per month, and only 5.3% would be entitled to a higher reduction (families with three and more children).The calculations therefore appear to reveal the relative injustice of the proposed measures. Since the basic costs of raising a child are more or less sTable and dependent on family income only to a small extent, a reduction in contributions is directly dependent on the amount of income, and so the above-mentioned preferential treatment for families with children in the pension insurance system in the form of the possibility of reducing the pension insurance contribution provides for “equal” child raising benefits in a different amount. Due to the nature of the measure, when the contribution rate for old-age pension insurance is decreased only for employed persons, there is a significant group of parents who will not benefit from this benefit because of their not being employed.

It is also interesting to compare the lifetime income of households in the event of raising children with respect to the variant designed by the ECPR and the MLSA modified variant. Taking the example of a family with 2 children (see Figure 1), which has been the most prevalent family model in the Czech Republic over recent decades, and remains predominant in terms of the declared preference of prospective parents, it was calculated to what extent the total income of the household would change should the proposed measures be adopted. The model considered is that of a household with two employed adults and two children born at an interval of three years, of which the first was born to parents aged 28 years, the first having completed secondary level education (SE) and the second tertiary level education (TE). The average period of insurance contributions is set at 43 years and they earn the average income throughout their careers. The calculation is performed using current prices. The comparative calculation reveals that under currently applicable conditions the contributions attribuTable to the parents would be 6.5% over 43 years, which corresponds to a total of around CZK 1,768,000 of contributions paid. According to the variant proposed by the ECPR these parents would pay the increased rate of 7.5% for 14 years, the basic rate of 6.5% for a further 14 years, and the reduced rate of 5% for 15 years. The total contributions paid by both parents for a period of 43 years would, in this case, amount to around CZK 1,714,000. The proposed measures would, therefore, over a period of 43 years of contributions provide a saving of almost CZK 54,000 for a household with two economically active adults and two children, which is a negligible amount especially if one takes into account that the model assumes the continuous employment of both parents, which in practice is virtually impossible. In the case of the variant proposed by the MLSA such parents would pay the higher rate of 7.5% for 7 years, the basic rate of 6.5% for 21 years, and the reduced rate of 5% for 15 years. The total contributions paid by both parents for the same period of 43 years would, in this case, amount to around CZK 1.67 million, which

would represent a saving compared to the current situation of CZK 98,000, and a saving of CZK 44,000 compared with the ECPR draft proposal. Again, in light of the above, it is an insignificant amount in terms of the lifelong family budget.

Figure 1: insurance contribution rates over the length of the working career



Source: own calculations on the basis of existing legislation in 2015

6 Macro-economic analysis

The macro-economic impact of the proposed variants, which suggest an increase or reduction in the insurance contribution based on the number of children of the insured, on the pension system may be advantageous or disadvantageous and may either increase or decrease revenue; put simply, it will depend on the proportion of childless people and those with children in a given year. The following Table illustrates the impact of the proposed measures on the balance of the pension system provided the model population is constructed on the basis of the restrictions described above.

Table 3: Macro-economic effects of changes in contribution rates depending on the number of children

number of children taken into account	employee contribution rate in %		selected insurance contributions in millions of CZK			number of contributors (in thousands)		change in the balance (CZK millions)	
	current status	ECPR, MLSA	current status	ECPR	MLSA	Current status, ECPR	MLSA	ECPR	MLSA
0	6.5	7.5	136,808	141,694	85,016	1,545	927	4,886	-51,792
1	6.5	6.5	99,508	99,508	154,231	1,124	1,742	0	54,723
2	6.5	5.0	113,764	107,669	107,669	1,285	1,285	-6,094	-6,094
3	6.5	2.5	19,976	17,122	17,122	226	226	-2,854	-2,854
4	6.5	0	3,615	2,776	2,776	41	41	-839	-839
Total			373,670	368,769	366,814	4,219	4,219	-4,901	-6,856

Source: own calculations on the basis of existing legislation in 2015

The above calculations reveal that the proposed variants involving differentiated pension insurance rates depending on the number of children raised by the family could generate a pension fund revenue shortfall in the amount of CZK 4.9 billion according to the ECPR suggestion and as much as CZK 6.9 billion according to the MLSA proposal. Sanctioning childless persons (families which are currently not raising children) would, in none of the cases examined, cover the overall losses caused by providing contribution relief for families with two or more children. It is therefore important to question whether the reduction in insurance contributions for families with more than one child and the duration of such benefits were set correctly. For example, the gradation of the contribution rate by one percentage point for each child raised would reduce the deficit by nearly CZK 4 billion. Moreover, this revenue shortfall does not take into account the increased administrative costs that would be incurred with the introduction of this measure. None of the publicly available materials provided by the ECPR or the MLSA provides a detailed explanation of the setting of contribution rates for families with children.

7 Critical Analysis

Globally, the reform of PAYG pension scheme conditions has resulted in, for example, the strengthening of the link between contributions paid by the insured person into the pension insurance system and the resulting pension benefits; however, no country has taken the path of linking the amount of insurance contributions to the number of children raised. Although current problems concerning the financing of pension systems, coupled with falling fertility rates, may create the impression that these systems are dependent upon the relationships between different generations, this does not provide a reason for the emergence of new pension scheme concepts which reflect the

number of children raised or conceived. As reported by Vostatek (2015B), neither the concept of children's pension contributions nor dependence of contributions on the number of children fit any of the fundamental social models.

Moreover, no unity exists between the raising of children (as an alleged contribution to the system) and future insurance contribution contributors (as real contributors to the system). Ensuring such unity is practically neither feasible nor desirable in terms of the openness of the Czech Republic and the associated movement of labour within the EU. Just as it cannot be guaranteed that the raised child will one day become an insurance contributor, it cannot be guaranteed that the contributor will in fact remain in the Czech Republic. The underlying premise of the differentiation of pension contribution rates depending on the number of children - taking into account the merits of working parents in the raising of future contributors is, therefore, erroneous.

Although the concept of the dependence of the pension insurance contribution rate on the number of children raised has, over the last two decades, been mentioned in various forms, in almost every case they amounted to purely theoretical proposals without related economic calculations or even educated guesses. For example, Sinn (2013) suggests an insurance rate for childless persons in the range of 6 - 8% without any specific justification being put forward for this level. Similarly, the ECPR proposal for pension reform fails to state on the basis of what criteria the selected pension insurance rates were determined.

No pension system globally currently applies the idea of introducing a variable pension insurance contribution rate according to the number of children raised or conceived. Model calculations of reductions in pension insurance rates show that the reduction in the financial burden of households with average incomes would be marginal. The variant of introducing variable contribution rates according to the number of children as proposed by the Expert Commission on Pension Reform would, under Czech conditions, mean a further increase in the already heavy workload involved in the insurance of a not inconsiderable proportion of the population.

As Vostatek (2015A) said in his paper: "The construction of the social pension insurance premium is determined by the concept of the insurance – it shall not be deformed by population aspects. Proposals for the differentiation of insurance premiums based on the number of raised children and proposals for introducing child care credits in assessing such insurance premiums may be fully implemented within the area of income taxes."

The differentiation of insurance contribution rates for families with children in the pension system represents an unsystematic measure which is unfair to parents in that it does not cover all parents but only those gainfully employed. For example, with concern to those groups of parents most vulnerable to poverty, i.e. single parents and families with three or more children, who are more often unemployed or work part-time and who, in essence, are most in need of assistance, the proposes measure would provide no or merely minimal benefit. The proposed concept is also unfair to employed parents in that every child is "valued" differently depending on the amount of income of his/her parents - the higher the income, the greater the advantage.

The provision of assistance for families with children could be provided in a fairer, more effective and administratively less demanding way via the provision of tax credits for raising children which would provide support in terms of the raising of children to a greater number of parents who require it than would the proposed concept. The introduction of the concept of insurance rate differentiation according to the number of children raised proposed by the Expert Commission for Pension Reform would mean a further increase in the already heavy workload involved in the insurance of a not inconsiderable proportion of the population.

8 Conclusion

On the basis of the assessment presented above of the proposed concepts concerning the differentiation of social insurance rates, the author recommends that the Czech Republic avoids this solution during the continued reform of the old-age pension system. A significant risk in terms of the introduction of such a concept consists of the problematic theoretical basis of the concept as well as the elusive nature of quantifying its effectiveness. A further major risk involved when considering the raising of children within the pension system consists of practically zero or even negative experience with its application in foreign pension schemes. The advantages for families with children at the micro-economic level are so inconsiderable that the high macro-economic costs cannot be justified.

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Economic and institutional determinants of regional investment attractiveness and their impact on FDI inflows

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Abstract. The paper is focused on analyses of countries' investment attractiveness criteria based on correlation between FDI inward stock levels and parameters of countries' competitiveness and business environment characteristics. The evaluation is done for the top-10 leading FDI countries worldwide. The results show that market size, legal and political environment have a high impact on attractiveness for FDI, while administrative parameters are characterized by low influence.
Keywords: FDI, investment attractiveness, investment climate, IFRS, country competitiveness
JEL Classification: E22, F21, M41

1 Introduction

In a fast changing economic reality with globalization, unexpected crises, redistribution of resources, emergence of new social and business trends investment topics get higher relevance. Both governments and businesses are interested in having beneficial investment conditions. Businesses search for investment possibilities that will support their long term growth and high profitability. Governments seek ways improve businesses environment and increase investment attractiveness of their territories to be accessible to more investors. Direct investments represent the best scenario, especially foreign direct investors (FDI), as local investment possibilities are limited. The reason is that foreign direct investments have a major contribution to regional financial and social development: increase of economically active population, rise in regional revenues from taxes, creation of new working places, infrastructure development, inflow and implementation of new technologies, increase of qualified workforce including development of managerial experiences, improvement of living standards on the territory.

As it was introduced by Massimiliano Ballotta in his presentation on the topic "Factors, Actions and Policies to Determine the Investment Attractiveness of a Territorial System" during the World Bank, WBI/PSD Investment Climate Seminar Series in 2004: "Attractiveness is the quality of being attracting or engaging". One of the indicators that are often used to measure level of countries investment attractiveness is the level of inflowing FDI.

The goal of the paper is to evaluate factors influencing countries' attractiveness for FDI based on analyses of business environment of top-10 FDI inward stock countries worldwide. The choice of this group of countries is based on the hypothesis that they have certain parameters of doing business in common that influence investment attractiveness of their territories.

The paper is organized as follows. After this introduction, next chapter reviews the literature. Chapter 3 contains correlation analyses of parameters of countries' competitiveness with inward FDI stocks.

2 Literature review

Factors influencing investment attractiveness of a territory are investigated by a range of researchers in different countries. The territorial investment determinants are analyzed e.g. by Agarwal (1980), Schneider and Frey (1985), Biswas (2002), Demirhan and Masca (2008), Walsh and Yu (2010), Resmini and Casi (2011), Chan, Hou, Li, Mountain (2014).

Schneider and Frey (1985) discovered, that country attractiveness for FDI depends on politic as well as economic factors, such as real GNP per capita, level of payments deficit, political stability, etc. This was done based on the econometric analyses of FDI in 80 less developed countries. Demirhan and Masca (2008) consolidated the materials on determinants of FDI and by using cross-sectional econometric model evaluated factors of FDI inflows in 38 developing countries for the period of 2000-2004. The study provides with the evidence about the heterogeneity of the FDI determinants and the impact of the same parameters on FDI flows in various countries. Another finding is that significant impact on FDI flow comes from growth rate of GDP per capita, telephone main lines and degree of openness having direct relationship, inflation rate and tax rate showing inverse relationship. Walsh and Yu (2010) divide investments into three sectors - primary, secondary and tertiary – and find the dependence for each of them on set of indicators in developing and developed countries. They conclude that FDI flows into primary sector have low dependence on any of variables, while investments into secondary and tertiary sectors are differently affected by parameters and the effect is often different in advanced and emerging countries.

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Resmini and Casi (2011) looked into distribution of investments on country level and, at the same time, inside regions within countries, trying to identify national and regional components of attractiveness for FDI. Valentey (2012) presents the results of the research of investment attractiveness of Russian regions based on innovative, social and economic characteristics. Liargovas and Skandalis (2012) evaluate the trade openness and FDI inflows in 36 developing economies (in Latin America, Asia, Africa, CIS and Eastern Europe) for the period 1990-2008 and came to conclusion that in long term perspective trade openness had a positive impact on FDI attraction in developing countries. Chan et al. (2014) find out that GDP growth has a direct influence on FDI flows in short and long terms, while growth in local infrastructure has an indirect impact.

Another group of researchers focuses on identifying the connection between parameters of easiness of running business and investment attractiveness. For example, correlation between IFRS adoption and FDI flows is evaluated by Marquéz-Ramos (2008), who unveils a connection between FDI level and the accounting harmonization in the country. Having analyzed data for the periods of 1996-2009, Gordon, Loeb and Zhu (2012) assert that adoption of IFRS in developing countries leads to increase in FDI inflows. Chen, Ding and Xu (2014), based on the research of 30 OECD countries between 2000 and 2005, confirm the hypotheses that the convergence of local accounting standards with the globally harmonized ones (such as IFRS) supports growth of FDI in the receiving countries. Furthermore, the authors ascribe the credit to decreasing information processing costs that allow investing companies to increase their profits. In other words, when choosing a region to invest, companies pay attention both on the possibilities for a sTable and high growth and possibilities to minimize costs. Based on the literature review connected to this topic, Procházka and Procházková (2011) summarize that there are a lot of evidences of correlation between regional attractiveness for FDI and the adoption of the IFRS standards on the territory, although it's not the only influencing factor.

FDI inflows are influence by large set of factors: economic, legal, political and administrative and each of them has different level of impact. Stemming from the paper's goal and the literature review, following hypothesis will be tested: biggest impact on investment attractiveness of a region is coming from legal and political factors as well as market size, while administrative parameters are not crucial.

3 Methodology, data and results

Various international researches are made to understand drivers and identify recent trends in development of world economies. They are often used to analyze investment climate in different countries of the world. The cross-country comparison is often performed by international organizations and research companies: World Bank (Doing Business report), World Economic Forum (The Global Competitiveness Report), UNCTAD (World investment report), EY (Attractiveness surveys), A.T. Kearney (Foreign Direct Investment Confidence Index), OECD (Attractiveness for Innovation, etc.), IESE and EMLYON Business Schools (Venture Capital & Private Equity Country Attractiveness Index), Milken institute (Global opportunity index), etc.

The paper attempts to evaluate the influence of different countries' characteristics on their investment attractiveness. The FDI inward stock levels (from UNCTAD database) are used as the indicator showing the investment attractiveness of the territory. Competitiveness determinants (from the Global Competitiveness Report prepared by World Economic Forum) are chosen as the explanatory variables. The Global Competitiveness Report provides one of the most comprehensive analyses of countries' development characteristics from various sides of countries' reality: institutions, infrastructure, macroeconomic environment, health and primary education, higher education and training, goods market efficiency, labor market efficiency, financial market development, technological readiness, market size, business sophistication and innovation.

The paper focuses on analyzing the competitiveness KPI's of world top-10 countries in FDI inflow stocks. Two criteria are used to identify the top-10 countries: the value of countries' FDI inward stock in mln. dollars and the value of countries' FDI inward stock per capita in dollars (Table 1). The following 10 countries were leading in 2014 based on the first ctiterion: United States, United Kingdom, Hong Kong, China, Singapore, Brazil, Germany, France, Spain, Switzerland. The ranking based on second criterion shows the following leaders: Malta, Luxembourg, Singapore, Switzerland, Gibraltar, Ireland, Anguilla, Cyprus, NewCaledonia and Bahamas.

Table 1. Top-10 countries in FDI inward stock.

Rank	Country	FDI inward stock, mln. dollars		Rank	Country	FDI inward stock per capita, dollars
1	United States	5 409 884		1	Malta	412 613
2	United Kingdom	1 662 858		2	Luxembourg	289 829
3	Hong Kong	1 549 849		3	Singapore	165 684
4	China	1 085 293		4	Switzerland	82 662
5	Singapore	912 355		5	Gibraltar	80 293
6	Brazil	754 769		6	Ireland	78 964
7	Germany	743 512		7	Anguilla	78 249
8	France	729 147		8	Cyprus	66 757
9	Spain	721 879		9	NewCaledonia	57 932
10	Switzerland	681 849		10	Bahamas	48 952

Source: UNCTAD FDI/TNC database

Firstly, top-10 countries are analyzed based on the first ranking criterion - the value of countries' FDI inward stock in mln. dollars. The strongest areas of countries' profiles for the top-10 leading countries in 2014 in FDI inward stock levels are identified by using the following methodology: if more than 5 countries out of top-10 are within top-10 places of the rating for related parameter we consider that this factor has a correlative connection with the FDI inflows. Based on the above explained logic the following groups of countries' characteristics influence the level of countries' attractiveness for FDI: infrastructure (7 countries out of 10 top FDI countries are in leading the rating of this group of factors), market size (6 countries out of 10 FDI leaders) and labor market efficiency (5 out of 10 top FDI inward stock countries) (Table 2). Infrastructure parameters include such factors as transport, telephone, electricity and overall infrastructure characteristics. Group of market size parameters consists of evaluations of domestic and foreign market sizes, as well as levels of GDP and exports as a percentage of GDP. Labor market efficiency represents relations on the labor market, including country capacity to attract and retain talent, ratio between women and men in labor force, reliance on professional management, pay and productivity characteristics, redundancy costs, flexibility of wage determination, effect of taxation on incentives to work, practices of hiring and firing, cooperation in labor-employer relations. Interesting to notice, that China and Brazil have strong rating position in market size characteristics (1st and 7th accordingly), while in infrastructure and labor market efficiency these two countries are far from being leaders of the rating (China is 39th and 37th and Brazil is 74th and 122nd accordingly). When it comes to concrete parameters, the strongest of them are: inflation (annual % change) and trade tariffs (% duty). 6 out of 10 top FDI inward stock countries are present within first 10 places in the rating for these characteristics.

Table 2. Placement of top-10 countries in FDI inward stock in the GCR 2015-2016.

	Based on GCI pillars (groups of KPI's)			Based on GCI KPI's	
Country	**Infrastructure**	**Labor market efficiency**	**Market size**	**Inflation, annual % change***	**Trade tariffs, % duty***
United States	11	4	2	1	33
United Kingdom	9	5	9	1	5
Hong Kong	1	3	32	93	1
China	39	37	1	1	117
Singapore	2	2	35	1	2
Brazil	74	122	7	113	120
Germany	7	28	5	1	5
France	8	51	8	1	5
Spain	10	92	15	71	5
Switzerland	6	1	39	64	41
Count of countries in Top-10	7	5	6	6	6

Source: The Global Competitiveness Index Historical Dataset © 2005-2015 World Economic Forum

Business environment factors are evaluated based on the Doing Business report, a World Bank Group report. As we can see in the Table 3, the strongest positions of top-10 countries for FDI inward stock are the general ranking of "Ease of doing business" and for the parameter "Getting electricity", where 4 countries out of 10 are within top-10 worldwide. For the parameter "Protecting minority investors" 3 countries out of 10 are within top-10 worldwide. In other parameters top-10 countries for FDI inflow stock do not show significant results: only 2

countries out of 10 are having a high position in ratings for the following parameters: “Starting business”, “Dealing with construction permits”, “Paying taxes”, “Trading across borders”, “Enforcing contracts”, “Resolving insolvency”; only one country is strong in the parameter “Getting credit”; no any of the top-10 countries for FDI inflow stock is presented in the top of the rating for the parameter “Registering property”. This correlation is confirmed by the correlation coefficient. For the first 10 countries the correlation coefficient is varying within low levels (between -0,22 and 0,33) for all parameters of Doing business ratings. However, there is a high level of deviation caused by low positions of China and Brazil in the ratings in many cases. This is confirmed by significance tests of correlation coefficients. Correlation coefficients excluding the impact of China and Brazil dramatically differ from the ones including these countries (Table 4).

Table 3. Rating of top-10 FDI inward stock countries in the Doing Business 2015 KPIs.

Parameter	US	UK	Hong Kong	China	Singapore	Brazil	Germany	France	Spain	Switzerland	Count
Ease of Doing Business Rank	7	6	5	84	1	116	15	27	33	26	4
Starting a Business	49	17	4	136	10	174	107	32	82	69	2
Dealing with Construction Permits	33	23	7	176	1	169	13	40	101	56	2
Getting Electricity	44	15	9	92	6	22	3	20	74	5	4
Registering Property	34	45	59	43	17	130	62	85	49	16	0
Getting Credit	2	19	19	79	19	97	28	79	59	59	1
Protecting Minority Investors	35	4	1	134	1	29	49	29	29	105	3
Paying Taxes	53	15	4	132	5	178	72	87	60	19	2
Trading Across Borders	34	38	47	96	41	145	35	1	1	40	2
Enforcing Contracts	21	33	22	7	1	45	12	14	39	46	2
Resolving Insolvency	5	13	26	55	27	62	3	24	25	44	2

Source: Doing Business 2015, Data Notes.

Significant positive relationship between parameters of business environment and FDI inward stocks ranking for top-10 countries excluding China and Brazil is visible for total Ease of Doing Business characteristic and the sub-parameter of Getting Credit (correlation coefficients are 0,84 and 0,86 accordingly with the significance of $p = 0,01$ ($< 0,05$)). Other parameters don’t have significant positive correlation. It is important to also mention that the calculations are partly based on the data from the Doing Business ranking that shows the linear distribution, while the factors that the ranking is based on are non-linear.

Based on the situation described above we can conclude that though ease of doing business is important and has a major impact on the business success, it’s not always the basic factor of decision making for investments. Correlation between the FDI inflow stock and parameters of “Doing Business report” is strong for most of the top-10 countries, meaning that the development of business environment plays an important role for attraction of investment flows. From another side China and Brazil don’t show high correlation coefficient levels between the conditions of business environment and FDI inflows, that can lead us to the understanding that other parameters have bigger impact on the business decisions in case of these two countries and ease of doing business plays rather a supporting role in the process of investing. We can conclude that for different groups of countries investors are focusing on different parameters during the process of decision making for direct investments abroad.

Table 4. Correlation coefficients between FDI inflow stock rank and parameters of Doing Business rating.

Parameter	Top-10 FDI inflow stock countries	Significance of correlation coefficient (p)	Top-10 FDI inflow stock countries excluding China and Brazil	Significance of correlation coefficient (p)
Ease of Doing Business	0,18	0,62	0,84	0,01
Starting a Business	0,27	0,44	0,57	0,14
Dealing with Construction Permits	0,17	0,64	0,58	0,13
Getting Electricity	-0,08	0,83	0,06	0,88
Registering Property	0,09	0,80	0,07	0,88
Getting Credit	0,57	0,08	0,86	0,01
Protecting Minority Investors	0,30	0,41	0,63	0,09
Paying Taxes	0,13	0,71	0,36	0,38
Trading Across Borders	-0,22	0,54	-0,50	0,20
Enforcing Contracts	0,33	0,36	0,30	0,47
Resolving Insolvency	0,28	0,43	0,58	0,14

Source: author's calculations, UNCTAD FDI/TNC database, Doing Business 2015, Data Notes.

For deeper analyses it is important to see also historical development of FDI inward stocks and countries' competitiveness factors. For the time period of 2005-2014, the top-10 countries in FDI inward stock levels based on average ranking were the following ones: US, UK, Germany, Netherlands, Belgium, France, Spain, Singapore, China, Canada. In average ranking over these nine years these top-10 countries were leading in the following competitiveness characteristics: Malaria cases per 100 000 of inhabitants (9 out of top-10), Quality of management schools and Trade tariffs (in both KPI's 7 out of 10 countries were leading), Available airline seat km/week (6 out of top-10). 5 out of top-10 countries were leading in the following KPI's: Domestic market size, GDP, Extent of marketing, Quality of scientific research institutions, University-industry collaboration in R&D, Quality of railroad infrastructure, Availability of research and training services, and Intensity of local competition. This shows that investments trends changed through years together with their determinants.

Finally, when it comes to FDI inward stocks per capita mentioned in the beginning of this chapter it is important to mention that Global Competitiveness report includes data only about 6 out of top-10 countries. All of them have high rating in the KPI "Malaria cases per 100 000 of inhabitants". 5 of them have leading positions in the parameter of Trade tariffs. 4 leaders in FDI inward stock levels per capita stand out in "Technological adoption" and "Goods market efficiency". Furthermore, the top-10 countries in FDI inward stock levels per capita have favorable tax conditions and even known as "tax havens" that also has an impact on investment decisions.

4 Conclusions

Foreign direct investments are a prerequisite of countries' economic development because of their positive contribution to different areas: economic, social, innovative, etc. They support revenues growth both for the territorial budgets and population, influence infrastructure development, stimulate regional competence development and their involvement of population in economic activities, introduce innovative working methods and bring know-how.

To improve investment attractiveness of the area and support FDI inflows governments need to understand criteria of investment decision-making and secure their presence in the region. At the same time, companies are also monitoring investment possibilities around the world, trying to find the best combination of market growth opportunities and to minimize costs.

Based on the above analyses of the regional characteristics of the top-10 countries of FDI inflow stock in 2014, it was identified that the biggest impact on the attractiveness for FDI inflow on territories is coming from such groups of factors as: market size, labour market efficiency and infrastructure parameters. Inflation levels and trade tariffs show high correlation with FDI inward stocks.

When it comes to business environment, 8 out of top-10 countries for FDI inflow stock show strong correlation for parameters of ease of doing business. The other two countries (China and Brazil) have different setup and administrative characteristics don't influence the processes of establishing and running businesses in countries. They focus on enlarging market opportunities and lower risks to increase income and decrease costs. In such conditions administrative difficulties are accepTable for investors.

- Tax conditions also play an important role in countries' attractiveness for FDI.
- The main limitation of the paper is connected to the level of details that are taken into account.

Future research shall deeper assess various parameters of countries' competitiveness and territorial business environment (including political parameters) and their correlation with regional investment attractiveness. It would be beneficial to have a deeper look into the relevancy of the same factors on different groups of countries, depending on the level of their economic development.

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General governments in the pre-crisis and crisis periods

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Abstract. In the paper we analyse some aspects of the general government behaviour during the pre-crisis period (1995-2007) and the crisis period (2008-2013) in the homogenous sample of 10 Member States of the eurozone. The general governments have tried to boost aggregate demand directly through increases in final consumption expenditure especially in the year 2009. Panel analysis has discovered a positive relationship between balance sheets (net borrowing and net saving) and economic activity especially during the crisis period. The increasing indebtedness of the general government has been a price for countercyclical fiscal policy.
Keywords: general government, eurozone, final consumption expenditure, net borrowing, net saving, panel analysis.
JEL Classification: H3, D9, E6

1 Introduction

The latest financial and economic crisis has put considerable strains on public finances in the majority of the EU Member States, see Blanchard et all (2010), Reinhart-Rogoff (2010), World Economic Outlook (2014), BIS Annual Report (2015), Checherita-Rother (2010), Claessens-Kose-Ayhen (2013), Izak (2012) and many other studies. We distinguish the behaviour of the general governments (10 old Member States of the eurozone) in the pre-crisis period (1995-2007) and in the crisis period (2008-2013) being aware of the recovery mainly in 2014. The increasing indebtedness of full-fledged market economies has been exacerbated by the recent financial and economic crisis using a kit of tools of fiscal policies. In this paper our effort has been concentrated on some countercyclical aspects of fiscal policy of the general government sector. Having mentioned the time series utilised in the analysis in part 2, we have been discussing the impact of the changes in the final consumption expenditure of the general government on the economic growth in part 3 and exploiting the possibilities of panel analysis we have shown the impacts of net borrowing and net saving on the growth rates of real GDP in both the pre-crisis and crisis periods in part 4. The conclusions have closed the paper.

2 Data

We have gathered data on time series of 10 old eurozone Member States which represent rather homogenous group allowing panel analysis in both the pre-crisis and the crisis periods. The initial year is 1995 and the final year is 2013 because of Q3 2013 the pre-crisis peak in real GDP was surpassed in many EU countries.

The source of data is represented by AMECO (macroeconomic statistic of the Eurostat) and by national accounts published by OECD including detailed national accounts (Financial balance sheets and Financial accounts labelled as flow of funds).

In what follows, and especially in the panel analysis, we use the cross identifiers for the countries in our sample: Austria (AT), Belgium (BE), Germany (DE), Greece (EL), Spain (ES), Finland (FI), France (FR), Italy (IT), The Netherlands (NL) and Portugal (PT). The 10 old Member States of the eurozone represent a relatively homogenous sample putting aside possible outliers (new Member States of the eurozone).

3 Growth rates and final consumption expenditure

The justification of the division of the time series of the growth rates of real GDP into two time spans is based on the Table 1.

Table 1. Average growth rates of real GDP in the pre-crisis and the crisis periods

	AT	BE	DE	EL	ES	FI	FR	IT	NL	PT
1995-2007	3.36	2.41	1.63	3.96	3.72	3.99	2.29	1.80	2.89	2.55
2008-2013	0.63	0.48	0.62	-4.93	-1.07	-0.78	0.38	-1.45	-0.12	-1.38

Source: Author´s calculations based on National Accounts, OECD (GDP, expenditure approach). The OECD reference year has changed from 2005 to 2010.

In the second row we see that in 6 countries of our sample the average growth rate in 2008-2013 has the sign minus and the remaining 4 has exhibited the growth rate lower on average than 1 percent.

General government can boost aggregate demand directly through increases in final consumption expenditure (the difference between net disposable income and net saving). More often, however, the countercyclical policy

aims to boost household final consumption expenditure through reduction in taxes or increases in social benefits or to boost gross fixed capital formation through subsidies, capital transfers or reduction in corporate taxes.

We expect the increases in general government final consumption expenditure as a tool of countercyclical fiscal policy during the recent financial and economic crisis. Final consumption expenditure of general government as a percentage of GDP at market prices has been highest in Finland and Spain (24% in 2009), followed by Germany, Greece, The Netherlands and France (over 20%). The lowest ratio has been exhibited in Belgium (16.5%), Portugal (17.3%), Italy and Austria (18.9%).

Final consumption expenditure is itself split into a) individual consumption expenditure (mainly spending on education and healthcare) that can be attributed to households and b) collective consumption expenditure including general administration, defence, policing, etc. Without going into the details we have analysed the changes in the final consumption expenditure in individual years-Table 2.

Table 2: The changes in the final consumption expenditure of the general government (percentage of GDP at market prices, ESA 2010)

	AT	BE	DE	EL	ES	FI	FR	IT	NL	PT
1996	**-0.02**	**0.37**	**0.25**	**-0.18**	**-0.11**	**0.27**	**0.29**	**0.23**	**-1.01**	**0.23**
1998	**-0.06**	**-0.10**	**-0.24**	**-0.18**	**-0.14**	**-0.74**	**-0.78**	**-0.14**	**-0.19**	**0.23**
2000	**-0.61**	**-0.14**	**-0.26**	**0.28**	**-0.11**	**-0.49**	**-0.28**	**0.21**	**-0.02**	**0.83**
2002	**-0.14**	**0.64**	**0.27**	**0.52**	**0.05**	**0.71**	**0.58**	**0.14**	**1.18**	**0.29**
2004	**-0.12**	**-0.32**	**-0.50**	**0.20**	**0.40**	**0.10**	**-0.09**	**0.18**	**-0.43**	**0.34**
2006	**-0.07**	**-0.22**	**-0.40**	**0.14**	**0.04**	**-0.10**	**-0.29**	**-0.15**	**1.08**	**-0.63**
2007	**-0.48**	**-0.30**	**-0.48**	**0.36**	**0.32**	**-0.53**	**-0.31**	**-0.49**	**0.49**	**-0.70**
2008	**0.51**	**0.96**	**0.36**	**0.20**	**1.10**	**0.80**	**0.13**	**0.49**	**0.00**	**0.14**
2009	**1.40**	**1.47**	**1.70**	**2.59**	**1.71**	**2.55**	**1.53**	**1.20**	**2.57**	**1.53**
2010	**-0.20**	**-0.47**	**-0.44**	**-1.10**	**0.03**	**-0.33**	**-0.10**	**-0.22**	**0.03**	**-0.72**
2011	**-0.60**	**0.22**	**-0.41**	**-0.52**	**0.01**	**-0.27**	**-0.22**	**-0.82**	**-0.48**	**-0.85**
2012	**-0.02**	**0.49**	**0.26**	**-0.04**	**-0.84**	**0.75**	**0.23**	**-0.04**	**0.33**	**-1.35**
2013	**-0.03**	**0.10**	**0.24**	**-1.31**	**-0.06**	**0.45**	**0.16**	**0.08**	**-0.19**	**0.58**
2014	**0.10**	**0.06**	**0.14**	**-0.40**	**-0.18**	**-0.01**	**0.19**	**-0.08**	**-0.31**	**-0.55**

Source: Author´s calculations, based on AMECO (Eurostat).

What is striking into eyes is the growth of general government final consumption expenditure in the years of deep crisis in 2008 and 2009. In all 10 countries the change is with a sign plus in both mentioned years. The highest change in the year 2009 has been in Greece, The Netherlands and Finland (over 2.5%) with the increase in all remaining countries (between 1.20% in Italy and 1.71% in Spain. All countries have exhibited an increase in 2008, the first recession year. Only later, during the beginning recovery phase, since 2011, general government final consumption expenditure began to decline as austerity measures were adopted. The partial conclusion that can be derived is the prevailing use of final consumption expenditure to supplement the insufficient aggregate demand.

Descriptive statistic reveals that taking the whole time span 1996-2014 into account the mean of the changes has been positive in all 10 countries with the highest increase in The Netherlands and Belgium (0.18%) and the lowest in Germany (0.01%) and Austria (0.03%).

4 Net lending (borrowing), net saving and GDP growth rates.

The financial and economic crisis has led to renewed interest by economists in the relationships between balance sheets and economic activity. In the majority of full-fledged market economies the net lending of general government decreased (or net borrowing increased). Economists use different aggregates depending on whether they are looking at non-financial corporations or at general government. In the case of corporations they look mainly at the profit ratio (net operating surplus, value added), while for general government they look mainly at net lending/net borrowing. For general government B9 (net lending/net borrowing) is equal to revenue minus expenditure. A negative B9 shows the existence of a public deficit or „net borrowing“, which as the name indicates shows that the government has to borrow to finance it. Net borrowing leads to an increase in the public debt.

Several countries, for example the United States, prefer to use a difference balance, namely net saving (B8N in the national accounts). Net saving has the advantage of being unaffected by a particular amount of investment in a given year, reflecting solely current operations, namely current revenue and current expenditure (including consumption of fixed capital).

The philosophy behind is that current revenue should, on average, cover current expenditure, allowing that investment can be financed through borrowing. This is often referred to, in many textbooks, as the „golden rule“.

On the contrary, the disadvantage of the B9 aggregate is that it can become negative as a result of government investment, which, in most cases, is positive in nature because it can contribute to future output.

In what follows we exploit panel analysis to discover the impacts of both net lending/net borrowing and net saving on the growth rates of real GDP. In order to avoid simultaneity we use 2year overlapping forward moving average of the growth rate of real GDP.

As a first step we look at the results of group unit root tests on the real GDP growth rates, net lending and net saving. It is well known that panel-based unit root tests have higher power than unit root tests based on individual time series. What is also well known is the fact that the method assuming common unit root process -Levin, Lin and Chu (LLC) leads sometimes to different results than the methods assuming individual unit root process-Im, Pesaran and Shin W-stat (IPS), ADF-Fisher Chi-square (ADFF) and PP-Fisher Chi- square (PPF).

Table 3: Group Unit Root Tests on GDP growth rates, net lending (borrowing), net saving

Group Unit Root Tests on GDP growth rates

Method	Statistic	Probabilities	Cross-sections	Observations
Common process				
LLC	-5.56	0.0000	10	189
Individual process				
IPS	-4.24	0.0000	10	189
ADFF	53.58	0.0001	10	189
PPF	65.77	0.0000	10	190

Group Unit Root Tests on Net lending/net borrowing

Method	Statistic	Probabilities	Cross-sections	Observations
Common process				
LLC	-3.48	0.0002	10	186
Individual process				
IPS	-4.30	0.0000	10	186
ADFF	54.13	0.0001	10	186
PPF	54.20	0.0001	10	190

Group Unit Root Tests on Net saving

Method	Statistic	Probabilities	Cross-sections	Observations
Common process				
LLC	-2.25	0.0122	10	187
Individual process				
IPS	-2.34	0.0098	10	187
ADFF	35.60	0.0171	10	187
PPF	27.41	0.1240	10	190

The results for the panel unit root tests presented in the Table 3 seem to be convincing. All the results allowing both common unit root processes and individual unit root processes reject the null of a unit root (see very low probabilities with one exception-PP-Fisher Chi-square test for net saving). Hence the stationarity of the 3 time series allows us to exploit the potential of the panel analysis.

The growth equations a la R.Barro have the following shape:

$$y_{it} = \alpha Z_{it} + \beta D_{it} + \nu_i + \pi_t + \varepsilon_{it} \quad (1)$$

where y is the growth rate of real GDP, Z represents some control variables, D specific independent variables, α, β are coefficients of interest, ν are specific cross-section coefficients, π are specific period coeefficients and ε are errors of the equation. The t indicates time periods, i then the number of countries.

In our more narrow interpretation we put aside control variables and as specific independent variables use independently net lending/borrowing and net saving. To avoid the simultaneity between GDP and fiscal variables (some recession related factors automatically contribute to the increase in net borrowing-the reduction of tax receipts, the automatic increases in various social benefits, expensionary fiscal programmes) we use as the growth rate of real GDP as 2 year overlappimg forward looking average. The results of the panel regressions are summarized in Table 4.

Table 4: Growth rates of real GDP, net lending/borrowing and net saving

Dep.var.gr2	1996-2014	1996-2007	2008-2013
Indep.var. nb	0.49	0.17	0.43
	(10.36)	(2.63)	(3.82)
constant	3.73	3.08	1.39
	(10.15)	(14.50)	(2.15)
Ar(1)	0.60	0.66	0.32
	(9.82)	(5.57)	(2.32)
R_{adj}^2	0.71	0.69	0.46
N	180	110	60
Dep.var. gr2			
Indep.var.ns	0.64	0.39	0.62
	(12.87)	(5.05)	(5.01)
constant	2.38	2.81	1.51
	(12.14)	(14.01)	(2.69)
Ar(1)	0.57	0.68	0.38
	(9.46)	(9.44)	(2.82)
R_{adj}^2	0.75	0.73	0.56
N	180	110	60

Note.: Pooled EGLS (cross-section weights, fixed effects).

The panel regressions confirm a positive impact of countercyclical fiscal policies in the mentioned countries. E.g. in the crisis period 2008-2013 the increase of the net borrowing of general government as a percentage of GDP by 1 percentage point led, on the average, to the increase of our dependent variable (2-year overlapping forward looking average of the growth rate of real GDP) by 0.43 percentage points. Similar results are obtained with another explanatory variable-net saving (the response in the crisis period is even higher).

Last but not least we have used period specific coefficients (symbol π in the equation 1) for the whole examined period 1996-2014. The coefficients of the explanatory variables (net borrowing, net saving) have been statistically significant since 2008 till the 2014. The adjusted coefficients of determination have been quite high (0.66 for net saving and 0.62 for net borrowing).*

5 Conclusions

We have divided the time span of our disposable time series into pre-crisis period (1995-2007) with a relatively high growth rate of real GDP in the sample of 10 old Member States of the eurozone and the crisis period (2008-2013) with a very low, often negative growth rate. We have demonstrated the increases of the general government final consumption expenditure as a tool boosting the aggregate demand mainly in the year 2009 practically in all countries of the sample. As the financial and economic crisis has led to renewed interest by economists in the relationship between balance sheets and economic activity we have examined the impacts of net lending/net borrowing and net saving on the growth rate of real GDP using panel analysis (fixed effects models). Panel-based unit root tests have rejected the null of a unit root utilising both assumptions (common unit root process and individual unit root process). The results of the panel regressions have confirmed a positive impact of countercyclical fiscal policies using both net borrowing and net saving.

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Examining the Interdependencies between Leverage and Capital Ratios in the CEE Banking Sector

Karel Janda* – Oleg Kravtsov**

Abstract. In this paper we discuss the implications of the Basel III requirements on the leverage ratio for the banking sector in the Central and Eastern Europe (CEE) and particularly in the Czech Republic. In the empirical study, we applied a data sample of 198 major banks operating in seven countries across the CEE region over the period 2007-2014. The data of the Czech banking sector confirms stronger capital ratios and an overall solid leverage level with only few historical observations being lower than the regulatory guidelines. By analyzing the components of ratios, we conclude that the Czech banks during the last seven years are focusing more on the optimization of risk weighted assets and structuring portfolios with lower risks. We propose an empirical model that allows to test how the leverage ratios and its variables respond to the changes in the cycle. Our analysis across financial institutions in the CEE region shows that the leverage in normal times is strongly related to capital ratio. The statistic evidences on the risk profile and strategy as measured by risk proxy in the model are pointing out on incentives of the banks to manage actively their balance sheet and reduce the riskiness of their portfolios in adverse economic conditions.
Key words: Leverage ratio, capital ratio, Basel III, Czech Republic, CEE
JEL classification: G32, G21

1 Introduction

It is widely believed that one of the causes of the latest financial crisis was the excessive build-up of the on and off-balance sheet leverage in the banking system. In some cases, the banks accumulated excessive leverage while evidently maintaining strong risk-based capital ratios BCBS (2014a). To address this issue and enhance the banks' resilience to crisis, the Basel Committee in 2010 introduced a minimum leverage ratio as an additional prudential tool to complement minimum capital adequacy requirements. The leverage ratio is defined as a Tier 1 capital divided by on and off-balance sheet exposure. The leverage ratio should be disclosed in the public reports of financial institutions from 1st of January 2015 onwards and fully implemented at the start of 2018 after appropriate review and calibration.

In our paper we discuss the implications of leverage and capital requirements for the banking sector in the CEE and particularly in the Czech Republic. We identify the potential binding constraints from regulatory limits and analyze the interactions among ratios over the country's economic cycle (during the period 2007-2014). The following points are of primary focus of our analysis. On the example of the Czech banks, we evaluate whether the specified regulatory ratios in the Basel III regime (i.e. Tier 1 capital ratio, capital adequacy or leverage ratio) represent a potential binding constraint during the crisis and recovery periods (over the years 2007 to 2014)? What leverage and capital ratios can say about the behavior and strategy of the banks particularly in case of the Czech banking sector? How the leverage ratio and its variables are responding to the business cycles across CEE banking sector and in comparison to the Czech and Slovak banks?

In the debate about financial market regulations and their impact on the economies Musílek (2011), Teplý, Šobotníková and Černohorský (2011) in their works are dealing with the challenges of the Basel III guidelines for the EU and Czech banking sector. The banking regulations and systematic risk in financial market systems are investigated by Klinger and Teplý (2016) with special focus on the capital regulations in studies of Avery and Berger (1991), Gropp and Heider (2009), Estrella, Park and Peristiani (2000). Notably few studies are focusing on the implications caused by interactions among regulatory ratios for example between capital and leverage ratios as risk and non-risk based measures. In the analysis by Adrian and Shin (2008a,b), Kalemli-Ozcan, Sorensen and Yesiltas (2011), Brei and Gambacorta (2014), the cyclical properties of the ratios are tested taking into account structural shifts in banks' behavior during the global financial crisis and its aftermath. They suggest that in normal times the new leverage ratio based on the exposure measure is always more countercyclical (less procyclical) than the other ratios. In contrast to capital ratios, it is a tighter constraint for banks in economy upturn and a looser constraint in recession. Nuno and Thomas (2013) argue that bank's leverage is endogenously determined by market

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forces. They found that leverage contributes at least as much as equity to the cyclical movements in total assets and leverage is negatively correlated with equity. Apparently it is positively correlated with assets growth and to a lesser extent with GDP. The impact of capital on bank survival during financial crises and normal times is examined by Berger and Bouwman (2013). Mainly focusing on the economic roles of capital depending on bank size and time period they indicate that the capital helps to enhance the survival probabilities of small banks at all times and for medium/large banks primarily during the banking crises and with limited government support. They note similarly that the off-balance sheet activities of banks are impacting the capital and consequently survivability of banks over the crisis.

The effectiveness of the Basel Accords as a regulatory framework and its implications on the Czech banking sector were investigated by Šútorová and Teplý (2013; 2014) or Teplý and Vejdovec (2012). The related topic of credit risk was modelled theoretically by Janda (2011) and empirically analysed by Janda, Michalikova and Skuhrovec (2013). The possibilities of major improvements over Basel II treatment of indebtedness and credit risk were discussed by (Witzany 2010). In other country specific case study, Kellermann and Schlag (2013) examine the binding constraint factors of ratios on the Swiss banking sector. From their analysis it is evident that the minimum leverage ratio shows a strong tendency to undermine the risk-based requirements. Since at least during the period 2009 to 2011 the minimum leverage ratio requirement became a binding rule for the major Swiss bank UBS. Furthermore, they pointed out that this fact might adversely encourage banks to take greater risks. Cathcart, El-Jahel and Jabbour (2013) investigate the interdependencies and pro-cyclical nature of capital and leverage ratios of the US banking institutions prior to the first 1990-1991 and the second credit crunch of 2007-2009. Their results demonstrate that unlike during the first credit crunch, the leverage ratio during the crisis of 2007-2009 was a binding constraint and generally more to blame for triggering the subprime crisis. Furthermore, they argue that the reversal in correlation patterns between the two ratios was a main reason of the change in binding constraint. The correlation patterns of the ratios are seemingly related to loan growth and GDP market signals.

2 The leverage ratio over the cycle

The Basel III leverage ratio (LR) is defined as the capital measure (the numerator) divided by the exposure measure (the denominator), with this ratio expressed as a percentage

$$LR = \frac{K_t}{Exp_t}, \tag{1}$$

where K_t - denotes a Tier 1 capital and Exp_t - the exposure measure, at the end of reporting period t

The capital measure represents the numerator of the leverage ratio and is based on the new definition of Tier1 class of capital as set out by Basel Committee (BCBS 2011). Under Basel III, the Tier 1 capital includes: the common equity Tier 1 (CET1) and the additional Tier1. CET1 refers to loss-absorbing equity capital of the highest quality and consists of paid-in capital, disclosed reserves and retained earnings. The exposure represents the denominator of the leverage ratio. The exposure measure in definition of the Basel Committee on Banking Supervision (BSBC 2014a) is the sum of the following exposures: on-balance sheet exposures; derivative exposures; securities financing transaction exposures and off-balance sheet items. During the transition period from January 1, 2013 to January 1, 2017, Basel Committee will test a minimum Tier 1 leverage ratio > 3 %. The disclosure requirements of the ratio and its components at the bank level started on January 1, 2015.

By introducing a leverage ratio the Basel Committee pursued several goals. The minimum leverage provides a simple and transparent accounting measure that serves as a non-risk based „backstop“ which ultimately serves to protect against model risk, and the reduction of capital requirements and generally it reinforces risk based requirements (BCBS 2014a). It captures both the on-and off balance sheet exposure which in fact could bear significant risks due to the complex and not fully transparent derivative and guarantees exposures. Finally the primary goal of leverage is to constraint a build-up of excessive leverage in banking system during the times of credit boom and help to soften the deleveraging processes in downturn economy cycle. These cyclical qualities of the leverage and capital ratios have been indicated in several studies. The evidences by Adrian and Shin (2008b), Nuno and Thomas (2013) are based on the empirical analysis of the US financial intermediaries that operate primarily through the highly liquid and dynamic capital markets. They suggest that these financial institutions are adjusting their balance sheets actively in such way that leverage tends to be higher during the economy booms and lower during the slowdown and recession. In normal times however, leverage is less cyclical. The capital ratios reveal opposite counter-cyclical qualities and seem to be more sTable and less procyclical in the crisis times Brei and Gambacorta (2014), Kellermann and Schlag (2013). According to this logic, both leverage and capital measures might represent a binding constraint for the banks in various economy cycles. Depending on which one of the two ratios is the stricter binding constraint, the incentive for the bank strategies might have different approach according to Blundell-Wignall and Atkinson (2010), Cathcart, El-Jahel and Jabbour (2013). All this implies that the management of bank capital and leverage ratios over the course of the business cycle might be as

important as the rules-based capital requirements particularly by determining the cyclical impact of capital regulation.

In the Table 1, we summarize the historical evolution and potential regulatory constraints on the capital and leverage ratios for the largest Czech banks over the economic cycles. The period 2007-2009 refers to crisis period and years of 2010-2014 as a recovery and normal times. The following ratios are evaluated: (a) the new Basel III leverage ratio (as Tier 1 / Exposure measure); (b) the accounting leverage ratio (Tier 1/ Total assets); (c) the capital-to-risk-weighted-assets ratio (Tier 1/ Risk-weighted assets); (d) the capital adequacy (Total capital / Risk weighted assets). The first three ratios (a), (b), (c) have different denominators but relate to each other with the same numerator - Tier 1 capital. We have included into our review an accounting leverage (b) which has total assets on balance sheet in denominator instead of exposure. This helps us to separate the impact of off- balance sheet exposures, derivatives and guarantees on the Basel III leverage ratio and additionally to judge the risks stemming from off balance transactions that we are discussing later in the paper. The capital ratio (d) has been added to estimate the development of the banks' capital adequacy over the period. The regulatory guidelines on minimum requirements under the Basel III regime are the following: minimum leverage requirement ≥ 3.0% during the testing period from 1st January 2013 to 1st January 2017 with disclosure requirement starting from 1st January 2015 (BCBS 2014a and BCBS 2011); minimum requirement for Tier 1 capital (incl. Tier 1 additional capital) ≥ 6.0% of Risk Weighted Assets (RWA) with minimum Tier 1 capital ratio in Basel III phase-in arrangements in 2013 ≥ 4.5% , in 2014 ≥ 5.5% and starting from 2015 ≥ 6.0%; minimum total capital requirement (sum of total Tier 1 and Tier 2 capital) ≥ 8.0% of RWA.

The weighted median of all risk and non-risk based ratios reveal an upward trend during the various economic cycles, newly analyzed by Stadnik and Miecinskiene (2015). Between the crisis period of 2007-09 and recovery years 2010-14, the median of the risk-weighted Tier 1 capital ratio increased from 11.3% to 14.9%, while the leverage ratio in the Basel III regime increased very moderately from 5.6% to 6.8%. The total capital ratio (capital adequacy) increased even at larger extent from 12.3% to 15.8%. The data (in Table 1) show that contrary to the capital ratios, the leverage of the Czech banks might represent potentially larger constraint in terms of meeting the transitional minimum regulatory limits. We observe that only in 5% of cases from total sample the leverage of few banks has happened to be lower than the regulatory guidelines at some point of time. The mean of the leverage ratio across the sample is around 8.3% that is overall higher than leverage level referred as a minimum requirements ≥ 3.0%. Teplý, Šobotníková and Černohorský (2011), Matejašák (2015) similarly noted that Basel III requirements on capital are not presenting a larger constraint because of the historically high capital ratios of the Czech banks.

Table 1: Capital and leverage ratios of the 15 largest banks in the Czech Republic (2007-2014)

Ratios	(a) Leverage (Tier 1 / Exposure)		(b) Leverage (Tier 1 / Total assets)		(c) Tier 1 Capital Ratio (Tier 1 / RWA)		(d) Capital Adequacy (Tier 1+ Tier 2 / RWA)	
	median	<3.0%	median	<3.0%	median	<6.0%	median	<8.0%
Top 5 largest banks	6.3%		7.0%		12.7%		13.7%	
All banks	8.3%		10.7%		18.6%		19.3%	
As a % from total observations		4.5%		2.7%		0.0%		0.0%
Period 2007-09	5.6%		6.3%		11.3%		12.3%	
Period 2010-14	6.8%		7.6%		14.9%		15.8%	

Source: annual reports and own calculation

Note: all ratios are mean weighted by respective denominator i.e. RWA, Exp or TA

In order to assess the strategies of banking sector towards adjustments in capital and leverage ratios, we take a closer look into interdependencies between the components of the leverage ratio and the Tier 1 capital ratio. Since both of them have the same numerator (Tier 1 Capital), it allows us to relate and analyze changes in their denominators - risk weighted assets versus exposure or total assets Berger and Bouwman (2013), Cathcart, El-Jahel and Jabbour (2013). We rearrange the relation of Tier 1 capital ratio to leverage ratios (both ratios with exposure based and accounting measure of total assets) as follows:

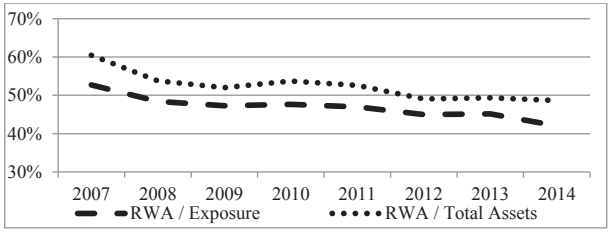
$$\frac{LR_t}{CR_t} = \frac{\frac{K_t}{Exp_t}}{\frac{K_t}{RWA_t}} = \frac{RWA_t}{Exp_t}, \quad (2)$$

where K_t - denotes a Tier 1 capital, RWA_t stands for risk-weighted assets and Exp_t - the exposure measure (or total assets on the balance sheet), at the end of reporting period t.

The relationship of risk weighted assets to exposure (or total assets) captures also the riskiness of the business model of the banks. The higher ratio of risk weighted assets to total assets suggests that the portfolio contains more risky assets. For example the sovereign bonds portfolio has usually the lowest risk, depending significantly on the level of interest rates – Stadnik (2014), weight up to 0.0% (in standardized approach of credit risk measurements under the Basel II capital adequacy guidelines), since this asset class is considered to be the safest and on opposite, traded securitization products have the highest up to 1250% risk weight.

In the Figure 2 for example we visualize the historical evolution of risk weights over the period of 2007-2014 of the largest Czech banks. The noTable trend is that both risk weights tend to decline steadily during the entire period. Apparently the Czech banks are focusing more on the optimization of risk weighted assets and structuring portfolios with lower risk weights. The minor risk weight increase (for RWA / TA) in the last two years 2013-2014 can be attribuTable to recent more demanding regulatory requirements on the risk management practices and measurements in the banking sector.

Figure 1: Historical evolution of risk weights of the 15 main banks in the Czech Republic (2007-2014)



Source: annual reports and own calculation

Other remarkable observation from the Figure 2 is that the off balance sheet exposure, which is mostly stemming from complex derivative transactions and other guarantees has a sTable proportion to total assets over the 8 year horizon. This fact suggests that the banks in the sample are not shifting significant risks off balance sheets in times of economic distress. The off balance-sheet items of the Czech banks constitute a relative small fraction to total assets on average (10%). In comparison, the empirical data across the top EU and US banks (over the period of 2000-2009) presented by Kalemli-Ozcan, Sorensen and Yesiltas (2011) shows that the maximum amount of the off-balance sheet items was 65% of assets with a mean of 10%.

3 The data and methodology

The panel data regression model is designed to test how the leverage ratios across CEE countries respond to the cycle and which of the bank specific variables has larger impact on the leverage. The regression model with fixed effect is applied to panel data containing the financial data of 198 financial institutions based in the following countries: Czech Republic, Slovakia, Slovenia, Poland, Hungary, Romania and Croatia. These countries in our view represent a relatively similar set up in the banking sector and showing evidences of business cycle synchronization as noted by Cevik, Dibooglu and Kutan (2016). The financial data is obtained from the database BankScope. Although, the financial data do not fully reveal details about the exposure measure to calculate it precisely according to the Basel III methodology, in our calculation we used the total assets Figures as a substitute. The summary of variables for the regression model is provided in the Table 2. The unbalanced data sample is due to the partly missing data for the entire period of last 7 years, mostly for the smallest banks in the dataset.

Table 2: Descriptive statistics and definitions for the regression variables

Variable name	Variable description	Obs	Mean	Std. Deviation	Min	Max
LR	Leverage Ratio as Tier 1 over Total Assets	863	0.11	0.10	-0.02	0.98
TA_ln	Total Assets (ln)	863	7.63	1.63	2.37	10.98
Risk	Risk Weighted Assets over Total Assets	863	0.54	0.27	0.00	2.13
CR	Capital Ratio as Tier 1 Capital over Risk Weighted Assets	863	0.15	0.14	-0.16	2.12
GDP	Annual growth rate of GDP	863	0.01	0.03	-0.08	0.11
Ct	Dummy that takes value 1 in the 2007-2009 and 0 elsewhere	863	0.26	0.44	0.00	1.00

Source: BankScope and own calculation

By performing the regression analysis we have to differentiate the cyclical properties of the ratios in normal times and during the crisis. Following the approach by Brei and Gambacorta (2014), we address this issue by introducing the dummy C_t with the regression variables that is allowing for a parameter shift in the estimated response depending on the condition of the economy. The dummy represents the value of 0 in normal times 2010-2014 and 1 in the time of crisis 2007-2009. The dummy C_t aims at capturing not only the effect of the financial crisis but also changes in banks' behavior due to the implementation of new policy of Basel III and the anticipation of more stringent capital requirements in the future. Hence, in our econometric model we apply a two period panel data analysis as follows:

$$LR_{it} = \beta_0 + \delta_o C_t + \beta_1 TA\_ln_{it-1} + \delta_1 C_t\, TA\_ln_{it-1} + \beta_2 RISK_{it-1} + \delta_2 C_t\, RISK_{it-1} + \beta_3 CR_{it-1} + \\ + \delta_3 C_t\, CR_{it-1} + \beta_4 GDP_{it} + a_i + \varepsilon_{it}\ , \qquad (3)$$

The control variables in the model equation (3) are chosen to explain banks' choice of target leverage ratios and intend to reflect the cyclical qualities, link to targeted capital structure and the risk profile of the banks. The variables are lagged *(t-1)* with one year period to test whether adjusting costs are relevant Ayuso, Perez and Saurina (2004). In particular, TA_{t-1} equals the amount of the total assets of the banks (note: log of total assets applied to eliminate significant differences in the asset size across countries). The risk profile of institutions is represented by risk proxy $RISK = \frac{RWA_{it-1}}{TA_{it-1}}$ that equals to risk weighted assets divided by total assets. This is also equivalent to an interaction between the capital and leverage ratio, irrespective of Tier 1 capital *K*. The logic behind the risk proxy is explained earlier in the paper in the equation (2). The component will be useful in understanding the relation between leverage and capital ratio over the cycle. The CR_t denotes a capital ratio and described as Tier 1 capital divided by total risk weighted assets. The statistical evidences between capital ratio and leverage are of interest for us to understand the patterns of ratios co-movements in various economic conditions. The annual change in GDP_{it} growth reflects the economic cycle of the countries in our model similarly to Jakubik and Fungacova (2013). In addition, there might be the time-invariant fixed effects due to the counties profile Izák (2011), which is captured in a_i and the regular unobserved factor is ε_{it}.

4 Results

The Table 3 shows the results of the estimation of equation (3). The analysis of the components and variables allows us to disentangle leverage ratio movements in reaction to changes in economic conditions. First of all, we tried to assess the interaction of leverage with capital ratio over the cycle. The pattern emerged that the leverage in normal times is strongly related to capital ratio which is particularly true for the Czech and Slovak banks. The capital ratio does not show co-movement with leverage and weak relation during the economy downturn. The statistics evidences of risk taking strategy measured in risk proxy (RWA / TA) are pointing out on incentives of the banks to manage actively their balance sheet and reduce the riskiness of their portfolios (i.e. negative coef. -0.016 and -0.034 in crisis times) which is valid for banking sectors in CEE and Czech and Slovak banks. The reaction of the banks to cycle conditions can be translated into banks' need to reduce the overall riskiness of their portfolios, or to deleverage in reaction to the crisis similarly as mentioned by Blundell-Wignall and Atkinson (2010), Cathcart, El-Jahel and Jabbour (2013). Notably the results do not suggest strong relation between leverage and total assets but fairly point to the counter movement tendencies in normal and crisis times. Over the period of

2007-2014, the leverage ratio reveals a quiet strong relation with GDP annual growth that might be explained by the sample of countries with similar banking sector set up.

Table 3: The comparison of regression results for CEE and Czech Republic, Slovakia

Dependent - Leverage Ratio	CEE countries			Czech Republic and Slovakia		
Independent Variables	Coef.	Std. Err.	P values 95%	Coef.	Std. Err.	P values 95%
TA_ln_Normal	-0.011	0.002	0.000	-0.005	0.003	0.086
Risk_Normal	0.072	0.011	0.000	0.317	0.016	0.000
CR_Normal	0.306	0.025	0.000	0.539	0.030	0.000
TA_ln_Crisis	-0.009	0.004	0.014	0.004	0.005	0.520
Risk_Crisis	-0.016	0.023	0.486	-0.034	0.032	0.428
CR_Crisis	0.119	0.038	0.002	0.012	0.039	0.280
GDP	0.539	0.128	0.000	0.224	0.347	0.758
Obs	863			220		
Banks	198			51		
F test	0.0000			0.0000		
R-sq	0.5611			0.8802		

Source: BankScope and STATA calculations

5 Conclusion

In this concluding section we summarize the main results of our analysis of the impact of the leverage Basel III requirements on the banking sector in CEE and particularly of the Czech Republic. In our empirical study, we used a data sample of 198 major banks operating in seven countries of the CEE over the period 2007-2014. The historical data of the Czech banking sector confirm stronger capital ratios and an overall solid leverage level with only 5% of the total historical observations being lower than the regulatory guidelines. By analyzing the components of ratios, we conclude that the Czech banks during the last seven years are focusing more on the optimization of risk weighted assets and structuring portfolios with lower risks.

The panel data regression model is designed to test how the leverage ratios across CEE countries respond to the cycle and which of the bank specific variables has larger impact on the leverage. The results of analysis show that the leverage in normal times is strongly relating and more pro-cyclical to capital ratio that is particularly true for the Czech and Slovak banks. The statistics evidences of risk taking strategy measured in risk proxies are pointing out on incentives of the banks to manage actively their balance sheet and reduce the riskiness of their portfolios in adverse economic conditions. Notably the results show weak relation between leverage and total assets but rather suggest a stronger link to the economic cycle indicator GDP annual growth.

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Assessing the local municipal default probability: the case of Portuguese economic adjustment programme

Karel Janda* – David Moreira†

Abstract. This paper investigates whether the economic adjustment program and post-program surveillance contributed positively to the structural recover of the Portuguese economy. This examination was conducted observing evidences related to several objectives included in the programs and on a sample of data collected from local defaulted and non-defaulted municipalities. Our results confirm that the financial aid provided by EC, ECB, and IMF had a small impact on the internal economic adjustment. There is a residual positive impact from the implemented reforms to promote growth, jobs, public debt, deficit, and stability of the country's financial sector. The evidence is revealed by the measurement of the key program achievements and by the indicators related to the current high default probabilities of a large number of local municipalities.

Keywords: public finance, municipalities, default, international aid
JEL Classification: E6, G28, O11.

1 Introduction

In the aftermath of the world economic crisis in 2009 (Izák, 2015), Portugal requested financial assistance from the International Monetary Fund (IMF), the euro member states, and European Union. The Portuguese government negotiated an economic adjustment programme with the European Central Bank (ECB), the European Commission (EC), and the IMF. The agreement adopted in 2011 includes a memorandum of understanding and a loan agreement with a financing package of €78 billion, €26 billion of which provided by the EU, €26 billion by the European Financial Stabilisation Mechanism (EFSM), and about €26 billion provided by the IMF. The implementation of this aid programme covered a period between 2011 and 2014 and had the following main objectives:

- Structural reforms to improve the national competitiveness, economic growth, and job creation.
- Fiscal consolidation to reduce the deficit to a level below 3% of GDP, and to diminish the ratio of gross public debt-to-GDP in the medium term.
- Deleverage of the financial sector through recapitalization, and governmental instruments supported by backstop facilities.

The core of this paper is the examination of these objectives, and the respective impact on the municipal accounts after the end of this adjustment programme and financial aid.

Portugal may be considered a European economy comparable with Czech Republic and Slovakia due the similar geographic size, number of inhabitants, GDP, growth rate, and social progress index (Pavel and Vítek, 2014). Relevant financial restructuring events at the level of governmental policy making that have happened in Portugal, will be analysed across this paper and may be used as a learning example to other similar countries to avoid falling in the same economic situation.

From 2014, the previous Portuguese economic adjustment programme was substituted by the post-programme surveillance which is being applied with the objective of measuring the capacity of Portugal to repay its outstanding loans to EFSM and other international creditors. The European Commission (EC) with the European Central Bank (ECB), have a mandate to review the national financial, economic, and fiscal developments. Furthermore, these institutions in liaison with the government are responsible to monitor, report, and if needed recommend further structural measures.

In this paper we conduct an observation comparing several objectives of the financial-economic restructuring plan, and the respective reality after its full implementation. We identified relevant findings such as imbalances across important areas such as GDP growth, competitiveness measured by international investment, national debt, and unemployment. In this context, this paper finds enough evidences that the €78 billion along with the austerity measures had very small positive impact on the Portuguese economy.

The progress of some key metrics included in the examination are stated below:

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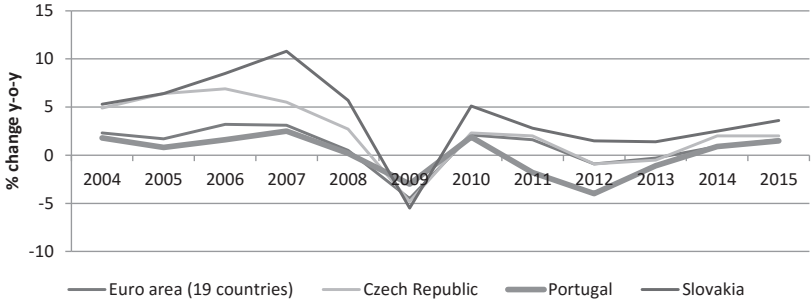
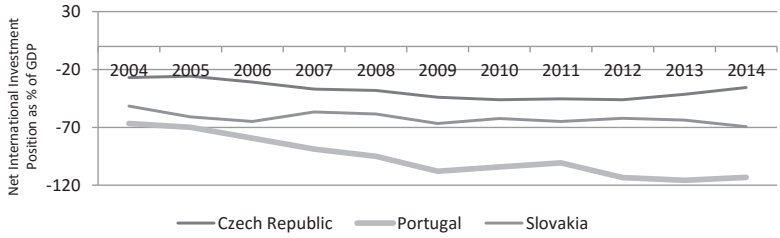
Figure 1: Real GDP growth rate - % volume



Source: Eurostat, DG ECFIN

The *x* axis of this linear graph shows the years between 2004 and 2015, while on the *y* axis appears the % of real GDP growth y-o-y. In this graph we see that the overall GDP rose steadily in the second part of the last decade before dropping off in 2008 and 2009. Then while the average of GDP growth in the Euro area (19 countries), Czech Republic, and Slovakia kept being between 0% and 5% (Teplý, Tripe, 2015), Portugal had another dramatic fall in 2012. Although in 2015 the Portuguese GDP had a slight recovery, it just reached the pre-crises values in 2005.

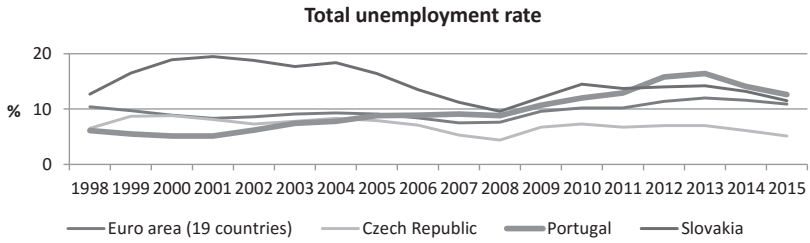
Figure 2: Aggregate view of the net international investment



Source: Eurostat, DG ECFIN

The trend lines observed in the Figure 2 show that the net international investment as % of GDP in Portugal fell significantly from 2004 till 2014, while in Czech Republic and Slovakia the foreign investment trends show a sTable line during the same 10 years period.

Figure 3: Comparison of unemployment rates since 1998



Source: Eurostat, DG ECFIN

The unemployment rate of Portugal between 1998 and 2008 was one of the lowest in Europe however after the crisis it reached a steady peak above its peers, and the Euro area. Czech Republic remained during almost 20 years with one of the most sTable and low unemployment rates (Potluka, Klazar, 2013). Slovakia, even though it had during the first 10 years in analysis the higher unemployment rate, at this moment it already stabilized at the level of the Euro area, and it is even performing positively under the Portuguese rate.

The government debt is defined as the total consolidated gross debt at nominal value at the end of the year in the following categories of government liabilities: currency and deposits, debt securities, and loans. The governmental debt in Czech Republic has been consistently lower than the average of Euro area (Janda, Zetek, 2014), while the Portuguese debt rate remained chronically at the largest levels throughout the time bottoming out with a considerable downward movement.

In order to achieve the proposed goals stated in the abstract, the article is structured as follows. The next section summarizes the general overview of the municipal default probability in all Portuguese regions and the selection of the financial and macroeconomic indicators. Section 3 characterizes the selected panel data and methodology more closely. Our results are given in Section 4. The research findings are summarized in the conclusion.

2 Assessing the local municipal default probability

Our study examines the outcome of the governmental structural measures taken in the aftermath of the financial crisis, and the related economic adjustments supported by the international financial aid packages. We analyse the impact of these measures from the microeconomic perspective and we assess the likelihood of default based on data for all the Portuguese municipal regions.

The Portuguese municipal local entities have faced strong stress during the application of the austerity measures enforced by new public finance policies. Several cities have declared emergency situation or have filed for default on payments against their creditors, however most of the municipal cities kept being able to meet their debt obligations. The default troubles that individual regions encountered usually received considerable publicity by the media and population. This publicity related to eventual default events strengthen the alarming predictions that a governmental financial crisis is approaching. This situation results typically in an external economic negative outlook according to Ang & Green (2011), which may exacerbate the country illiquidity in international financial markets. This topic is also analysed by Stadnik & Miecinskiene (2015). After the collapse of the Portuguese economy, the municipal creditworthiness and its financial strength may be assessed applying the statistical methods herewith suggested predicting their default risk.

We have created an empirical methodology to score the municipalities according to their probability of default. This predictive modelling procedure is applied also by several financial institutions to evaluate their borrowers. Using this econometric model, we evaluated the default probability across 308 municipal regions. The term default is commonly used as the inability of a borrower to pay the interest or principal on a debt when it is due, or it is an estimate of the likelihood that a borrower will be unable to meet its debt obligations. (Roger, 2002). Default is more likely to happen in recessions because it is when it becomes more costly for a risk averse borrower to repay non-contingent debt (Cristina, 2008).

The framework of the conceptual default status in this paper is related to the failure of a municipality to carry on paying its debt obligations to employees, beneficiaries, suppliers, contractors, among other senior creditors. Even though it is considered a distressful indicator when there happens an event of payment delinquency among a governmental institution, there is also a small incentive to publish publicly the governmental default on payments (Stadnik 2014). Several evidences showed that most of these defaulted cities had a period before this event when they renegotiated the payment terms with their debtors to longer maturities. This information may be found observing the increasing number of days to pay above the market trend year-over-year. This is typically an external sign that the creditors prefer to extend the payment terms before consider the debt uncollecTable (Holian, Joffe, 2013).

We also observed the yearly balance sheets and profit & loss statements of each municipality. Reading the respective accounts, we discovered that there are regular transfers of money from the government directly to the local municipalities. In this respect, taking in consideration that they are mostly governed by political parties from different wings there is not enough available information to conclude if the amounts transferred are following the strict legal obligations. Therefore, this unclear observed topic may serve as a moto for a future paper research related to public policies addressing the need of more specific legislation to clarify the transparency of governmental financial transfers to local regions.

The relevant existing literature contains many efforts to model the likelihood of default using logit and probit, however Ohlson (1980) was acknowledged as the first researcher applying logistic regression approach to model the probability of defaults. Shumway (2001) developed a new model from previous logit models by using panel rather than cross sectional data. This approach addresses the fact that most bankrupted firms were solvent for many years before going into bankruptcy. The RiskCalc methodology document written by Falkenstein, Boral & Carty

(2000) suggests that the choice of probit over logit was not significant, as the two models usually produce similar results. On the other hand, Altman & Sabato (2007) identified that logit models have outperformed probit models in the financial default and bankruptcy field. A logit model was already applied by Bialaszewski (1985) to a set of municipal revenue bonds. Bialaszewski collected financial, economic and demographic inputs to include in the model as independent predictor variables. She reported that one year prior to default, the model accurately classified 87% of the observations into defaulting and non-defaulting categories. These categories were defined in terms of a "cut point" in the calculated probabilities. The cut point that she has set was 65.8% to produce the highest degree of accurate classification. It also may be more appropriate to use a fixed cut point of 50%, since probability estimates over that level could be reasonably characterized as default predictions, while probabilities under this level could be seen as predictions of non-default (Bialaszewski, 1985). The logit methodology was also applied by Jakubík & Teplý (2011), who constructed a new indicator (named the JT index) evaluating the Czech economy's financial stability.

3 Data and Methodology

We have chosen default probability modelling using logistic regression because it has the advantage of having a dependent variable restricted to the amplitude between 0 and 1. The logistic model is extensively applied in the financial corporate field to classify subjects based on values of a set of predictor variables, however very few attempts were made in the field of public financial municipalities. The predictive probability of bankruptcy using the logistic model is expressed with this formula:

$$P(X) = \frac{1}{1 + e^{-(\propto + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \cdots \beta_\infty X_\infty}} \quad (1)$$

This predictive model developed in this paper is based on 22 initial variables collected from three main sources. The 1st source used to classify the dependent variable municipalities as defaulted or non-defaulted, was the Portuguese "Public budgeting" website. There was possible to find a list of the defaulted entities in governmental areas such as municipal regions, central administration, and social security sectors. The 2nd main source addressing the selection of independent variables or predictors, was the Portuguese governmental website called "Portal Autarquico", from where it was possible to find the balance sheet, and profit & loss yearly statements of all municipal regions. The 3rd main source also used to find significant macroeconomic predictors to the model, was the governmental bureau of statistics named "Pordata", which has a systematization of data on municipal, country, and European areas. The independent variables which included number of inhabitants, active population, and the accounting ratio "tax revenues of total municipal revenue in 2014", were obtained from this statistical database. Since the model shall include solely the independent variables that are significant to the prediction, the final determinants applied in the log equation were: expenditures with municipal employees, sales of services and goods, taxes paid, governmental transfers and subsidies obtained, total debt to third parties, population in 2014, ratios between tax revenues collected and total municipal revenues, and active population in 2014.

Table 1: General description of variables

Step 1a	B	S.E.	Wald	df	Sig.	Exp (B)	95% C.I.for EXP(B)	
							Lower	Upper
Expenditures with employees	.0000014	.000	9.056	1	.003	1.000	1.000	1.000
Sales of services and goods	-.0000013	.000	6.523	1	.011	1.000	1.000	1.000
Taxes paid	-.000001	.000	11.831	1	.001	1.000	1.000	1.000
Governmental transfers and subsidies obtained	-.000001	.000	8.260	1	.004	1.000	1.000	1.000
Total debt to third parties	.000000	.000	12.636	1	.000	1.000	1.000	1.000
Population 2014	-.0006472	.000	3.660	1	.056	.999	.999	1.000
Tax revenues of total municipal revenue in 2014	.0534122	.029	3.485	1	.062	1.055	.997	1.116
Active population 2014	.0012954	.001	3.778	1	.052	1.001	1.000	1.003
Constant	-3.024761	1.001	9.125	1	.003	.049		

Source: Authors' calculations

4 Results

Considering that the probability of bankruptcy must lie within 0 and 1, the final result is a probability between 1% and 100%. The test applied to the model to assess its statistical fit was the Hosmer-Lemeshow goodness-of-fit. We also made a diagnostic using a residual plot to observe the change in deviance versus the predicTable probabilities, and the Cook's test to observe the distances versus predicted probabilities. The Hosmer-Lemeshow statistical analysis is considered to have a good fit if the significance value is more than 0.05. Therefore, as this test had the result value of 0.996, the model is considered adequately fitting the data. The statistical test Cox & Snell based on the log likelihood has a value of 0.203, and the Nagelkerke test of parameter estimates has the value of 0.594. These two results suggest that the dataset included in the model is useful to explain the bankruptcy probability.

Our predictions using the logistic model were achieved with a cutting level of 50%, and they showed a likelihood range of default from 67% up to 99% among the following cities: Sines, Portimao, Faro, Aveiro, Cartaxo, Vila Real de Santo Antonio, and Santa Comba Dao. These results are considered significant taking in consideration that the total number of municipalities that effectively defaulted in 2015 were 16, therefore the model was able to accurately predict defaulted municipalities with 44% of success. The final population sample used in this analysis had included 299 different municipal regions across Portugal, out of the existing number of 308. This sample is also significant because it covered the whole country at the level of 97%. If the modelling cutting level would have been 40% there were two more municipal regions also with a correct default prediction – Santiago do Cacem and Vila nova de Poiares, therefore the overall predictive likelihood of default would be at the level of 56%.

Table 2: Assessing the default prediction of Portuguese municipal regions

Rank	Municipalities	2015 Financial report 0=NOT DEFAULT 1=YES DEFAULT	% Probability of Default	Classification output after logistic regression (SPSS)
1	Sines	1	99.990%	1
2	Portimao	1	99.961%	1
3	Faro	1	98.893%	1
4	Aveiro	1	95.264%	1
5	Cartaxo	1	94.294%	1
6	Vila Real de Santo Antonio	1	93.226%	1
7	Santa Comba Dao	1	67.058%	1
8	Evora	0	57.011%	1
9	Santarem	0	55.897%	1
10	Porto Santo	0	50.350%	1

5 Conclusions

The aim of our research was to verify whether the economic adjustment program and post-program surveillance contributed positively to the structural recovery of the Portuguese economy. The assessment of the probability of default among the municipal regions in Portugal confirmed the previous findings about the small impact of the implemented programmes. To be more precise, if more than 5% of the largest municipalities are likely to default after the application of economic measures and financial aid, the conclusion is that the whole adjustment programme was not sufficient to recover the economic growth, the financial stability, and the national wealth.

We also conducted an examination on several observations from a sample data collected from Eurostat, comparing the peer economies of Czech Republic, Slovakia, Portugal, and as a benchmark the Euro zone (19 countries). The observation of this comparative data has confirmed that the financial aid package provided to Portugal of €78 billion, along with the austerity measures applied by local governmental had a very small positive impact on the Portuguese economy. This outcome is relevant for the transition peer economies like Czech Republic and Slovakia to provide them with the lessons learned from the Portuguese experience during its international assistance. In conclusion, considering a hypothetic future scenario of a governmental default in Czech Republic or Slovakia, there would have to be applied other than just austerity measures with a financial aid to recover more efficiently their economies. Our recommendation to the international financial institutions (ECB, IMF, EC) supports the inclusion of financial and fiscal stimulus in any future European sovereign economic adjustment programmes.

Acknowledgements

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Fiscal reaction function with fiscal decentralization variable

Milan Jílek*

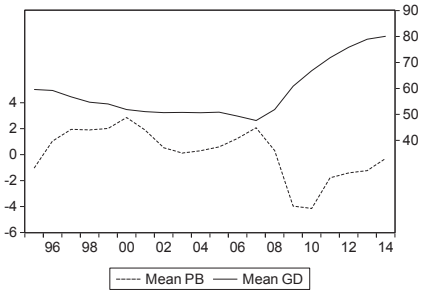
Abstract. The paper deals with the fiscal behavior of EU countries within the period from 1995 to 2014. The responsiveness of general government primary balances and primary expenditure to several variables is analyzed using panel data. The main focus is on the fiscal decentralization effect on the fiscal behavior of general government with the main hypothesis that the lower fiscal decentralization (higher centralization) allows the central government to exert more control over the general government budget and therefore enables it to enforce fiscal sustainability. The results suggest that revenue and tax decentralization might have adverse effects on the responsiveness of general government primary balances, while expenditure decentralization might have a positive effect on the ability of government to adjust general government primary expenditure.

Keywords: fiscal reaction function, primary government balance, primary government expenditure, fiscal decentralization, European Union.
JEL Classification: E62, H62, H72

1 Introduction

Recent developments in European Union countries revealed the importance of public finance sustainability. The already unsatisfactory fiscal performance deteriorated during the crisis years (Figure 1) and, at the same time, governments faced the dilemma between fiscal consolidation and counter-cyclical fiscal stabilization policies. Figure 2 reveals that the governments' primary balances on average reacted to the economic cycle. Indeed, there is a convincing argument to bring general government budgets under control in order to ensure maneuver room in times when there is a need for counter-cyclical expansionary fiscal policy.

Figure 1: Mean values of primary balances (PB) and debt (GD) of general government in sample EU countries (% of GDP)



Source: Authors calculation, Ameco data, Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Luxembourg, Netherlands, Portugal, Slovakia, Slovenia, Spain, Sweden, United Kingdom included.

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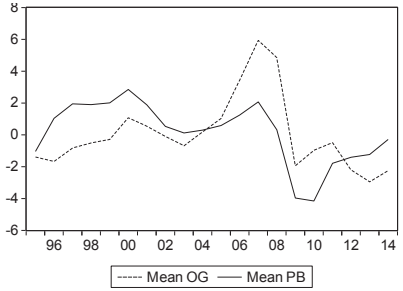
Figure 2: Mean values of primary balances of general government (PB) and output gap (OG) in sample EU countries (%)

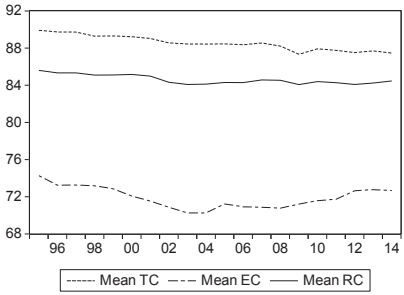


Source: Authors calculation, Ameco data, Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Luxembourg, Netherlands, Portugal, Slovakia, Slovenia, Spain, Sweden, United Kingdom included.

There is an abundant body of literature providing the theoretical background (for example Alesina & Tabellini, 1990; Eslava, 2011) and the empirical knowledge about the patterns of fiscal behavior of governments. The seminal paper of Bohn (1998) shows that in order to reach sustainability of public finances, governments adjust primary balances as a response to government debt. The usual empirically tested baseline scenario includes lagged government debt levels and output gap. These studies frequently provide evidence that governments meet the fiscal sustainability condition. To find a more detailed view of the fiscal behavior, sets of economic, institutional and political variables are employed (Afonso, 2008; Ayuso-i-Casals et al., 2009; Pikhart et al., 2015; Plodt & Reicher, 2015).

The main idea behind linking together fiscal decentralization and fiscal behavior is that there are possible adverse effects of fiscal decentralization on the ability of central government to exercise control over public finances. Oates (1972) declares the traditional normative view that there are allocation efficiency gains from fiscal decentralization on both expenditure and revenue sides of a government budget, whereas there are numerous reasons to keep the stabilization function centralized. The more centralized the public finance is, the easier it might be for central governments to improve primary balances as a response to an increasing general government debt ratio. Figure 3 shows the development of fiscal centralization ratios in 20 EU countries. While the government revenue and taxation, especially, is rather centralized, one quarter of government expenditure on average is decentralized, i.e. out of direct control of central governments.

Figure 3: Mean values of expenditure (EC), revenue (RC) and tax (TC) centralization in sample EU countries (%)



Source: Source: Authors calculation, OECD Fiscal decentralization database, Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Luxembourg, Netherlands, Portugal, Slovakia, Slovenia, Spain, Sweden, United Kingdom included.

Literature analyzing fiscal decentralization as the determinant of government fiscal behavior is much less frequent. Afonso and Hauptmeier (2009) analyze the fiscal behavior in European Union countries for the period prior to the economic crisis within the years 1990-2005. Their results show the impact of government debt, fiscal rules, electoral cycles and the degree of government spending decentralization on primary general government budget balances. Bartolini et al. (2015) offer a different view of the fiscal decentralization effects. Their empirical investigation of 19 OECD countries over the period 1980-2010 showed that expenditure decentralization had improved the central budget balance without prejudice for local budgets, thus improving the overall country's fiscal position. They find this effect to be reinforced when combined with tax autonomy.

The aim of the paper is to find the effect of fiscal decentralization on the fiscal behavior of general government expressed in terms of primary balance and primary expenditure. The paper contributes to the contemporary discussion on whether the recent fiscal decentralization trends in EU countries threaten the sustainability of public finances. This paper uses the most recent Eurostat and OECD data, focuses on EU countries and uses different fiscal decentralization measures.

2 Data and the Model Specification

The data used for the analysis are organized in the balanced panel with a 20 year period (1995 to 2014) and 20 cross sections. The following countries are included in the data panel: Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Luxembourg, Netherlands, Portugal, Slovakia, Slovenia, Spain, Sweden, United Kingdom.

Variables and data sources are specified in the Table 1.

Table 1: Variables specification

Symbol	Specification	Units	Source
PB	Net lending (+) or net borrowing (-) excluding interest: general government : ESA 2010	Percentage of GDP at current prices	AMECO
PE	Total expenditure excluding interest: general government : ESA 2010	Percentage of GDP at current prices	AMECO
OG	Gap between actual and trend gross domestic product at 2010 reference levels	Percentage of trend gross domestic product at constant prices	AMECO
GD	General government consolidated gross debt (based on ESA 2010)	Percentage of GDP at current prices	AMECO
EY	Election year	Dummy, 1 in the year of parliamentary elections, 0 otherwise.	European Election Database, Norwegian Social Science Data Services (NSD).
TC	Central gov. tax revenue	Percentage of total general government tax revenue	OECD Fiscal decentralization database
EC	Central government expenditure	Percentage of total GG cons. expenditure	OECD Fiscal decentralization database
RC	Central government revenue	Percentage of total GG cons. revenue	OECD Fiscal decentralization database

The model is generally following the specification used by Bohn (1998) and later by Afonso and Hauptmeier (2009). The difference compared to Afonso and Hauptmeier (apart from the different data panel and estimation procedure) is a narrower focus and the use of different fiscal indicators of fiscal decentralization. The fiscal decentralization is measured indirectly, expressing fiscal centralization instead, which is the approach used by Cerniglia (2003).

$$Y_{it} = \alpha_i + \beta Y_{i,t-1} + \gamma GD_{i,t-1} + \eta OG_{i,t} + \varepsilon_{i,t}, \quad (1)$$

$$Y_{it} = \alpha_i + \beta Y_{i,t-1} + \gamma GD_{i,t-1} + \eta OG_{i,t} + \iota EY_{i,t+1} + \varepsilon_{i,t}, \quad (2)$$

$$Y_{it} = \alpha_i + \beta Y_{i,t-1} + \gamma GD_{i,t-1} + \eta OG_{i,t} + \iota EY_{i,t+1} + \emptyset X_{i,t} + \varepsilon_{i,t}, \quad (3)$$

where X … fiscal centralization variables
Y … dependent fiscal variable
$\varepsilon_{i,t}$ … error term
i … country
t … year

The model is estimated in several specifications. The baseline specification (1) includes lagged dependent variable, either primary balance (PB) or primary expenditure (PE), lagged debt (GD) and output gap (OG). Later, the model (2) is extended by including an election year (EY) dummy variable. Since the aim of the paper lays in the fiscal decentralization explanatory variable, the expenditure, revenue and tax centralization are included in model (3). The overview of expected coefficients is shown in the Table 2.

Table 2: Summary of hypothesis

Explanatory variable	**Primary balance of general government (PB)**	**Primary expenditure of general government (PE)**
GD_{t-1}	$\gamma>0$ reflects that government respects inter-temporary budget constraint	$\gamma<0$ reflects that government respects inter-temporary budget constraint
OG	$\eta>0$ reflects counter-cyclical behavior	$\eta<0$ reflects counter-cyclical behavior
EY_{t+1}	$\iota<0$ reflects political budget cycle	$\iota>0$ reflects political budget cycle
EC	$\varphi>0$ reflects positive effect of fiscal centralization (negative one for fiscal decentralization) on the primary balance response	$\varphi<0$ reflects negative effect of fiscal centralization (positive one for fiscal decentralization) on the primary expenditure response
RC	$\varphi>0$ reflects positive effect of fiscal centralization (negative one for fiscal decentralization) on the primary balance response	-
TC	$\varphi>0$ reflects positive effect of fiscal centralization (negative one for fiscal decentralization) on the primary balance response	-

The two-step panel Generalized Method of Moments (GMM) estimator is used in order to correct for endogeneity of regressors and country-specific heterogeneity (Arellano & Bover, 1995; Blundell & Bond, 1998). The two-step estimation uses first differences transformation and one lag with robust standard errors consistent to panel specific heteroscedasticity and auto-correlation. The auto-correlation is tested using Arellano-Bond serial correlation test. The AR(1) and AR(2) statistics report the p-values for the first and second order residual auto-correlation in the first differenced equation, providing no evidence for significant second order auto-correlation. J-test for over-identifying restrictions provides the probability value for H0 of joint validity of the instruments. Higher probability value suggests that the instruments are exogenous and not correlated with the error term.

3 Results

The estimation outputs are summarized in Tables 3 and 4. Table 3 provides fiscal reaction function for general government primary balances in different scenarios. Table 4 shows coefficient estimations for general government primary expenditure. Estimated coefficients generally confirmed the coefficient sign and size for lagged government debt, output gap and pre-election year reported in previous studies (Afonso, 2008; Afonso & Hauptmeier, 2009; Plodt & Reicher, 2015).

The size of coefficient of lagged debt varies between 0.05 and 0.09 at the extremes for primary balances, being close to 0.08 in most cases. For primary expenditure the size of the lagged debt coefficient is between minus 0.04 and minus 0.05. This confirms that governments respect the inter-temporary budget constraint, approaching to the fiscal adjustment in reaction to changes in general government debt ratio. Governments also reflect the economic cycle, the coefficients of the output gap vary between 0.25 and 0.36 and for primary balances minus 0.28 and minus 0.35 for primary expenditure. The political budget cycles seem to be strong as the coefficient for primary

balances and primary expenditure is lower than minus 0.7. Governments, as expected, lower their primary balances and increase primary expenditure prior to elections.

The fiscal centralization ratios showed expected signs in most cases, with the exception of expenditure centralization ratio, where the coefficients for primary balances were not statistically significant and the coefficients for primary expenditure reaction function were statistically significant with the opposite sign. Interestingly, the coefficients of expenditure centralization (0.09 and 0.10) were statistically significant for the primary expenditure reaction function, whereas the revenue centralization (0.34) and tax centralization (0.94) were statistically significant in two specifications of primary balance reactions function.

Table 3: Fiscal reaction function – primary balances

	Base1	**(1)**	**(2)**	**(3)**	**Base2**	**(4)**	**(5)**	**(6)**
GD(-1)	0.075*** (0.005)	0.077*** (0.010)	0.065*** (0.008)	0.046*** (0.013)	0.070*** (0,009)	0.071*** 0.010	0.097*** (0.019)	0.086*** (0.027)
OG	0.281*** (0.016)	0.295*** (0.043)	0.299*** (0.023)	0.262*** (0.029)	0.268*** (0.027)	0.253*** 0.040	0.356*** (0.069)	0.319*** (0.083)
EY(1)					-0.714*** (0.039)	-0.674*** (0.056)	-0.885*** (0.156)	-1.047*** (0.298)
EC		-0.012 (0.056)				-0.057 (0.065)		
RC			**0.342*** (0.069)**				0.266 (0.221)	
TC				**0.936*** (0.334)**				0.953 (0.680)
PB(-1)	0.567*** (0.014)	0.594*** (0.046)	0.514*** (0.027)	0.407*** (0.051)	0.596*** (0.025)	0.586*** (0.041)	0.561*** (0.044)	0.420*** (0.057)
n	360	360	360	340	340	340	340	340
J-stat p-value	0.383	0.396	0.582	0.643	0.457	0.348	0.640	0.734
AR(1)	0.055	0.108	0.365	0.000	0.068	0.073	0.075	0.038
AR(2)	0.892	0.914	0.981	0.865	0.842	0.757	0.838	0.657

P-value: *** p<0.01, ** p<0.05, * p<0.1. Robust standard errors reported bellow coefficients.
Source: author calculations

Table 4: Fiscal reaction function – primary expenditure

	Base3	**(14)**	**Base4**	**(15)**
GD(-1)	-0.047*** (0.005)	-0.054*** (0.006)	-0.041*** (0.004)	-0.046*** (0.006)
OG	-0.325*** (0.024)	-0.309*** (0.026)	-0.287*** (0,030)	-0.282*** (0.030)
EY(1)			0.774*** (0.065)	0.707*** (0.063)
EC		**0.102*** (0.026)**		**0.086* (0.045)**
PE(-1)	0.546*** (0.014)	0.540*** (0.029)	0.589*** (0.030)	0.569*** (0.035)
n	360	360	340	340
J-stat p-value	0.319	0.314	0.381	0.295
AR(1)	0.081	0.084	0.110	0.123
AR(2)	0.910	0.976	0.973	0.912

P-value: *** p<0.01, ** p<0.05, * p<0.1. Robust standard errors reported bellow coefficients.
Source: author calculations

4 Conclusions

The hypothesis that general government balances react positively to the government debt, i.e. $\gamma>0$, should not be rejected, because the size of the estimated coefficient is higher than zero and statistically significant. Similarly, the hypothesis of coefficient $\gamma<0$ in the primary expenditure reaction function should not be rejected. EU countries increase their general government primary balances and decrease their primary expenditure in response to the increase of general government debt ratio. With the statistically significant higher than zero coefficient, the

hypothesis of counter-cyclical behaviour of primary balances, i.e. $\eta>0$ should not be rejected. Consistently, also the primary expenditure show counter-cyclical behaviour with statistically significant coefficient $\eta<0$. Furthermore, there seems to be a political budget cycle since the hypothesis of the coefficient $\iota<0$ in the primary balance reaction function as well as the coefficient $\iota>0$ in the primary expenditure reaction function was not rejected as well.

As far as the main aim of the paper is concerned, i.e. to find the effect of fiscal decentralization on the fiscal behavior of general government expressed in terms of a primary balance and primary expenditure, the results support the hypothesis that the revenue and tax decentralization might have adverse effects on general government primary balances, while the expenditure decentralization might have a positive effect on the ability of general government to reduce primary expenditure.

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Administrative burden of procurement under the new Public Procurement Act

Radek Jurčík*

Abstract. Experience shows that excessive administrative complexity of the process (in this case, public procurement) ignores the purpose of this process and leads to an emphasis on the formality of the process itself and in extreme cases up to the collapse of the system. Bring less formality procurement for contracting authorities was one of the purposes of the adoption of new directives on public procurement. These guidelines go against the policy of the Czech Republic in the field of public procurement within the framework of the so-called. Transparent amendment essentially formalized procurement system from 1. 4. 2012. Analysis of the administrative requirements of the procurement process, according to the Law no. 137/20016 Coll. on public procurement, and the new law on public procurement approved by the Chamber of Deputies is the subject of this article. The author focuses on time-consuming procurement and other relevant aspects.

Keywords: new procurement law, procurement directives, the Czech Republic, administrative burden, duration of procurement process.
JEL Classification: H57

1 Introduction

Awarding public procurement is the process leading to the conclusion of the contract. This process is regulated by Act no. 137/2006 Coll., On Public Procurement, as amended. At the same time in April 2016 (or later) will come into effect a new law on public procurement, which implements the new procurement directives. It is a Directive of the European Parliament and Council Directive 2014/24 / EU of 26 February 2014 on public procurement and repealing Directive 2004/18 / EC Directive of the European Parliament and Council Directive 2014/25 / EU of 26 February 2014 on the procurement entities operating in the water, energy, transport and postal services and repealing Directive 2004/17 / EC Directive of the European Parliament and Council Directive 2014/23 / EU of 26 February 2014 on the granting of concessions. One of the main reasons for adopting new procurement directives is decrease administrative burdens for contracting authorities. For example according article 84 Directive no. 2004/17/EC many economic operators, and not least SMEs, find that a major obstacle to their participation in public procurement consists in administrative burdens deriving from the need to produce a substantial number of certificates or other documents related to exclusion and selection criteria. Limiting such requirements, for example through use of a European Single Procurement Document (ESPD) consisting of an updated self-declaration, could result in considerable simplification for the benefit of both contracting authorities and economic operators.

The main aim of public procurement is arrange goods, services and works mainly for public bodies by equal, non-discriminatory and transparent and effectiveness way (Ochrana, Maytová, 2012, Pavel, Sicakova-Beblava, 2013, Jurčík, 2015, Nemec, Sumpikova, Klazar et al., 2014). This procurement procedure should be with a reasonable degree of formalism and operational and administrative burden on the part of the procurement authorities (Ochrana, 2010).

The main aim of the article is to analyze the public procurement procedures from point of view selected administrative requirement according to present Public Procurement Law and new Law which was passed by the Czech Chamber of Deputies and which should be valid form April, 18th, 2016 and is based on new European directives (European Commission, 2014). Procurement law and legal regulation have more aspects (Finardi, Vancurova, 2014, Jurčík, 2013, Kubicek, Vitek, 2010, Kubatova, Piatkova, 2014) and should be ensure economic competition (Jurčík, 2015).

According to the explanatory memorandum to the Act no. 55/2012 Coll. (Czech Government, 2012) should bring the introduction of the use of prior notification and reason the public contract to the state budget 5 billion Czech crowns per year. According to the explanatory memorandum to the new law on public procurement (Czech Government, 2015) are mentioned institutes administrative burden burdensome contracting authority. For this reason, the article also aim to assess whether the application of these institutes brings the administrative burden for the sponsor or not. Furthermore, what it costs with the use of these institutes together.

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2 Formalism in the present public procurement law

In law no. 137/2006 Coll., on public contracts (PPL), we have two institutes which are last relict of so-called transparent amendment accepted with great media coverage. The first one is above framework of procurement directives prior notification of the contracting authority. The second one is reason public contract. According to § 86 PPL the contracting authority shall publish in the form of a pre-notification above the threshold and below threshold procurement. The contracting authority is entitled to call for tenders soon as one month after sending the notification. The pre-announcement is justification effectiveness of public procurement. Details reasoning of the implementing legislation. The provisions for prior notification shall not apply

- contracts awarded in a simplified sub-limit procedure
- to public contracts awarded in negotiated procedure with publication according to § 22 paragraph. 1 and 2,
- to public contracts awarded in negotiated procedure without publication pursuant to § 23 para. 1, § 23 para. 4 point. b) § 23 para. 5 point. c) to e), § 23 para. 6-9, § 23 para. 10 point. a) and c) or § 23 para. 11 and

According to § 156 PPL (Reason Public Procurement) the contracting authority above the threshold and below threshold procurement and publish on the contracting entity profile reasoning

- the effectiveness of public procurement,
- the adequacy of the requirements for technical qualifications,
- definition of business and technical conditions of public procurement in relation to the needs of the contracting authority,
- determination of basic and partial evaluation criteria and method of evaluation of bids in relation to the needs of the contracting authority.

The contracting authority shall publish a justification to 3 working days of publication of the notice of initiation of the procurement procedure or after sending the notice of initiation of the procurement procedure. The contracting authority submit the reasons for public contracts for major public contracts, together with the reasons for establishing the estimated value of a public contract to government approval. The condition discuss the justification of the government's submission opponent's expert opinion. Elaboration of expression provided by the ministry. Government approval is a prerequisite for the commencement of the tender procedure. The contracting authority pursuant to § 2 para. 2 point. c) submit the reasons for major public contracts for approval by the council. Assembly approval is a prerequisite for the commencement of the tender procedure. The provisions concerning Reason Public Contracts shall not apply

- contracts awarded in a simplified sub-limit procedure
- to public contracts awarded in negotiated procedure with publication according to § 22 paragraph. 1 and 2
- to public contracts awarded in negotiated procedure without publication pursuant to § 23 para. 1, § 23 para. 4 point. b) § 23 para. 5 point. c) to e) and § 23 para. 6-9, § 23 para. 10 point. a) and c), § 23, paragraph 11. (7) The contracting authority shall proceed using a design contest under paragraphs 1 to 5 apply.

3 Contracting costs associated with formal institutions (prior notification of the reason public contract)

According to explanatory memorandum to ht PPL publication of prior notification in Information system on Public Contracts (ISVZ), if they will all purchasers in ISVZ publish electronically (as in most cases), the proposed measure is a burden to 4.3 miles. CZK when considering the volume of 8900 contracts annually, 4.8 mil. CZK at the intended increase in orders due to a lower limit for the procedure in a simplified sub-limit procedure. Costs for publishing simplified sub-limit procedure depends on whether the sponsor has its own profile sponsor or procures these services externally. The proposed measures will cost in the millions. Costs for publishing in ISVZ can be estimated in the amount of CZK 5 mil. The cost of publication Reason of Publication of the profiles of contracting authorities can be estimated at the same amount. Costs caused by prolongation of the tender procedure cannot be estimated, this measure will sponsor a more thorough timing of tenders. The cost of completing the preamble to the effectiveness of public procurement will return in the form of increased public scrutiny. Costs caused by this measure outweigh the savings made up of competitive bids and practicality orders.

The contracting authority may commence a tender procedure only 1 month after sending the notification. Measures monitors strengthening the transparency of the award procedure. Part of the pre-announcement is also the justification effectiveness of public procurement.

Legislator hypothesized in the explanatory memorandum in the case of the adoption of legislative measures and the implementation of non-legislative measures, without taking into account the cost of such measures is estimated by the petitioner scope for an annual saving of public funds amounting to about 15% of the procurement

volume, ie. 87 billion. CZK. This saving can be broken down into individual savings associated with the use of central purchases (up to CZK 40 billion.), Filling strategy computerization (up to 45 bn. CZK), to decrease the threshold for public procurement of small scale (up to 5 billion. CZK) and the implementation legislative measures connected with them.

Individual examples assignment showed that the expected savings to be achieved, and therefore the new law on public procurement with the above institutes count. The following Table shows the additional costs that were associated with these institutes, which in practice proved too formal and purposeless.

Table 1: Number of procurement procedures and number of compulsory prior notification and reason of public contract

Procedure	Open	Limited	Negotiated with advertisement	Competitive dialog	Number of prior notification	Number of reason public contract
2012 (from 1.4.)	2765	134	102	5	3006	3006
2013	6906	442	254	17	7619	7619
2014	7970	447	267	4	8688	8688
2015	6587	280	257	7	7131	7131
2016 (to 31.3.)	1973	109	68	3	2153	2153
Sum	26201	1412	948	36	28597	28597

Source: ISVZ (2016), own calculation

Table 1 shows that the total number of procurement procedures, where applicable, the Act establishes the obligation to apply that notice was in the period from April 1, 2012, when it was the obligation to apply the prior notification and justification of public contracts enshrined in the law on the basis of a transparent amendment No. . 55/2012 Coll., March 31, 2016 to a total 28,597th It was mostly open procedure, restricted procedure, negotiated procedure with publication and competitive dialogue. In some cases, the use of the negotiated procedure with publication, negotiated procedure without publication in its entirety and the simplified procedure under-duty use prior notification and justification of public procurement was not, therefore, the author did not include her.

Costs related to the execution of prior notification and justification of the public contract contains Table 3.

Table 2: Time expenses on fulfilment of prior notification and reason public contract

Number of prior notification	Time consuming (working hours)	Number of reason public contract	Time consuming (working hours)
Fulfilment of form	5	Fulfilment of reasons in relation to	10
approval and signature and advertisement	5	approval and signature and advertisement	10
Sum	10		20

Source: own calculation

Table 2 by quantifying time costs per employee related to the execution of prior notification and justification of public contracts. For copies of the preliminary announcement I of author's own experience that few a dozen of them filled, or check shows that the overall process of its approval takes 10 hours on a single contract, justification for public contracts 20 hours on a public contract. These costs are calculated in the following Table 3.

Table 3: Expenses on fulfilment of prior notice and

Procedure	Number of prior notification	Time expenses (1 hour per 200 CZK)	Number of reason public contract	Time expenses (1 hour per 200 CZK)
2012	3006	6,012 mil. CZK	3006	12,024 mil. CZK
2013	7619	15,238 mil. CZK	7619	30,476 mil. CZK
2014	8688	17,376mil. CZK	8688	34,752 mil. CZK
2015	7131	14,262 mil. CZK	7131	28,524 mil. CZK
2016	2153	4,306 mil. CZK	2153	8,612 mil. CZK
Sum	28597	57,194 mil. CZK	28597	114,388 mil. CZK

Source: own calculation, MPSV

Table no. 3 shows that the total estimated costs based on the compilation and publication of notice and justification of the public contract is for the period from 1 April 2012 to 31 March 2016 Total 171 528 000, - CZK not including the costs of publication in the Bulletin of public procurement which were enumerated in the explanatory memorandum to approximately 5 mil. CZK annually.

For devices that will be able to use public administration needier things. Table no. 4 shows that these institutes SVU purpose unfulfilled.

Table 4: Examples of reason effectiveness

Registration number of public contracts	Selected public contract more than 1 billion prize, selected versions of Reason public contract (part Reason effectiveness of public procurement - a description of needs).
629970	Achieving savings by contracting the performance of the framework contract using the institute centralized procurement. Subject of public procurement - subject of public procurement is the acquisition and renewal of licenses for Oracle for the client. Contracting authority for public authorities and organizations established by them, which conclude with the central authority (Ministry of Interior) Agreement on centralized procurement. Description of the relationship between the subject contract and the client's needs - Public contract completely covers the defined target, since it ensures the coordinated procurement of licenses for Oracle for public authorities and ensures optimum economic profitability of the acquired licenses and access to the latest versions of Oracle software products. Expected date of concluding a framework agreement is June 2016. The contract will be concluded for four years.
630373	Achieving savings by contracting the performance of the framework contract using the institute centralized procurement. The subject of public procurement is the acquisition and renewal of licenses for Cisco products for the client. Contracting authority for public authorities and organizations established by them, which conclude with the central authority (Ministry of Interior) Agreement on centralized procurement. A public contract fully covers the defined target, since it ensures the coordinated procurement of licenses for Cisco products for public authorities and ensures optimum economic profitability of the acquired licenses and access to the latest versions of software products, Cisco. Expected date of concluding a framework agreement in May 2016. The contract will be concluded for four years.
631154	Reason effectiveness of public procurement: a) rebuilding the road width arrangement will meet the need to improve the flow and safety of traffic in the region, reduce accidents and noise and emission load. b) The contract is an extension of the I / 48, for more information see section II.4)

631155	Reason effectiveness of public procurement: a) construction of bypasses of Frydek-Mistek will fulfill the needs and plynolosti improve transport safety in the region, reduce accidents and noise and emission load. b) The contract is the construction of a bypass of Frydek-Mistek, more see section II.4)
631709	In accordance with Art. §86 par. 2 Act no. 137/2006 Coll., On Public Procurement, as amended (the "Act"), as part of the pre-announcement Authority submits the justification effectiveness of public procurement: a) A description needs to be the fulfillment of public contracts achieved: ensuring VZ-making will fulfill the needs and improve the flow of traffic safety in the region, reduce accidents and reduce noise and emission load in residential pledge to which it relates VZ b) Description of the public contract subject of the contract is complete, collision-free connections and D8 I / 7 Slaného bypass and adjacent communities c) A description of the relationship between the subject contract and the needs of the contracting authority: VZ implementation fully meet the needs of the contracting entity security-related construction and modernization of motorways and main roads, which is the subject VZ d) the envisaged deadline for fulfilling the public contract is 37 months from the start, depending on the course of the procurement procedure

Source: own calculation, VVZ (2016).

Table 4 contained examples of 5 reason effectiveness, to be entered into as a prior notification and reason public contract. The author chose the first form 17 public contracts in which they were used mentioned institutes in period 1.1.2016 do 31.3.2016. Each of the contracts exceeded the value of CZK 1 billion. From the wording contained in the Table shows that instead of economic benefit and transparent justification of coherence, it was a description of a formalist who did not benefit, but the administrative burden for the contracting authority.

4 Conclusions

Applications and use of prior notification and reason public contracts have not explanatory memorandum anticipated savings and conversely revealed that the administrative burden lengthening the duration of the award procedure. From the above analysis shows that contracting authorities treated the institute of prior notification and reason public contract more as a formality without its originally anticipated individual economic reasoning-cation. From Table 1 - 4 we can conclude that the using of these institutes are not cultivated awarding of public contract. At the same time, these institutes require higher administrative costs, as described in Tables no. 1 to 3. From all of these reasons, I believe that the legislature chose correctly when these institutes in the new draft law on public procurement in 2016 abolished. Author same time disregards the fact that after they have been published prior notification, followed by up to 1 month contracting authority was entitled to launch a procurement procedure. This time aspect delays in the procurement procedure was not the subject of this article.

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Characteristics of aging population in Europe and Israel, their health care utilization and prevalence of supplementary health insurance.

David Kosák*

Abstract. Aging of population in developed countries transforms current societies and impacts various sectors, including health care. Gap between life expectancy and health life expectancy is considerable in many countries. Understanding the key aspects of aging and developing proper health policy is essential to address the possible future challenges. The Survey of Health, Ageing and Retirement in Europe (SHARE) provides unique opportunity to explore in more detail behavior and habits of the elderly population. This study analyzes the sample (n=65 269) demographics as well as health care utilization across the countries. Positive relationship between age and health care utilization was found. The study also provides insight about prevalence of supplementary health insurance by respondents' country of residence with highest share in countries with considerable deductibles.
Keywords: SHARE project, aging, health care, utilization
JEL Classification: I140

1 Introduction

The old continent is truly standing up to its name as the ongoing demographic shift translates into aging of the European population. Multiple reasons that are behind this transition are also significantly affecting various aspects of our society. One of the most sensitive sectors to such change is the health care sector. In developed countries the health care expenditures are on rise and among the main reasons is the aforementioned population aging (European Commission, 2015). Relevance of this phenomenon is especially augmented given the accumulation of health care expenses at the end of life (Alemayehu et al., 2014).

Life expectancy at birth has been increasing over the years in all developed countries. Nevertheless, this indicator alone can be misleading as it does not reflect the quality of life nor the length of life lived in good health. For many countries in Europe, the difference between life expectancy and healthy life expectancy can be as much as 10 years as it is for instance in the United Kingdom (WHO, 2012). In Grossman's concept of health capital and the demand for health, health is considered a stock of capital of individual which ultimately produces healthy time (Grossman, 1972). The stock of health can be increased with an investment in health; however on the other hand it also depreciates over time. Increase of employment opportunities and higher productivity are one of the reasons to invest in health. In the same time, there are many determinants that affect health such as income or education. Despite the discovered relationships between health and production of health, the elderly cohort is likely to differentiate, given their vastly different characteristics such as use of their productive and free time as well as resources. Hence, it is essential to critically assess the major influencers and develop strategy as well as policies to enable healthy aging and utilization of high life expectancy.

The Survey of Health, Ageing and Retirement in Europe (SHARE) is a unique project that aims to provide researchers and governments with data on socio-economic status, social and family networks as well as on health of surveyed individuals. This multidisciplinary and cross national panel database of micro data has collected data from more than 120,000 individuals aged 50+ from 20 countries in Europe and Israel. The health section provides impressive insight into the behavior of the aging European society and their health-related habits. This analysis takes a broader look at the sample characteristics and aims to provide preliminary thoughts on the relationship of age and healthcare utilization in the SHARE sample. Furthermore, information on variation in supplementary insurance participation among elderly Europeans is provided.

2 Methods

The data from SHARE project (Börsch-Supan, 2015) were collected in five waves and pool of participating countries has increased over time considerably as some countries joined the study later. The dataset is very complex and consist of different questionnaire modules with information, among other things, on demographics, physical health (e.g. self-rated health), behavioral risks (e.g. smoking and alcohol consumption), mental health (e.g. depression) and health care utilization. Different modules on individual level were merged using the key person identifier identical across the waves and modules. Furthermore, new modules were introduced into Wave 2, 4 and 5 examining areas such as the respondents' childhood health or computer and internet skills. The dataset

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also provides information about the respondents family and household. Data collection was carried out using computer-based personal interviewing mechanism where face-to-face interview is conducted. For several countries, drop-off questionnaire using pencil and paper was introduced as an alternative. This study focused exclusively on Wave 5, which was carried out in 2013 in 14 European countries and in Israel.

The target population are people aged 50 years and over and who regularly reside in the respective SHARE country. To deal with sample attrition problem, calibrated weights are introduced into the dataset. For missing data, SHARE uses method of multiple imputations. For further details regarding the collection and statistical methodology, we refer the reader to SHARE project website.

Statistical analysis was done using IBM SPSS version 24. Significance of correlation between variables was tested at 0.01 level (2-tailed) and Pearson product-moment correlation coefficient was calculated. Partial correlations were tested while controlling for age and gender of the respondents. For comparison of means among different groups, ANOVA was used.

3 Results

In terms of access to health care, 95,1% of respondents did not find a problem consulting a general practitioner (GP) due to costs and for 93,2% of respondents long waiting times were not the barrier to consult their GP. Access to health care is one of the key determinants for effective utilization of health care services and thus good health, which is especially true for the elderly. Table 1 provides selected descriptive statistics of the sample analyzed in this study.

Table 1: Sample characteristics

Variable	Sample size, n= 65 269	Missing values, n (%)
Age, mean (SD)	66,86 (16,8)	12 (0,1)
Male, n (%)	28 539 (44,1)	12 (0,1)
Height, mean (SD)	166,5 (19,35)	454 (0,6)
Weight, mean (SD)	75,2 (17,21)	522 (0,7)
Self-rated health, n (%)		160 (0,2)
Excellent	5 414 (8,3)	
Very good	11 501 (17,6)	
Good	23 778 (36,4)	
Fair	17 440 (26,7)	
Poor	6 966 (10,7)	
Limited for 6 months in normal activities due to health problems, n (%)		152 (0,2)
Severely limited	10 243 (15,7)	
Limited, but not severely	19 185 (29,4)	
Not limited	35 684 (54,7)	
Alcohol consumption, n (%)		159 (0,2)
Daily	(17,1)	
5-6 times a week	(2,9)	
1-4 times a week	(26)	
1-2 times a month	(21,6)	
Not at all in past 3 months	(32,1)	
Smoke at present time, n (%)	11 563 (17,7)	12 648 (19,4)
Health problems that limit work, n (%)	11 652 (17,8)	13 326 (20,4)
Depression last month, n (%)	25 269 (38,7)	521 (0,8)
Job situation, n (%)		1 566 (2,4)
Retired	36 094 (55,3)	
Employed or self employed	18 205 (27,9)	
Homemaker	5 191 (8)	
Permanently disabled	2 292 (3,5)	
Unemployed	1 878 (2,9)	
Old age pension, n (%)	(61,1)	17 623 (27)
Seen medical doctor in past 12 months, n (%)	56 771 (87,0)	549 (0,8)
Hospitalized in past 12 months, n (%)	10 075 (15,4)	201 (0,3)
Paid for doctor visits, n (%)	25 201 (38,6)	8 021 (12,3)
Paid for medication, n (%)	43 245 (66,2)	255 (0,4)
Deductible in basic health insurance, n (%)	14 124 (21,6)	601 (0,9)
Supplementary health insurance, n (%)	25 633(39,3)	339 (0,5)
Receive help from others in last 12 months, n (%)	9 184 (14,1)	20 648 (31,7)
Given help to others in last 12 months, n (%)	12 867(19,7)	20 705 (31,7)

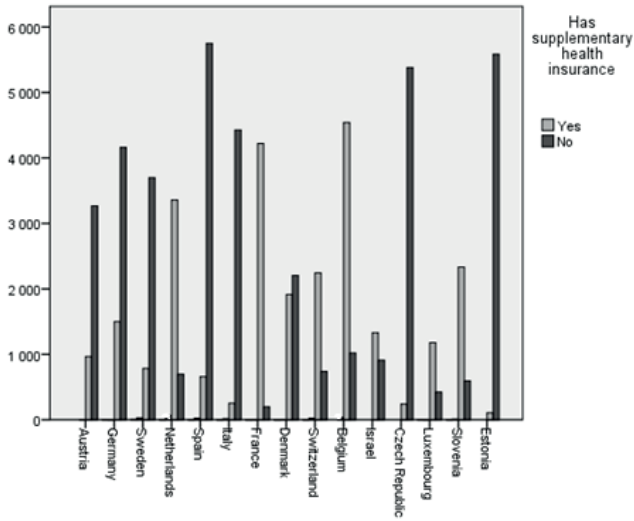
Source: SHARE Data – Wave 5.

Apart from general sample characteristics, Table 1 provides information of health care utilization and health-related factors such as alcohol consumption or prevalence of depression. Majority of respondents have visited medical doctor in past 12 months. There are multiple covariates for predicting health care utilization and as proven by Geitona (Geitona et al., 2007), age is among the strongest predictors. It is not different in our sample as there was significant positive correlation ($p<0,01$) between health care utilization and age. The mean number of visits for the sample was 6,84 (SD 9,87) times per annum. Nevertheless, there are significant differences among countries with highest mean in Germany of 9,04 (SD 12,49), whereas in Sweden the annual mean number of visits was considerably lower with 3,77 (SD 7,37). The results are consistent with statistics from Eurostat. Nevertheless, regarding the accuracy, recall bias should be taken into account.

Examining the trends in hospitalization over the past twelve months, 15,4% of respondents have been hospitalized and this has occurred on average 1,72 times (SD 1,58). Furthermore, vast majority (97%) of respondents have not been hospitalized in any other care institution. Similarly, the respondents declared that they have not received any professional help at home such as meals on wheels or help with personal care and domestic tasks. Yet more than 14% of respondents were receivers of informal care and nearly 1/5 identified themselves as informal care givers.

Aversion against risk is connected with risk minimizing behavior and often results in setting up some form of insurance. Although health sector differs from other areas given the presence of social health insurance in most developed countries, there are several countries where market for supplementary health insurance has developed. The prevalence of supplementary health insurance among the respondents can be seen in graph 1 below. Nearly 40% of respondents across the participating countries have supplementary health insurance. It is important to stress out that there are significant differences among countries, as for instance, in France more 95% of respondents have supplementary health insurance whereas in the Czech Republic or Estonia it is below 5% of respondents.

Figure 1: **Prevalence of supplementary health insurance**



Source: SHARE Data – Wave 5.

4 Discussion

This study has confirmed a strong relationship between age and health care utilization on a large sample of elderly population across 15 countries with different health care systems. As the groups within countries share similar characteristics, presumably the variation among countries could be attributed to specifics of the country's health care system and potentially to cultural differences. In this matter further research is needed to identify all the significant factors. For example, use of informal care in our sample was surprisingly low, except in the Czech Republic and Estonia. This reflects the fact that both countries share insufficient available capacity for long-term care and are among the lowest spenders on long-term care among OECD countries (OECD, 2013). Furthermore, informal care also reflects the cultural differences as well as priorities of the government on means of providing

care. In case of the Czech Republic, results of Eurobarometer survey show that informal care within the family is believed to be the best way to provide care to the elderly (Sowa, 2010). In the same time informal care is supported by the allowances from the government towards the informal care givers (OECD, 2011).

According to the current predictions, share of population aged 65+ will significantly increase and can represent as much as 28% of overall population by 2060 in the European Union (European Commission, 2015). The similar trend can be observed in most European countries. Therefore, given the strong link between age and health care utilization, considerable impact on public health care budget as well as potential increase of private spending can be expected. Full understanding of trends and patters in health care utilization among elderly is critical to develop proper policies to counteract aforementioned demographic transition.

Equally important is to explore equality of health within subgroups. For many elderly, old-age pension is the main, and often only, source of income. There are numerous differences among health care systems in European countries. Common for all is the existence of social health insurance and thus universal access to health care for all citizens. Nevertheless, all health care systems are financed from both public and private sources (Jacobs et al., 2011). The aversion against risk has led to development of secondary health insurance in multiple countries where deductibles were introduced. Needless to say that secondary insurance is based on market principles and does reflect the risk profile of the insured party. In the context of rising health risks with age, this can pose a significant threat to access to health care for the elderly population. Primary and secondary insurance also significantly increases moral hazard and counteract the effect of a deductible (Pauly, 1974).

5 Conclusion

The topic of aging society and its impact onto health care systems is more relevant than ever as governments seek to contain health care costs at accepTable levels. The positive relationship between health care utilization and age found in this study suggests a future challenge for health care budgets. Furthermore, accessibility to health care was not reported as an issue among the respondents; however rising prevalence of supplementary health insurance due to higher deductibles can limit accessibility for the lower socioeconomic groups. Without thorough understanding of the major influencers, it is unlikely the governments succeed and will not be forced to considerably ration health care services.

This study aimed to map the demographics of the sample in Wave 5 of the SHARE project and provide preliminary results for further analysis of health care utilization patterns among elderly in European countries.

The broad approach of this study yielded valuable insights for future work with the database; however more-in-depth statistical analysis is needed to provide sound results that can be interpreted on a large scale.

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Application of α-STable Distribution on Czech Financial Market

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Abstract. In this paper it is examined the most appropriate probabilistic distribution that approximates log-return of Czech PX stock index on daily data. It turned out that the normal distribution is not appropriate , it was rejected by the Kolmogorov-Smirnov and Anderson-Darling test. Student t-distribution passed KS the test but it was refused by AD test. STable distribution (with tail index α=1.81) get by both tests, and emerges as the best approximation (of the considered distributions) of empirical distribution PX index

Keywords: sTable distribution, α-parameter, fat tails, quantile methods.
JEL Classification: G10, G120

1 Introduction

It appears that the tails of the empirical distributions of returns of financial assets tend to be thicker than the normal ones, which in turn has implications in the management of financial risks: the probability of the loss is much higher than in a normal distribution.

The α-sTable distribution can be a useful tool that replaces the normal distribution, since it allows to model variable power tails. In addition, according to the Generalized Central Limit Theorem these distributions may be the standardized limit of the sum of independent identical distributed random variables (with the same tail index).

In this paper we analyze the log-returns of Czech stock index PX on daily data. The first parts give a definition of the α-sTable distribution and its basic properties. In the next sections a MLE method is applied and to estimate the alpha and beta parameters.

2 Definition of sTable distribution

Let $X, X_1, X_2, X_3, \ldots, X_n$, i.i.d. A random variable X is said to have the α-sTable distributions if there is for any $n \geq 2$ a positive number c_n and a real number d_n such that

$$X_1 + X_2 + \cdots + X_n \overset{d}{=} c_n X + d_n \quad .$$

Thus, any sum of independent equally distributed random variables have the same distribution except for the „mean" and „variance". Unfortunately there is no general form of the probability density function (pdf), we know only the general form of the characteristic function:

$$\Phi(t) = \exp\left\{-\sigma^\alpha |t|\left(1 - i\beta \operatorname{sgn}(t) \tan\frac{\pi\alpha}{2}\right) + i\mu t\right\} \quad for \ \alpha \neq 1$$

$$\Phi(t) = \exp\left\{-\sigma^\alpha |t|\left(1 - i\beta \frac{2}{\pi} \operatorname{sgn}(t) \log|t|\right) + i\mu t\right\} \quad for \ \alpha = 1 \qquad (1)$$

where

α …tail power (tail index), as α decreases tail thickness increases

β…skewness parameter, determines asymetry, a positive β indicates that right tail is father than left one and vice versa, β=0 corresponding to a symetric distribution

μ…location parameter, corresponding to mean value for α>0

σ…scale parameter, generalized standard deviation, for α=2 corresponding to a standard deviation of normal distribution

There is another (equivalent) parametrization of the characteristic function, that differs only in location parameter:

$$\Phi(t) = \exp\left\{-\sigma^\alpha |t|\left(1 - i\beta \operatorname{sgn}(t) \tan\frac{\pi\alpha}{2}\right)\left(|\sigma t|^{1-\alpha} - 1\right) + i\mu_1 t\right\} \quad for \ \alpha \neq 1$$

$$\Phi(t) = \exp\left\{-\sigma^\alpha |t|\left(1 - i\beta \frac{2}{\pi} \operatorname{sgn}(t) \log|\sigma t|\right) + i\mu_1 t\right\} \quad for \ \alpha = 1 \qquad (2)$$

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Location parameters are related by

$$\mu = \mu_1 + \beta\sigma \tan\frac{\pi\alpha}{2} \quad for \ \alpha \neq 1$$

$$\mu = \mu_1 + \frac{2\beta}{\pi}\sigma \log\sigma \quad for \ \alpha = 1$$

According to Nolan [7], from applied point of view it is preferred parametrization (2), but we will use the parametrization (1).
Although there is no general explicit formula for pdf for some special cases exists:

1) Normal distribution with the pdf

$$f(x) = \frac{1}{\sqrt{2\pi}\sigma}\exp\left(-\frac{(x-\mu)^2}{2\sigma^2}\right)$$

is a sTable distribution $S(2,0,\sigma/2,\mu)$

2) Cauchy distribution with the pdf

$$f(x) = \frac{1}{\pi}\frac{\sigma}{\sigma^2 + (x-\mu)^2}$$

is a sTable distribution $S(1,0,\sigma,\mu)$

3) Lévy distribution with pdf

$$f(x) = \sqrt{\frac{\sigma}{2\pi}}\frac{1}{(x-\mu)^{3/2}}\exp\left(-\frac{\sigma}{2(x-\mu)}\right)$$

is a sTable distribution $S\left(\frac{1}{2},1,\sigma,\mu\right)$

Properties of sTable distributions

The following properties holds for a sTable distributions:

1. Let X_1, X_2 are the independent sTable random variables, with $X_i = S(\alpha,\beta_i,\sigma_i,\mu_i)$ $i = 1,2$ then $X_1 + X_2 \approx S(\alpha,\beta,\sigma,\mu)$ with

$$\sigma = \sigma_1 + \sigma_2$$

$$\beta = \frac{\beta_1\sigma_1^\alpha + \beta_2\sigma_2^\alpha}{\sigma_1^\alpha + \sigma_2^\alpha}$$

$$\mu = \mu_1 + \mu_2$$

2. If $X \approx S(\alpha,\beta,\sigma,\mu)$ and $a \in R$ then

$$X + a \approx S(\alpha,\beta,\sigma,\mu + a)$$

3. If $X \approx S(\alpha,\beta,\sigma,\mu)$ and $a \in R$ then

$$aX \approx S(\alpha,\mathrm{sgn}(a)\beta,|a|\sigma,a\mu)$$

3 Maximum Likelihood Estimation

According Bora, Hardle Weron (2005), after substitution $\zeta = -\beta\tan\frac{\pi\alpha}{2}$ the density of standard $\alpha-$ sTable random variable (μ=0, σ=1) for $\alpha \neq 1$ can be expressed as:
for $x > \zeta$:

$$f(x;\alpha,\beta) = \frac{\alpha(x-\zeta)^{\frac{1}{\alpha-1}}}{\pi|\alpha-1|}\int_{-\xi}^{\frac{\pi}{2}} V(\theta;\alpha,\beta)\exp\left(-(x-\zeta)^{\alpha/\alpha-1}\,V(\theta;\alpha,\beta)\right)d\theta,$$

for $x = \zeta$:

$$f(x;\alpha,\beta) = \frac{\Gamma\left(1+\frac{1}{\alpha}\right)\cos\xi}{\pi(1+\zeta^2)^{\frac{1}{2\alpha}}}$$

and for $x < \zeta$:

$$f(x;\alpha,\beta) = f(-x;\alpha,-\beta)$$

where

$$V(\theta;\alpha,\beta) = (\cos\alpha\xi)^{\frac{1}{\alpha-1}}\left(\frac{\cos\theta}{\sin\alpha(\xi+\theta)}\right)^{\alpha/\alpha-1}\frac{\cos[\alpha\xi(\alpha-1)\theta]}{\cos\theta}$$

$$\xi = \frac{1}{\alpha}\arctan(-\zeta)$$

In MLE we have to find from observation data x_i a maximum of the likelihood function

$$\sum_{i=1}^{n}\log f(z_i;\alpha,\beta,\delta,\mu),$$

with respect to parameters α,β,δ,μ , where $z_i = \frac{x_i-\mu}{\delta}$.

3 Results

We use MLE method described shortly in the previous section to estimate value of α from the Czech Stock Index PX on daily data. The recorded data are from1.1996 to 4.2015 . All original data series have been transformed into logarithmic differences series. The following Tables provide parameters estimation and results of Kolmogorov-Smirnov and Anderson –Darling tests. Neither of them shows that the data are generated by the normal distribution.

Table 1: Estimated parameters of alpha sTable distribution for returns of PX

Alpha	Beta	Mu	Gamma
1.82	-0.03909	4.2e-5	0.00604

Table 2: Estimated parameters of student t distribution for returns of PX

Mu	Sigma	Degree of Freedom
1.6e-4	0.00777	5,4522

Table 3: Mean root square error in segments of theoretical CDF wrt empirical one

Quantile	Mean Root Square Error		
	Alpha sTable	Normal	Student t
0 - 10	0,0123	0,0049	0,0112
10 - 20	0,0097	0,0262	0,0124
20 - 30	0,0102	0,0420	0,0026
30 – 40	0,0197	0,0430	0,0117
40 - 50	0,0169	0,0296	0,0120
50 - 60	0,0099	0,0129	0,0086
60 - 70	0,0086	0,0160	0,0076
70 - 80	0,0058	0,0239	0,0031
80 - 90	0,0052	0,0261	0,0051
90 - 100	0,0079	0,0114	0
Total	0,0115	0,0270	0,0093

Testing (for critical value 5%)

Table 4: H0-PX returns are normally distributed

Test	Test statistic	Critical value at 5	Conclusion
Kolmogorov - Smirnov	0.4844	0,0566	Reject
Anderson - Darling	2.4479	0,7531	Reject

Table 5: H0- PX returns are alpha sTable distributed

Test	Test statistic	Critical value at 5	Conclusion
Kolmogorov - Smirnov	0,0299	0,0571	Do not reject
Anderson - Darling	0,0517	2,5059	Do not reject

Table 6:H0-PX returns are student t distributed

Test	Test statistic	Critical value at 5	Conclusion
Kolmogorov - Smirnov	0,0216	0,4893	Do not reject
Anderson - Darling	268,4022	212,5226	Reject

Table7: Descriptive statistics of Prague daily stock market index PX returns

mean	median	max	min	st deviation	skewness	kurtosis
-1.2e-04	4.65e-04	0.0447	-0.0471	0.0097	-0.2575	5.3764

4 Conclusions

The paper was examined the most appropriate probabilistic distribution that approximates log-return of Czech PX stock index on daily data. Normal, Student and sTable distributions were compared. For the sTable distribution parameter estimation method was used MLE, which is considered the most accurate (despite the absence pdf closed form). It turned out that the normal distribution is not appropriate division, it was rejected as the Kolmogorov-Smirnov statistic and Anderson-Darling test. Student-t distribution KS passed the test but was refused AD test. STable distribution underwent both tests, and emerges as the best approximation (of the considered distributions) empirical distribution.

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How to pay for health: selected macroeconomic aspects of health budgets

Jan Mertl*

Abstract. This paper is focused on the macroeconomic properties of health care financing in the context of macroeconomic development. Together with absolute and relative increase of health expenditure, the significance of health expenditure is rising and the public policy must be adjusted accordingly. So the paper aims to cover significant trends in this area and discuss their causes according to the utilized financing schemes. Special attention is paid to so-called "state insured persons" in the Czech Republic in the context of government and health budget relationships. Although being theoretically debaTable, there are no signs of abandoning this group in Czech health policy. Current proposals of adjusting the amount paid for this group according to macroeconomic development are discussed.
Keywords: health insurance, health expenditure, economic cycle, health systems
JEL Classification: I13,I18,H51

1 Introduction

Health care financing is one of the most complex public finance tasks worldwide and thus it became a tough proposition for Czech health policy, too. While it is sometimes perceived in public discourse as a "black hole for money" (Hrstková, 2015), it has become a second largest expenditure item of public budgets with nearly 300 billion CZK total in 2014 (ÚZIS, 2015). Its macroeconomic role and significance is thus steadily rising, both because of the importance for the human capital maintaining and development and because of being significant part of national economy with consequences in employment, public and private expenditure and a contribution to GDP formation in general (Suhrcke, et al, 2005). In this sense, it is worth to analyze important aspects of this sector and the management of health care financing resources. So the paper aims to cover significant macroeconomic trends in this area and tries to capture the approach of selected countries. Special attention is paid to so-called "state insured persons" in the Czech Republic in the context of government and health budget relationships.

Scientific methods used to write this paper include macroeconomic analysis of health expenditure, public policy evaluation of health resources' settings in the Czech Republic and synthesis of observed trends from the health policy point of view.

2 Health expenditure in the international and macroeconomic context

In current health systems two main schemes of health financing resources' management have evolved. The first one is based on highly regulated (especially regarding risk classification targeting community ratings) individual contracts between health care insurer (provider) and the insured (patient), allowing for individual coverage of a person's health care consumed. This method is based on the willingness of people to pay for health care as they are limited by their budget. The second one is based on centralizing resources and distributing them through one or more financing agents based on the health care needed by the population. This method is usually based on allocating a share of personal income to health care, either as social health insurance contribution, earmarked health tax (Doetinchem, 2010) or share of general taxation income. Both of them have their typical attributes (positive and negative) and are chosen by health policy makers in specific countries to fulfill the goals of health policy as desired. Actually in current reality, majority of health system uses a mixture of those schemes, which even sometimes overlap in health care and population coverage as their different characteristics do not imply perfectly sharp boundaries that can be used to classify them (Durdisová & Mertl, 2013).

Purely theoretically, the second method should provide sTable resource of financing relatively to GDP, as when we take a share of wages (personal income) at allocate it for health care, it should fluctuate with GDP proportionally and thus copying the economic cycle, in the same way as general taxation works macro economically. The problem is, among others, that the health care sector does not shrink and expand with the economy as a whole symmetrically, e.g. as the sectors of information technology or civil engineering. So the expenditure which has to be paid is not mainly the exact function of the actual resources available or even consumers' demand, but rather the function of health care determinants (life style, environment, health care itself, and genetics) and their management in the economy. The problem of health care needs is also important, as

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demand for some types of treatment and some drugs is highly inelastic, causing the necessity to pay for and provide health care without strict relation to resources available (Mooney, 1992). As an extreme example we can show an epidemics of infectious disease, which would have to be managed on the national level. Moreover, health care sector is a significant employer and its employees, even if they usually exhibit higher degree of loyalty that in other sectors, also demand their wages to be paid and valorized as they see the macroeconomic development in sense of the labour market theories, including the stiffness of wages aspects.

This does not mean, however, that health care does not have to respect economic laws and budget limitations, rather it means just that sometimes the care is provided and the whole sector runs while creating deficits or imbalances that are publicly perceived as inefficiencies. First part of those inefficiencies is caused at the microeconomic level by inadequate management, and the second part is determined at the macroeconomic level by inadequate schemes of financing in relation to the economic development. For example, in the first part the hospitals could be indebted, in the second part the public health care coverage could be diminished or not innovated, leaving those who can pay out-of-pocket to buy the care they need and those who cannot being under-treated.

As for the relationships of health care expenditure at the macroeconomic level, the following data are appropriate for consideration. Behind them is the fact, that the relative health care expenditure to GDP* is driven by two factors: actual trend of health policy decisions and needs with results in absolute health expenditure, and the development of GDP caused by general trends, which provides resources for health care system (see also Gerdtham & Jonsson, 2000). For example, during the economic crisis (2008-2010) the relative health expenditure in majority of OECD countries significantly arose, but the main factor was not the health expenditure itself, but the decline of GDP which increased the relative share (burden) of health care expenditure overall.

Table 1: Share of health care expenditure on GDP, OECD, 2003-2013, %

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Index 2013/2003
Australia	7.9	8.1	8	8	8.1	8.3	8.6	8.5	8.6	8.8	8.8	1.114
Austria	9.6	9.6	9.6	9.5	9.5	9.6	10.1	10.1	9.9	10.1	10.1	1.052
Belgium	9.1	9.1	9	8.9	9	9.4	10.1	9.9	10.1	10.2	10.2	1.121
Canada	9.1	9.1	9.1	9.3	9.4	9.5	10.6	10.6	10.3	10.2	10.2	1.121
Chile	7.2	6.8	6.6	6	6.1	6.7	7.1	6.7	6.7	7	7.3	1.014
Czech Republic	6.6	6.4	6.4	6.2	6	6.4	7.3	6.9	7	7.1	7.1	1.076
Denmark	8.9	9	9.1	9.2	9.3	9.5	10.7	10.4	10.2	10.4	10.4	1.169
Estonia	4.9	5.1	5	4.9	5	5.7	6.6	6.1	5.7	5.8	6	1.224
Finland	7.5	7.5	7.7	7.6	7.4	7.6	8.3	8.2	8.2	8.5	8.6	1.147
France	10	10.1	10.2	10.1	10	10.2	10.9	10.8	10.7	10.8	10.9	1.090
Germany	10.3	10.1	10.3	10.1	10	10.2	11.1	11	10.7	10.8	11	1.068
Greece	8.2	8	9	9	9.1	9.8	9.8	9.2	9.7	9.1	9.2	1.122
Hungary	8.2	7.8	8.1	7.9	7.3	7.2	7.4	7.7	7.6	7.5	7.4	0.902
Iceland	10.1	9.5	9.2	8.9	8.7	8.7	9.1	8.8	8.6	8.7	8.7	0.861
Ireland	6.6	6.8	6.9	7	7.2	8.3	9.2	8.5	8	8.1	8.2	1.242
Israel	7.2	7.1	7.2	7	7	7	7.1	7	7	7.4	7.5	1.042
Italy	7.9	8.2	8.4	8.5	8.2	8.6	9	8.9	8.8	8.8	8.8	1.114
Japan	7.9	7.9	8.1	8.1	8.2	8.5	9.4	9.5	10	10.1	10.2	1.291
Korea	4.7	4.7	5	5.4	5.6	5.8	6.3	6.5	6.5	6.7	6.9	1.468
Luxembourg	7.1	7.4	7.2	6.8	6.4	6.6	7.5	7.2	6.8	6.6	6.6	0.930
Mexico	5.9	6	5.9	5.7	5.8	5.9	6.4	6.2	5.9	6.1	6.2	1.051
Netherlands	8.5	8.6	9.5	9.4	9.4	9.6	10.3	10.4	10.5	11	11.1	1.306
New Zealand	7.7	7.9	8.2	8.6	8.4	9.2	9.7	9.7	9.7	9.8	9.5	1.234
Norway	9.2	8.8	8.3	7.9	8.1	8	9.1	8.9	8.8	8.8	8.9	0.967
Poland	6	5.9	5.8	5.8	5.9	6.4	6.6	6.5	6.3	6.3	6.4	1.067
Portugal	8.9	9.3	9.4	9.1	9.1	9.3	9.9	9.8	9.5	9.3	9.1	1.022
Slovak Republic	5.4	6.5	6.6	6.9	7.2	7.5	8.5	7.8	7.5	7.7	7.6	1.407
Slovenia	8.1	7.9	8	7.8	7.5	7.8	8.6	8.6	8.5	8.7	8.7	1.074
Spain	7.5	7.6	7.7	7.8	7.8	8.3	9	9	9.1	9	8.8	1.173

* As consulted with the Institute of Health Information and Statistics of the Czech Republic (UZIS), the slight differences between national and international statistics are caused primarily by the revisions of GDP performed recently at the EU level. To keep international comparison consistent the latest data (11/2015) from OECD are used.

Sweden	8.5	8.3	8.3	8.2	8.1	8.3	8.9	8.5	10.6	10.8	11	1.294
Switzerland	10.4	10.4	10.3	9.8	9.6	9.8	10.4	10.5	10.6	11	11.1	1.067
Turkey	5.2	5.1	5.1	5.4	5.5	5.5	5.8	5.3	5	5	5.1	0.981
United Kingdom	7.1	7.3	7.4	7.6	7.6	7.9	8.8	8.6	8.5	8.5	8.5	1.197
United States	14.5	14.6	14.6	14.7	14.9	15.3	16.4	16.4	16.4	16.4	16.4	1.131

Source: OECD Health Data 2015, index own calculations

This Table shows that with the exception of five countries the index of share of total health expenditure on GDP has risen in the majority of OECD countries during the selected ten years period. However, we can also see that in many countries this trend has slowed down in recent years and since 2010 many countries experienced stagnation or slight decline in relative health care expenditure. This is consequent with the hypothesis, that the observed values are not result of the health policy and the changes in health expenditure alone, but when we measure health care expenditure relatively to GDP they are also determined by the overall economic development. This is supported by the next Table, which shows the trends of real health expenditure per capita.

Table 2: Health care expenditure per capita, constant prices OECD base year, constant USD PPPs, 2003-2013

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Index 2013/2003
Australia	2709	2840	2842	2912	2993	3062	3181	3161	3281	3377	..	1.247
Austria	3211	3299	3324	3383	3493	3594	3630	3684	3702	3787	3777	1.176
Belgium	2879	2964	2976	3006	3098	3227	3371	3344	3433	3437	3441	1.195
Canada	3139	3224	3282	3392	3463	3523	3769	3844	3795	3806	3812	1.214
Chile	748	794	833	869	928	957	1030	1092	1148	1219	1320	1.765
Czech Republic	1314	1341	1425	1474	1503	1618	1756	1701	1744	1743	1740	1.324
Denmark	2902	3007	3097	3232	3300	3330	3536	3485	3438	3446	3428	1.182
Estonia	687	766	821	905	1003	1080	1063	1017	1025	1105	1153	1.679
Finland	2253	2361	2471	2535	2575	2653	2640	2683	2746	2769	2774	1.231
France	2972	3058	3101	3128	3162	3188	3293	3318	3351	3372	3413	1.148
Germany	3260	3226	3298	3375	3440	3552	3684	3795	3825	3929	3993	1.225
Greece	1964	1991	2263	2378	2479	2653	2539	2262	2198	1931	1881	0.958
Hungary	1283	1291	1391	1412	1315	1307	1265	1320	1345	1315	1308	1.020
Iceland	3233	3288	3295	3257	3394	3400	3349	3144	3148	3190	3297	1.020
Ireland	2500	2647	2795	2899	3022	3327	3443	3144	3013	3047	..	1.219
Israel	1668	1705	1769	1787	1859	1902	1905	1964	2021	2136	2196	1.316
Italy	2298	2417	2479	2551	2485	2562	2528	2556	2532	2457	2371	1.032
Japan	2311	2381	2464	2514	2587	2669	2789	2933	3078	3169	3277	1.418
Korea	1039	1096	1221	1380	1496	1576	1724	1865	1939	2024	2130	2.050
Luxembourg	3501	3770	3724	3576	3493	3495	3659	3579	3371	3204	..	0.915
Mexico	699	732	731	732	760	774	782	792	775	821	837	1.197
Netherlands	3024	3109	3511	3601	3738	3882	3995	4089	4157	4290	4278	1.415
New Zealand	1899	1987	2124	2261	2226	2396	2494	2503	2524	2593	2559	1.348
Norway	3867	3950	4029	4051	4148	4271	4344	4341	4454	4538	4563	1.180
Poland	755	787	806	855	925	1049	1113	1126	1148	1162	1206	1.597
Portugal	1918	2035	2079	2041	2072	2137	2190	2214	2108	2001	1937	1.010
Slovak Republic	805	1007	1094	1234	1432	1566	1677	1625	1587	1657	1657	2.057
Slovenia	1783	1824	1903	1963	2005	2166	2159	2178	2181	2163	2133	1.196
Spain	2030	2082	2140	2214	2279	2399	2484	2482	2468	2407	2316	1.141
Sweden	2729	2768	2840	2915	2960	3007	3041	3033	3846	3899	3978	1.458
Switzerland	3891	3986	4015	3969	4024	4126	4235	4345	4437	4595	4683	1.203
Turkey	489	519	556	618	687	682	675	667	675	670	707	1.446
United Kingdom	2361	2467	2569	2672	2743	2811	2956	2918	2915	2922	2939	1.245
United States	6098	6304	6460	6619	6773	6885	7075	7211	7281	7395	7510	1.231

Source: OECD Health Data 2015, index own calculation

Here we can see vast differences for some countries, e.g. Slovakia (2.057 vs 1.407 in Table 1), Chile (1.765 vs 1.014 in Table 1) and Estonia (1.679 vs 1.224 in Table 1). Also we can see e.g. in Sweden, that the per capita expenditure has been very similar in 2008-2010 (3007;3041;3033 USD PPP), but the relative expenditure fluctuated (8.3;8.9;8.5 %).

Those findings suggest that the macroeconomic imbalances in relation to health care expenditure are significant enough to be included in health policy considerations and thoughts. Actually empirically, we can see that the countries already employ mechanisms that help to compensate them.

To name the significant examples: in the United States, the health insurance companies set their premium based on (highly regulated) insurance policies and thus do not take into account the wages (incomes) of the people directly. The clients either accept the offer or decline it, in the past they could remain even uninsured, now they are required to buy a plan under "Obamacare" health reform. In Germany, the rate of social health insurance was in the past changing regularly and was even different between branches of economy on the principle of (true) social insurance, allowing to get required resources as a share of wages paid to the employees. Now we see the trend of decreasing the number of social health insurance companies there and unifying the social health insurance rate, even if the possibility to change it remains. And in the Great Britain, where the health care is paid from the government budget, the amount allocated into health care is a (largely) direct decision of public choice in each year among other budget priorities.

This means that the health care systems take different approach to manage the imbalances in the health care expenditure and needs in relationship to the resources available and health care needed: either they simply charge and spread the price (costs) of health care through highly regulated insurance mechanisms among the insureds, changing the proportion of the health expenditures on a personal income directly (if individual budget constraint allows). Or they change the rate of social health insurance, changing the overall share of indirect health labor costs. Or they change simply the amount of public expenditure flowing to health care from public budgets. If those mechanisms fail, the system exhibits deficits and/or does not provide adequate health care to citizens. The deficits can actually act as a "buffer" for the discrepancy between health system incomes and expenditure, theoretically they can emerge in the form of surpluses (reserves) in the times of economic growth when the incomes become usually higher. And this buffer could be realized at the level of (social) health insurance company (companies), or it can be a part of government budget balance.

3 Health financing resources in the Czech Republic

When the system of multiple health insurance companies (agents) was introduced in the Czech Republic at the beginning of the 1990's, among other elements a new category of the insured was introduced: the state insured persons. The logic behind this was then to establish a system where every citizen must have a health insurance and has the right to choose health insurance company and for those who do not have disposable income will the government pay to the company chosen. Then it was assumed, that the insurance companies will be primarily employer based and the health expenditure did not so much differ between age and disease groups as it currently does.

Up to now, the category of state insured persons has vastly expanded and currently to this category belongs nearly 60 % of the citizens (e.g. pensioners, students, unemployed, parents caring for small children), with the total amount paid 53.7 billion CZK in year 2013. In this sense, this payment can be also seen as a simple government subsidy to health system budget, varied (now) automatically only by the number of citizens who fall into this category. It means that any changes in this amount are directly related to the level of government budget expenditure on health care system. And this amount also made possible to set the health insurance rate little lower than it would be otherwise – 13.5 % and keep it unchanged. When introduced the amount was set by law as a fraction of minimum wage, since year 2003 it was a fixed amount set by law and changed by the government order, for a short period 2006-2009 it was connected to average wage but this mechanism was abandoned in 2009. No automatic mechanism of changes of the amount (valorization) is currently employed and thus it is (again) purely a matter of discrete economic policy when and how much it gets changed. Table 3 shows these changes.

Table 3: Changes in the base and premiums (amounts) for stated insured persons, 2003-2016, Czech Rep., CZK

Time	Base	Premium/amount
1.1.2003 - 31.12.2003	3458	467
1.1.2004 - 31.12.2004	3520	476
1.1.2005 - 31.12.2005	3556	481
1.1.2006 - 31.01.2006	3798	513
1.2.2006 - 31.03.2006	4144	560
1.4.2006 - 31.12.2006	4709	636
1.1.2007 - 31.12.2007	5035	680
1.1.2008 - 31.12.2009	5013	677
1.1.2010 - 31.10.2013	5355	723
1.11.2013 - 30.06.2014	5829	787
1.7.2014 - 31.12.2015	6259	845
Since 1.1.2016	**6444**	**870**

Source: (VZP, 2016)

Of course, some authors see this mechanism as obsolete under current conditions and logically claim that it could be replaced by the changes in the general taxation of personal income and government budget scheme (Vostatek, 2013) – this is consequent with the possibility of movement to more centralized health care system where the autonomy (and number) of health insurance companies could decrease and government-based financing of health care will be performed. Given the changes in the structure of health care expenditure and the importance of central redistribution of health contributions (Göpffarth & Henke, 2013), it also stresses the importance of centralizing the resources at least initially, before they are spent by the health insurance companies on the market of health care providers.

On the other hand, significant effort is put into keeping the idea of multiple health insurance companies working and relevant (Kotherová, 2014). In this system, the payment (support) of the government for people who do not have (enough) disposable income is valid, because the payment has to be, at least to some extent, individualized. An extreme form of this we can find in the Netherlands, where poorer people simply receive subsidy so that they can buy (highly regulated) product at the health insurance company that they choose.

It is not an aim of this paper to discuss which model of health system is better, actually it seems that this cannot be done with simple economic calculation (OECD, 2015). That's why now will focus on the situation in Czech health system as being run by current public policy, and this contains the discussion of the role of the state insured persons' payment as it has been performed.

The economic crisis, as measured by the slowdown in the key macroeconomic indicator of GDP and in parallel with the increase in unemployment reflected, caught the Czech health sector in a difficult situation. Before it occurred in 2008 the first phase of an ambitious unpopular reform was implemented, on simple calculations based (30-60-90 CZK) implemented regulatory fees. This should have created space for the next phase of reform, involving the introduction of regulated competition in the private health insurance companies based on their economic performance as an incentive to save resources. This did not occur, for two reasons. The first of these was a political unwillingness to continue the reforms in the spirit proposed.

The second one was the "W" character of GDP trend, which brought a deterioration in key macroeconomic parameters and effectively blew a pillow that was created for the reform of health insurance companies on the basis of increased payments for state insured persons and favorable macroeconomic developments in the pre-crisis period. The overall balance of health insurance companies budget was surplus 17.2 billion CZK in 2007 and 10.7 billion CZK in 2008 (MF ČR, 2009). For health economics and health policy, however, this brought an interesting study material, because for the first time in the history of Czech health insurance system, the system was exposed to a massive decline in employment and thus incomes and the analysis shows that, if this pillow had not been accumulated before, the situation would have been significantly worse. And many of the general crisis measures (VAT changes, wages changes) influenced health system too.

Considering the structure of insureds and their burden, the indirect labour costs, including health insurance ones, are especially in the case of employees perceived as being high enough to stop any ceteris paribus changes (especially increases) of the current rate 13.5 %. Also the discrepancy between average amount of employee and state insured person is frequently stated and thus, when the overall balance of the system is challenged, there is an expressed demand for changing the amount paid for state insured persons (Tempus Medicorum, 2015). Within this outline we can see the second important role of this amount: actually it works as a part of health care financing

that can in the described environment as a reserve (buffer) or stabilizer of the health system overall balance. Generally said: although it is a controversial concept, the public policy and the stakeholders currently do not seem to have an intention to abandon it, actually the opposite is true and we can discuss the possible variants lower.

The first aspect is how to set the base for the stated insured persons so that it is not dependent on public choice in the sense that if the public policy forgets about it, it is not changed and with the ongoing macroeconomic development is gets out-of-date; e.g. suggest some methods of its update (valorization). In this sense the following possibilities exist (Zdravotnický deník, 2016):

- Make relationship to general average income assessment base (used also for pensions valorization), or to simply to the average wage in the national economy.
- Administratively valorize the base regularly, e.g. by 5 % annually (percentage estimated from the average of growth of payments at other insured persons).
- Unify the base with the base for persons without taxable incomes, which is currently the minimum wage.

Fiscally the third possibility is the most extensive, according to calculations done by the Ministry of Health (MZ ČR, 2016) it would increase the resources by 30 billion CZK, in addition minimum wage is now set by discrete economic policy which compromises the rationality of related values. The second one, costing about 3 billion CZK is rather theoretical as it does not relate directly to the macroeconomic reality and thus is probably even more prone to being inadequate in time than the current scheme. The first one (currently being preferred at the stage of proposal) has fiscal dimension around 5 billion CZK in the first year and when utilizing similar schemes as pension valorization base, also the average values cover longer term.

Within this first aspect primarily the issue of changing the government expenditure for health care is resolved (in the conditions when the payments of other social groups is not desired to be changed. But also as we have discussed the second aspect exists and this is the reaction to the economic cycle, which causes lowering absolute incomes of health insurance funds through macroeconomic channel as a whole.

This second aspects leads to the discussion about the anti-cyclical measures in health insurance. It is clear, macroeconomically, that with rising unemployment the number of state insured persons will also rise. Thus the health insurance budget will lose its payment and in addition, the government will have to pay its amount for such a person. Actually it is theoretically interesting, that from the pure fiscal principle the decrease of public revenue from health insurance, similarly to the decrease from tax income, could be seen as an automatic macroeconomic stabilizer, however, in the current environment it causes deficits in health insurance budgets and creates additional expenditure pressure for the government budget. So the guardian of health budgets, or so called stewardship maker (WHO, 2000) Ministry of Health, to protect the interest of the health budget, discusses currently the introduction of weighted state insured person coefficient.

This coefficient measures the deviation of the actual number of state insureds from the average number of them during a selected period (approximately 1 economic cycle). It is computed as a linear share of the actual number of the state insureds to the average; when this number is equal to the average the coefficient is 1. To simplify actual calculations its "resolution" is set for every 2000 persons by 0.001. By this coefficient will be reduced/increased the total amount of money paid for the state insured persons, calculated with one of the valorization mechanisms described above. One of the discussed variants works with creating an lower and upper limit (0.95-1.05) for this coefficient to limit the extent of consequences for the government budget during large or sudden fluctuations of employment.

4 Conclusions

While gaining fiscal importance and gradually moving from perceived "consumption only" branch of economy to the human capital investment approach, the health care system keeps its specific characteristics that should be taken into account when designing its financial flows. Simultaneously, the health expenditure is not primarily driven by usual factors of market demand, but rather complex spectrum of health determinants and their volume is closely related to the health status and needs of the population as a whole.

Also, the situation is complicated by inevitable existence of specific health system models, and the current analyses show clearly that it does not make much sense to try finding the "best" or "most efficient" one. Although it is important to analyze their effectiveness (and say what we mean under this term, too), the mix of resources collection and allocation differs from country to country and the theoretical models serve more like the schemes from which the actual practice is derived and combined.

Nevertheless, the issues that health systems (re)solve are to the vast extent common for all the development countries. One of them is the problem of their financing: it is clear that two main factors influence their sustainability. First one are the health needs of the population and the requirements and costs is causes. The second one is the general economic performance of a country, which determines the level of health care provision that is available, either universally based on solidarity financing or individually based on private payments.

These facts were prominent during the last economic crisis, when many countries struggled to fill their budgets and simultaneously tried to keep the health expenditure as high so that the necessary health consumption would not be harmed. In some of them this even accelerated the systemic changes, such as the "Obamacare" reform in USA or the process of decreasing the number of social health insurance companies in Germany. Also in the Czech Republic the macroeconomic properties of the crisis brought high pressures into health care system.

In the Czech Republic kind of hybrid health system is run, and this has consequences in the measures taken. In this paper we have been focusing on the amount paid for state insured persons, which emerged in Czech health care system in the 1990's as a fiscal supplement to the payments of employed and self-employed persons. Although theoretically debaTable and having direct connection to the government expenditure side, which leads to approaches that ask for its abandoning or minimizing in favour of the more standard solutions based on general taxation, its position in the health care system remains active.

Actually, when the public choice and public policy do not seem to make a health system reform fundamentally changing the categories of the insured that were introduced in the 1990's, and when the burden of health costs spreading between them seems to be fixed in the last decade or so, the fiscal subsidy representing the amount paid for the state insured becomes one of the tools of optimizing the public expenditure to health budgets.

This is supported by recent public discourse about the methods of this amount determination. Recent proposals include its linking to the standard valorization procedure used for public pensions and introducing anti-cyclical measure which is sensitive to the number of state insured citizens and thus indirectly to the employment rate. Whether they are accepted or not of course remains a task of public choice but in the given environment technically they strive for better automatic determination of the government payments fairly well.

Of course, this does not say much about if the system provides better health status outcomes which is mainly a function of the health care providers, in this paper we focused mainly on the resources' side. For the future research of this and the overall degree of adherence to the theoretical models of health care organization is important.

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Transaction costs in Czech and Slovak public procurement

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Abstract. The results of the public procurement process cannot be assessed solely in terms of the savings achieved through competition among potential suppliers. Such calculations have been presented in several studies, despite being somewhat problematic. The academic literature clearly indicates that transaction costs for both procurer and supplier significantly influence the public procurement results, and the procurement processes, for example the level of competitiveness, and the prices offered (Pavel, 2007).

The goal of this paper is to add some quantitative and qualitative information about select aspects of public procurement transaction costs in the Czech Republic and Slovakia. Two elements are investigated: Czech data on the views of building firms about transaction costs; and the transaction costs of a newly established e-market in Slovakia. The data show quite high indirect transaction costs, which we argue are ultimately the result of a non-functional public procurement system.

Keywords: transaction costs, public procurement, Czech Republic, Slovakia.
JEL Classification: D23

1 Introduction – literature review

The results of the public procurement process cannot be solely assessed in terms of the savings achieved through competition among potential suppliers. In any case such calculations are somewhat problematic, particularly because of the issue of "estimated" versus "achieved" prices, though this has been done in a number of quantitative studies and practical analyses. The academic literature clearly indicates that both procurer and supplier transaction costs significantly influence the public procurement results and the procurement processes, such as the level of competitiveness, and the prices offered (Pavel, 2007).

The term "transaction costs" was developed by Coase (1937) for private sector conditions and later extended to public sector conditions (Coase, 1960). This issue was further developed by other authors, including Williamson (1981), Demsetz (1968), Akerlof (1970), Barzel (1985), and Hill (1990).

The transaction costs are associated with contract management. The relationship of these costs to the benefits derived from competition, are essential elements of any contracting relationship. According to Coase (1937), transactions costs are the price of exchanging goods in the market. Demsetz (1968, p. 35) defined transaction costs as "the price derived from ownership change". Barzel (1985, p. 4) had a similar opinion: transaction costs are the "exchange price". In CEE, Merickova (2011, p. 179) defines transaction costs as "all costs connected with the realization of a contract between a public and a private entity, other than productive-production costs". This definition is very much based on works by Pavel (2007).

Most authors argue that there are two types of transaction costs with contracting: those associated with the contract formation and those associated with the contract performance. Some authors (Pavel, 2007) distinguish three types of transaction costs: ex-ante, intermediate, and ex-post. Table 1 indicates the possible transaction costs connected with public procurement.

Decreasing transaction costs represents a very important pre-condition for effective and efficient procurement. Transaction costs are an inevitable part of any public procurement (contract) action, in all three phases: ex-ante, intermediate, and ex-post. Pavel (2007) states that the ex-ante and intermediate transaction costs of public procurement are to a large extent fixed costs. But ex-post costs offer the largest potential for savings, through improving the most important aspects of a country`s public procurement system. Similar opinions were expressed

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by Akerlof (1970), North (1990), and Fukuyama (1995). One concrete aspect determining ex-post costs are the selection criteria, as discovered by Tadelis (2012) and by Pavel (2013) and also confirmed by our own studies (Grega and Nemec, 2015). Private firms focus on value for money, but especially in CEE public procurers in 80% to 90% of cases select the lowest price suppliers, despite the fact that this significantly increases the risk of contract execution failures (Grega and Nemec, 2015).

Table 1: Transaction costs in public procurement – main types

Time / Sector	Ex-ante	Intermediate	Ex-post
Public sector	Preparing tender documentation Announcing tender Cost of outsourced services (for experts used – e.g. legal & technical)	Explanations	Complaint-solving costs Legal costs Costs to hire a new supplier if the first contract fails Price increase, if the first contract fails
Private sector	Preparing bid Purchases to be able to fulfill qualification criteria Guarantees	Communication	Complaint-solving costs Legal costs

Source: own construction, based mainly on Pavel (2007)

2 Methodology

This study uses two data sources. The data on estimated levels of transaction costs used in our research for the Czech Republic were collected for our team by a private association in late 2015. A total of 47 building firms engaged in transportation construction responded to our questionnaire (Table 2).

Table 2: Structure of interviewed firms

Number	Category	Employed	Turnover
4	Small	<50	<150 million CZK
36	Medium	<250	<450 million CZK
7	Large	<500	<700 million CZK

Source: own construction

The selected firms participated in 311 tenders for transportation construction works in 2014–2015 (Table 3).

Table 3: Activity of interviewed firms

Estimated Tender Prices	Participation
500,000 – 6 million	45
6 million – 20 million	41
20 million – 50 million	118
50 million – 100 million	77
100 million – 300 million	28
300 million – 500 million	2
500 million – 1 billion	---
over 1 billion	---

Source: own construction

The competition for the tenders in which the interviewed firms participated was relatively high, as shown in Table 4.

Table 4: Competition and estimated tender prices (sample used)

Estimated Tender Price	Average Number of Bids
500,000 – 6 million	22
6 million – 20 million	15
20 million – 50 million	17
50 million – 100 million	14
100 million – 300 million	12
300 million – 500 million	7

Source: own construction

Data for Slovakia were collected through our own direct research, calculated from the available information published on the web page of the regulator, Urad pre verejne obstaravanie [Office for Public Procurement] (www.uvo.gov.sk). We decided to calculate one element of the total transaction costs on the public sector side: the costs of e-procurement website creation and maintenance, based on 2015 data. We did not investigate other types of transaction costs, such as contractors' and suppliers' need to hire IT experts, or pay fees.

3 Research results: Czech Republic

During our research in the Czech Republic, the interviewed firms were asked to estimate the percentage of direct costs connected with the preparation of bids, including drafting the budget, technical proposals, and bank guarantees. Their estimates are summarized in Table 5 (number of stars reflects the frequency of answers).

Table 5: Direct costs of tender preparation by firms

Direct Costs to Prepare the Tender	Small	Medium	Large
>2% of estimated price			
3–5% of estimated price	**		
6–10% of estimated price	*	**	
10–15% of estimated price		*	***
15–20% of estimated price			
<20% of estimated price			

Source: own construction

The firms responded that the core direct costs connected with the preparation of tenders are, in particular, employee salaries, IT costs (especially the purchase of necessary software), the purchase of additional equipment (cars, copy machines, and telephones), and training the employees responsible for preparing the bid.

The firms then estimated the indirect costs connected with their participation in tenders, such as legal costs in case of complaints and reviews and fees for complaints. The estimates were very high and somewhat surprising (Table 6 - number of stars reflects the frequency of answers).

Table 6: Indirect costs of tender preparation by firms

Indirect Costs to Prepare the Tender	Small	Medium	Large
>2% of estimated price	*		
3–5% of estimated price	**	*	
6–10% of estimated price		***	**
10–15% of estimated price			*
15–20% of estimated price			
<20% of estimated price			

Source: own construction

4 Research results: Slovakia

Slovakia introduced an electronic procurement market in 2014. The aim of this e-procurement tool was to speed public procurement and increase savings. The total 2015 costs for the e-procurement web market platform included six basic elements and (based on our reserved approach) represented 10% of the total costs (Table 7). All prices exclude VAT. All data are estimates based on the available information, but should be reasonably accurate.

Table 7: Estimate of the costs of the e-procurement platform (www.eks.sk) in 2015

Type of expense	Price per unit	# of units / total	Total cost in 2015
Price for creating website	x	x	351,420 EUR
Monthly fee for website	166,501 EUR	1,998,012 EUR	1,998,012 EUR
Each completed procurement	198 EUR	29,074 procurements	5,756,652 EUR
Each canceled procurement	99 EUR	6,291 procurements	622,809 EUR
Share on size	0.55%	288,771,538 EUR	1,588,243 EUR
Share on savings	2%	45,142,800 EUR	902,856 EUR
Total	x	x	11,219,992 EUR

Source: own construction

Table 8 estimates the main efficiency indicators of the e-market in Slovakia. The transaction costs resulting from the web platform are our calculations of the relationship between costs and estimated/ claimed savings = difference between estimated and final price (Table 7).

Table 8: Estimates of transaction costs connected with the Slovak web platform in 2015

	Price or amount
Total number of procurements	35,365
Number of completed procurements	29,074
Number of canceled procurements	6,291
Total value of contracts (excluding VAT)	192,434,274 EUR
Total estimated/ claimed savings	45,142,800 EUR
Average transaction costs connected with the web platform	5.83%

Source: own construction

5 Discussion of results

The data from the Czech Republic revealed that the firms had very negative opinions about the size of indirect transaction costs. There is an explanation for such high estimates, and it is typical of less-developed administrative public procurement systems in countries where the "rule of law" is limited. The most frequent statement by the firms was that building firms are subject to "dirty" competition practices during tenders. A visible manifestation of this is the very high number of complaints submitted to the regulator, Urad pro ochranu hospodarske souteze [Office for the Protection of Competition]. When a complaint is submitted, the tender is slowed and extra time is required for negotiations. Because of the problems that result from such complaints, firms need to buy in expensive legal services. Moreover, in most cases the firms have to contract or purchase extra technology and human capacities to fulfill tender requirements. If these capacities are unused because of tender delays, huge costs may be incurred.

There is additional support for this argument in the recent research by Placek et al. (2016). Their data show that the probability of complaint and revision procedures is relatively high in the Czech Republic – almost 1.5% of all open tenders are subject to revisions by the regulator. The total amount of fees by the regulator for procurement mistakes was 72 million CZK (almost 3 million EUR) in 2014, and the total amount of financial cautions from firms (cautions are necessary to start the revision procedure by the regulator) was 130 million CZK. Almost 20% of complaints are approved by the regulator. This is a very high percentage. The data also reveal one more important and negative aspect: in the Czech Republic, there are a relatively high number of cancelled tenders. In such a situation, all of the direct and indirect costs the firms incurred are just wasted resources, with a very negative impact on the procurement system.

The Slovak data suggest that the costs of a web platform for e-tendering are very high, possibly representing 25% of the total estimated savings from the e-tendering. Because these costs are only a proportion of total transaction costs and the savings are probably over-estimated, the efficiency of the e-market is dispuTable. In our opinion, the costs for the web platform are higher than necessary. We will try to gather further evidence of this in our future research.

6 Conclusions

In general transaction costs may significantly limit potential savings in public tenders. Our data indicate that the level of transaction costs in the Czech Republic and Slovakia can be very high. In the Czech Republic the opinions of firms about indirect transaction costs were very surprising, although we were able to connect them to certain elements of a non-functional public procurement system. These included a very high numbers of complaints, cancelled procedures, low levels of trust, and excessive bureaucratization. In Slovakia, our data also indicated very

high transaction costs. We argue that the costs to construct and maintain an existing web platform may be as high as the potential direct benefits or savings from competition via this tool. Our findings are important and our team plans to investigate them further in future research.

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The prisons systems of V4 and their efficiency

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Abstract. The article deals with the evaluation of the efficiency of use of inputs the Czech Republic, Slovakia, Poland, and Hungary. For evaluating the efficiency of the use of inputs, we utilized the data envelopment analysis (DEA) method. The results show that the prison system in the Czech Republic does not use its effectively v letech 2013-2014, vzhledem k předchozím letem 2011-2012, kdy přibližně stejné zdroje využívala pro obsluhu mnohem větší capacity vězňů. Za hlavní příčinu můžeme označit nedostatečně flexibilní reakci na amestii prezidenta republiky v roce 2012.
Keywords: prison systems, DEA, inputs, efficiency
JEL Classification: H80, H83

1 Introduction

Efficiency in the public sector is quite frequented by theoretical and practical problems. Nevertheless, we find segments of the public sector that have not been sufficiently explored from the perspective of efficiency. One of them is the prison system (corrections system). There are few economic works dealing with the study of prison systems. Exception to this include the (now classic) work of Becker and Landes (1974), and Ehrlich (1996). These authors deal with a microeconomic analysis the issue of crime and punishment. In the Visegrad Four countries (the Czech Republic, Slovakia, Poland, Hungary), this issue is of marginal interest to theoretical research.Rektořík (2007), deals with an economic examination of the prison system in the Czech Republic by having carried out a qualitative analysis of the prison system. It describes the prison as one of the branches of the public sector.

For examining the effectiveness of the prison service we used the DEA method. According to (Hague, 2015) the expansion of DEA in the public sector is related to the easy availability of free software as well as manuals for the use of the DEA. Therefore, this tool has become widely available. Another positive aspect is the existence of pre-built models that can benefit policy makers who don't possess a deeper knowledge of operational research and quantitative methods. This process is called the democratization of DEA (Hague, 2015). On the other hand, it is also necessary to draw attention to the fact that the use pre-built models having different parameters can produce divergent results and lead to ineffective decision-making.

The DEA method is applicable also for examining efficiency in the public sector. The use of DEA within the context of performance management in the public sector in the spirit of New Public Management is mentioned by Schubert (2009). DEA is perceived as a tool that helps to empirically measure the results of government policies, as the example of analyzing the results of science and research in Germany shows. The same view is also held by Tankersley (2000). They argue that DEA provides an interesting starting point for the comparative analysis of organizational performance. (Chalos, Cherian, 1995) add that such metrics, it is argued, improve internal control and external accountability. More detailed instructions on the use of DEA in the public sector are provided by the publications Public-sector efficiency measurements - applications of data envelopment analysis by the authors (Ganley, Cubin, 1992). An overview of the modifications DEA models are given e.g. by Jablonský and Dlouhý (2004).

In the Czech environment, DEA is mostly used in the public sector for analyzing efficiency in higher education. Thus, for example. (Kuncová, Bisová, Mulac, 2015) use this method to analyze the influence of size and research point university for efficiency. Another application (see Jablonsky, 2013) analyzes the efficiency of instruction at economics faculties of universities. As inputs to the analysis uses The number of academics and labor costs are used as input for analysis while the number of students and the number of graduates are used as outputs.

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This method is applied to the health sector by (Vrábková, Vaňková, 2014), who deal with the technical efficiency of hospitals. For inputs they take into consideration the number of physicians (full time equivalents), the average length of stay in days per hospitalized patient, the cost per day of stay in hospital and two output parameters: the number of hospitalized patients and the hospital revenues from health insurance companies for in-patient care.

(Struk, 2014) deals with the efficient use of DEA method in municipalities when evaluating the efficiency of municipalities in the South Moravian region regarding waste management. Additionally, for a comparison of quality of life in the regions, this method was utilized by (Friebel Friebelová, 2014).

With regard to the prison system, we have not yet found a record the DEA method being applied, just a few publications that deal with the potential for measuring performance in prison systems. Wright (2004) focuses on the availability and quality of data for describing the performance of individual national prison systems. Experience with the use of performance management in the USA is described by (Wright, 2005). (Craigh, 2004) describes the conflict between control vs rehabilitation as a key output of performance of the prison system.

We put forth these research questions:

1. What are the results of the DEA analysis for each of the countries surveyed?

2. Is it possible in the countries surveyed to identify "fluctuations" in the indicators of the efficiency of the prison service?

3. Is it possible in the current (present) period to identify opportunities to improve the efficiency of the prison service?

2 Data and Methodology

The basic method for our analysis is data envelopment analysis. This method is used for evaluating the efficiency of a certain number of units. The usual statistical approach is characterized as the central tendency approach and evaluates the efficiency of the unit relative to the average unit. Unlike a statistical approach, DEA compares the efficiency of the unit with the best unit. The foundation of the method lies in the assumption that the unit A is capable of producing Y (A) units output and X (A) units of input. Thus, other units are able to have the same level of production, if they behave efficiently. Similarly, if the entity B is capable of producing Y (B) units of output and X (B) units of input, the other units will be capable of producing the same.
Units A and B and others can be combined to form a composite producer with composite inputs and composite output. This unit does not have to in fact exist. Therefore, we call it the "virtual unit". The sense of the whole analysis lies in finding the best virtual unit for each real unit. If the virtual unit is better than the original unit in creating a larger amount of outputs with the same inputs or generating the same number of outputs with fewer inputs, the original unit is, therefore, inefficient.
Data envelopment analysis is therefore a linear programming procedure for frontier analysis of inputs and outputs. DEA assigns a score of 1 to a unit only when it does not display inefficiencies in the use of inputs and production outputs compared with the relevant units. A score of less than one represents an inefficient unit. This means that the linear combination of the other units in the sample are capable of producing the same vector output using the same vector inputs.
This analysis is applied to the prison systems of the following countries of Central Europe: the Czech Republic, Hungary, Slovakia, Poland. We have defined the following as inputs for individual systems: staffing, the budget for prisoners (EUR), repletion capacity as a %, and for outputs we have used recidivism as a %, escapes, assault on staff, and emergencies. When defining outcomes, we start with the assumption that the general primary goal of any prison system is the isolation of offenders and their rehabilitation. The isolation of offenders is reflected in the variables of escapes, assaults on employees and emergencies. Rehabilitation is reflected in the percentage of recidivism.
For our analysis we use data for the years 2011 - 2014. The data was drawn from the annual reports of prison services, which are available on the Internet. V příloze číslo 1: přinášíme porovnání České republiky, Polska, Maďarska a Slovenska z hlediska základních charakteristik jednotlivých systémů

3 Results and Discussion

The answer to the first and second research question are given in the following Table:
The following Table shows the results of DEA analysis for each country, including the objective function.

Table 1: Result of DEA analysis

Country	2011	2012	2013	2014
Czech Republic	1	1	0,714961	0,704407
Slovakia	1	1	1	0,976162
Polland	0,998249	1	0,99534	1
Hungary	1	1	1	1

Source: Authors

The indicator of efficiency (or inefficiency) is the value of the objective function. It is true that if the value of the objective function is less than one, then it is an inefficient unit. As is evident from the analysis, there is inefficiency in the prison systems in the Czech Republic and Poland. In the case of Poland, it is a very small blip, which can be interpreted as a small statistical error. In the Czech Republic, however, there are fairly significant inefficiencies in the years 2013 and 2014. The cause for this was the inability to customize inputs and flexibly respond to the amnesty proclaimed by the President of the Republic, which caused a significant reduction in the number of prisoners. The number of prisoners abruptly dropped from 21200 to 14000. Interestingly, in the years 2002 to 2012 there was a growth in the number of prisoners from 13,800 to 21,200, an increase of 54% (Dušek, 2015). The Prison Service reached the same level of output at a higher volume of inputs than in previous periods of 2011 and 2012, when prison capacity was exceeded.
Our analysis (DEA method) also revealed the possibility to simultaneously improve efficiency in the prison service at the level of inputs. The DEA results are shown for the years 2013-2014 (see Table below).

Table 2: Appropriate strategy for the use of inputs for 2013 and 2014 for the Czech Republic

Year	Objective Function	Recommended Strategy (Country, Year, Part of Efficiency)		
2013	0,714961	Czech Republic, 2011, 1		
2014	0,704407	Czch Republic, 2011, 0,330434	Slovakia, 2012, 0,18942	Poland, 2012, 0,443081

Source: Authors

It is obvious that for 2013 it would be appropriate to undertake the use of the capacity from 2011, i.e. from the situation where the absolute number of prisoners in prisons peaked. In 2014, it would be appropriate to take roughly from 33% efficiency in 2011, from 18% use of inputs from Slovakia. The dominant source of inspiration should be the Polish system (see the use of its inputs in 2012). As a useful tool for the transfer of achieving efficient use of inputs among individual systems, we recommend benchmarking.

In our opinion, the main cause of inefficiency in the use of inputs Czech prison system are external influences and policy interventions, such as amnesty. Fluctuation in efficiency is a short time phenomenon, because due to high recidivism and criminal policy, the number of prisoners returned to the level before the amnesty occurred in a relatively short period of time. This assumption was confirmed by a study by (Dušek, 2015).

4 Conclusion

The article presents a comparison of the efficiency of the utilization of inputs using DEA among the prison systems of the Czech Republic, Slovakia, Hungary and Poland for the period 2011-2014. The findings show that there are not significant differences among the individual systems regarding efficiency in the given years. The exception would be the Czech Republic in 2013 and 2014. We may note the amnesty by the President of the Republic as the main cause, when the sharp decline in the number of prisoners was not responded to by limiting operational resources. Thus, the CR system achieves the same output as in previous years, but with a higher volume of inputs. To improve efficiency, the Czech Republic should seek inspiration in the Polish prison system from among the given systems. Benchmark would seem to lend itself as the optimal tool for the transfer of best practices. The resulting measures should not, however, focus on the reduction of inputs, because in a relatively short period, we can expect an increase in the number of prisoners at the level of 2012.

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Appendix

Table 1: Number of employees

Country	2011	2012	2013	2014
Czech Republic	10573	10964	10608	10673
Slovakia	5203	5196	5176	5214
Polland	29532	29529	29565	29404
Hungary	8156	8219	8329	8487

Source: Authors

Table 2: Budget

Country	2011	2012	2013	2014
Czech Republic	7.652 mld. Kč	7.859 mld. Kč	8.109 mld. Kč	8.239 mld. Kč
Slovakia	142.051 mil. EUR	143.065 mil. EUR	148.061 mil. EUR	150.579 mil. EUR
Polland	3 492 939 mil. Zl	3 641 034 mil. Zl	3 882 676 mil. Zl	4 048 505 mil. Zl
Hungary	42 mld. HUF	51.141 mld HUF	54.08 mld HUF	55.279 mld. HUF

Source: Authors

Table 3: Usage of the capacity

Country	2011	2012	2013	2014
Czech Republic	**110%**	**112%**	**78%**	**87%**
Slovakia	**100%**	**100%**	**94%**	**91%**
Polland	**99%**	**99%**	**96%**	**90%**
Hungary	**136%**	**137%**	**143%**	**141%**

Source: Authors

The Impacts of Decentralization on the Quality of Public Procurement

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Abstract. The article deals with the influence of decentralization and other factors on the quality of public procurement. The quality of public procurement in our concept is indicated by the odds ratio that the Office for the Protection of Competition will find a violation by the contracting authority. The basic tool of our analysis is the logit model which we apply to data on public procurement for 2011-2015, which we then match with the decisions of the Office for the Protection of Competition. The results are quite surprising because the best results in this area were achieved by the regions, not the central government, where there should be better conditions in the form of the qualifications of the employees.

Keywords: public procurement, decentralization, the Office for Protection of Competition

JEL Classification: H57, H72, H77

1 Introduction

The basic theory of decentralization is associated with Oats' theorem. The transition to the decentralization of public goods and services has become one of the basic tools for improving public sector efficiency. When evaluating the consequences of decentralization, the issue is not whether or not to decentralize in a general fashion, but rather what functions, in which sectors, and in what regions should be decentralized. In many cases it is not important whether the service is provided by the central or local government, but how to coordinate the provision of these services (Prudhomme, 1995). The theoretical framework for these decisions has been defined by (Freille, Hague, Kneller, 2007), who distinguishes a so-called market decentralization, which is associated with traditional fiscal federalism, political decentralization in terms of the transfer of decision-making to citizens, constitutional decentralization in terms of creating federal institutions in the regions, spatial decentralization which includes regional development outside major urban areas.

For our analysis, the important issues are: the current level of knowledge of the impact of decentralization on efficiency of public procurement. In the area of public procurement, we can identify several comparative studies, for example. (Halásková, 2015), which utilizes the theoretical-empirical model to evaluate the role of territorial self-governments connected with procuring local public services in fifteen EU Countries. We consider (Březovník, Oplotník, Vojinovič, 2015) to be the most important study. It analyzes the current state of decentralization of public procurement in European Union countries, in addition to the classic benefits of decentralization, the authors also mention the importance for small and medium business.

They also mention the impact of the economic crisis as a trigger for reflection on the transition towards a greater centralization of public procurement, and, of course, modern electronic tools such as electronic auctions or systems to aggregate demand have a strong influence on this trend. From an economic perspective, the benefits of centralization consist of achieving economies of scale, which is reflected by lower prices and fewer transaction costs. Having a professional and qualified staff providing these activities is also a very important factor. However, the coordination of activities between the branches of government, and selecting the most appropriate way of organizing public-public partnerships (vertical or horizontal), so as to achieve the greatest possible efficiency remains problematic. Further studies on the centralization or decentralization of public procurement are from Sigma (2000, 2007).

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Additional studies which we can mention looking at the impact of decentralization on public procurement in individual countries are, for example, Italy (Dametri, et. al. 2012), Serbia (Jovanovic, et. al., 2013), Slovakia (Pavel, Sičáková-Beblavá, 2012) and The Czech Republic (Plaček, et. al. 2015).

The aim of this article is to use an econometric model to analyze the influence of the factor of decentralization on the probability that the Office for the Protection of Competition (OFC) will rule that a violation was committed by a contracting authority.

2 Decentralization of public procurement

A significant volume of resources is awarded annually on public contracts. In 2014, the volume of public contract market in the Czech Republic had a value of 577 bil. CZK. In 2014, the public sector contracting entities allocated 13.5% of GDP though public contracts. In 2015 this share was 13.7% of GDP (see the Annual Report of Public Procurement 2014, MMR, May 2015). In the EU – 28, the proportion of total expenditures on public works, goods and services (excluding utilities) as a % of GDP amounted to 13.67% in 2013 (EC, 2015). As is evident, a considerable amount of public funds is allocated through public procurement. It also follows that each step to streamline the process of public procurement will bring considerable savings of resources.

Public procurement in the Czech Republic faces the same problems as in other post-socialist countries. It is not only corruption (the Czech Republic was listed 53th place in the CPI index published by Transparency International in 2014), but also other problems such as over-legislation (Nemec, et al., 2015), the pursuit of bureaucratic safety (Nemec, et. al., 2015). And of course, last but not least the limited capacity of public authorities to implement the process of public procurement themselves in an efficient manner. This capacity can be expressed by the zIndex. The zIndex is the result of academic research at the Faculty of Social Sciences at Charles University. It is published by the Centre of Applied Economics o.s. The zIndex is a tool that indicates consistency public contracts with good practice, as it is given by the Ministry of Regional Development and International Institutions. The zIndex consists of eleven quantitative indicators (proportion of public contracts on total purchases, tendering, consistent negotiation, the concentration of suppliers, the number of offers, using tools that support competition, errors in the contest according to the OPC, the quality of data in the official bulletin, the quality of data on profiles, supplier evaluations and the provision of information on request. The values of the zIndex are between 0 and 100, with 0 being the worst and 100 the best. The zIndex is divided into three categories, namely the state government, big cities, and small cities (towns).

In the category of state administration, the zIndex evaluated 92 contracting authorities from 2012-2014. The average from the zIndex was 64. The highest value of the zIndex was 78 and the lowest value was 38. In the category of large cities, the zIndex evaluated 60 contracting authorities and the average value from the Z Index was 64. The highest value achieved was 76 and the lowest was 45. In the category of small cities, 121 submitters were evaluated having an average value from the zIndex of 59. The highest value was 75 and the lowest was 27. We consider the values of the zIndex, unlike many others, to faithfully describe the procurement market relatively. It indicates that there is quite a considerable amount of room for the improvement of the system and also that there are quite significant differences among the contracting authorities. The situation in the category of small cities/towns is very significant.

3 Data and Methodology

In the empirical analysis, data on public contracts was used, whose publication or awarding was published in the Bulletin of public procurement in 2010 and 2014 (including canceled contracts). There were a total of 69,959 contracts, where contracts which had been divided into parts were processed as if they were whole. These data were combined with information about the administrative decisions of the OFC issued during the period January 2011 to March 2015. Data on these decisions is published in the Collection of Decisions of the OFC, which includes 1965 first-instance decisions. Since this data contains more decisions regarding the same contract and some decisions related to contracts which are not published in the Bulletin of public procurement (e.g. minor public contracts or cases where the contracting authority failed to publish data in the bulletin) as well as reviews concerning contracts started before the reporting period, a total of 867 of the contracts listed in the Bulletin of public procurement were tracked, of which the OFC led the administrative procedures. Of this total, 752 proceedings were commenced by petition, and in 258 cases the Office found violations of the law by the contracting authority. Given the nature of the response variables, logit model was used, utilizing the logistic function during parameter estimation.

4 Response Variables

A partial explanation of the odds ratio that a contract will be subject to review by the Office for Protection of Competition is sought in the model, therefore, it is of interest to find which contract parameters are subject to investigation more often. For this reason, a corresponding artificial variable was created that takes a value of 1 in

the case that the OFC leads an administrative procedure against a specific public contract and a value of 0 for other contracts.

An additional explanatory variable is used regarding whether the OFC found violations of the law by the contracting authority involving a public contract, and upon which, it proceeded to impose corrective measures or fines. In this case, the variable takes the value 1, otherwise, it is 0.

5 Explanatory Variables

The level of decentralization of the contracting authorities

Further characteristics of the variables are listed in the following Table.

Table 1: The level of decentralization of the contracting authorities

The degree of decentralization of the contracting authorities	Frequency	% share
State	**7 934**	**11.3**
Regions	**4 390**	**6,3**
Municipalities	**20 730**	**29.6**
Others (unclassified)	**36 905**	**52.8**
Total	**69 959**	**100**

Source: Bulletin of public procurement, custom categorization by the name of the contracting entity.

The other explanatory variables, which are based on previously realized econometric studies, deal with the efficiency of public procurement. Thanks to their inclusion in the model, there is an increase in adjusted coefficient determination. Further included explanatory variables are the following:

Estimated value of the public contract

As an explanatory variable for describing the size of the public procurement, its estimated value is used. This is denominated in CZK without VAT. This value is the sponsor's responsibility to determine prior to the commencement of a public contract and this value also determines whether the contracting authority may proceed according to the law, or not.

The estimated value of the obtained data possesses an average 24 510 490.05 and the median is 4.8 million CZK. Contracts having a value of less than CZK 10 000 were also removed from the data, since the unit price or the value had apparently been mistakenly entered.

Type of contract and type of award procedure

When specifying the type of public contract, the basic divisions of procurement procedures according to the law were used. The data analyzed included: 23,509 contracts for supplies, 19,326 service contracts and 27,124 contracts for construction work. Depending on the degree of openness, we distinguish the following types of procurement procedures: open tender, restricted tender, negotiated procedure with publication, negotiated procedure without prior publication, simplified below the threshold procedure, awarding of a contract without prior publication of a contract notice in the Official Journal of the European Union.

Administration of an external entity

Another factor to anticipate was the possible impact on the course of the procurement procedure when the contract was administered by the internal resources of the contracting authority or by the utilization of external administrators of public contracts (typically, the services of consulting companies or law firms). This information could be found in the contact details on the administrator's contract specified in the Bulletin of Public Procurement. External administrators were used in 14.5% of cases from the analyzed data.

Other explanatory variables

- whether there was use of the evaluation based on the lowest bid price - 73.3% of analyzed orders
- whether there was use of electronic auctions - in 3,4%
- contract is financed from EU subsidies - 42.8%
- contract is divided into parts - 10.7%
- contract is awarded to another contracting authority (central procurement) - 3.2%

6 Results and Discussion

The following Table presents the results of the econometric model:

Table 2: Results of logit model
Logit, using observations 69958, Missing or incomplete observations dropped: 2945, Dependent variable: errors Standard errors based on Hessian

	Coefficient	Std. Error	z	p-value
const	**−6.23522**	**0.225528**	**-27.6472**	**<0.00001**
Regions	**−1.06975**	**0.386785**	**-2.7657**	**0.00568**
the evaluation based on the lowest bid price	**−0.775813**	**0.128903**	**-6.0186**	**<0.00001**
financed from EU subsidies	**0.356535**	**0.129155**	**2.7605**	**0.00577**
service contracts	**0.611102**	**0.133619**	**4.5735**	**<0.00001**
open tender	**1.08972**	**0.203847**	**5.3458**	**<0.00001**
restricted tender	**1.78844**	**0.261327**	**6.8437**	**<0.00001**
Negotiated procedure without prior publication	**−0.815817**	**0.452713**	**-1.8021**	**0.07154**

Mean dependent var	**0.003763**	**S.D. dependent var**	**0.061228**
McFadden R-squared	**0.058613**	**Adjusted R-squared**	**0.052559**
Log-likelihood	**−1554.930**	**Akaike criterion**	**3129.861**
Schwarz criterion	**3220.941**	**Hannan-Quinn**	**3158.014**

Source: Authors.

In this model, which examines the odds ratio that the contracting authority will be found to have committed a violation of the law, we reached some crucial findings. When the sponsor is a region, the chanced of discovering violations are significantly reduced. The central government and the municipality variables are not statistically significant.

In the case of regions, public procurements appear to have higher quality results than in the cases of municipalities and the central government. This finding is surprising because modern studies, e.g. (Březovník, Oplotník, Vojinovič, 2015) indicate the benefits of centralization regarding improvements in public procurement, as the central authorities have more qualified personnel. Therefore, the best results should be achieved by central government.

In the Czech Republic, the regions sit upon the middle degree of centralization / decentralization, and can be assumed to have qualified personnel. This may also explain the statistically insignificant results in the case of the municipalities. The Czech Republic is characterized by a high degree of territorial fragmentation, which is dominated by municipalities with sizes up to 1000 people. Due to the size of the municipal budget, however, it is very difficult to get qualified staff for the administration of public contracts.

This reality limits the effect of the accountability factor a great deal, and this factor has the greatest potential for municipalities. Accountability is currently associated with fiscal decentralization, and has, according to empirical studies, for example (Freie, Hague, Kneller, 2007) a significant impact on the level of corruption, which is a big problem with public contracts even in the Czech Republic.

The better results of the regions in public contracts has also been confirmed by the study (Placek et al. 2016) which analyzes the impact of decentralization on the purchase of homogeneous commodities such as natural gas. In this area, the region achieved better results than the state and municipalities. The authors explain this fact to the effects of the economies of scale and less on the difficulties of coordinating purchases.

Another interesting finding is the fact that the evaluation of the tenders according to the lowest tender price significantly reduces the odds ratio of violations being found by the Office for the Protection of Competition. Conversely, the funding of contract by grants increases the chances of violations being found by the OFC. This situation can be explained by two factors, with one being a greater emphasis from the OFC to oversee contracts funded through grants from the EU, and the existence of a higher potential for corruption with these contracts.

The odds ratio of a contracting authority committing a violation also increase based on the type of award procedures for services, this fact can generally be associated with the difficult evaluations for such contracts, e.g.

for legal and advisory services. If we focus on the type of award procedures, open and restricted procedures carry the highest risk of violations, whereas the chances fall with the negotiated without prior publication procedure.

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Open budget data and current praxis in Czech towns

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Abstract. Publishing budget data as Open Data can increase budget transparency. The paper specifies the concept of open budget data and evaluates the format of the published 2015 draft budget in 77 Czech towns and the diffusion of the so called click-through budgets. The potential of the open budget data remains so far unused: Analyzed towns published the draft budgets mostly as scanned images or PDF files, only 11 towns published the draft budget in the xls format. Use of open machine-readable formats was not observed. At least 20 towns use a click-through budget, but their characteristics differ significantly.
Keywords: municipal budget, open budget data, budget transparency.
JEL Classification: H72, C8

1 Introduction

Budget transparency is perceived as a tool for effectiveness improvement, accountability enhancement (Heald, 2003) and increase of the probability that corrupt or wrong decision is detected (Bac, 2001). Government officials often think that they give clear information on the budget and budget management but are puzzled by citizens' responses (Rubin, 2000). Full disclosure of all relevant fiscal information in a timely and systematic manner (OECD, 2003) does not necessarily mean that citizens know if they are getting a good deal for their money (Rubin, 1996). The pure availability of budget documents is thus accompanied by the requirement of their accessibility to the public, i.e. that governments are proactive in helping the general public to make sense of the budget (Ramkumar and Shapiro, 2011).

Financial management information systems became an important tool for increasing budget transparency in the last decade, but they rarely provide open budget data. (Dener and Min, 2013). "Open" indicates the legal and technical reusability of budget data (Gray, 2015). Publication and further utilization of open data in case of budget data may be an interesting way how to make these information really accessible to the public. Prerequisite for this is disclosure of budget data in open and machine-readable formats under terms and conditions allowing its re-use.

The purpose of the paper is to specify the concept of open budget data and to assess the current praxis in Czech towns in case of the 2015 draft budget. We also assess how the Czech towns make the budget data accessible in a form of so called click-through budgets, i.e. web-based platforms allowing exploration and sometimes even analysis of budget data.

First we define the concept of open budget data, then we describe the data and methods used in our survey and summarize the main results. Finally we discuss our findings and provide conclusions.

2 Open Budget Data

Open Data is data "that can be freely used, re-used and redistributed by anyone – subject only, at most, to the requirement to attribute and sharealike" (Open Knowledge, n.d.). Open Definition (Open Knowledge, n.d) provides a precise definition of what "open" means in Open Data. Open Data needs to be open both legally and technically (Open Knowledge, n.d.). Legal openness of data means that it needs to be available under a licence that permits its free reuse and redistribution (open licence). Technical openness means that data needs to be available as a complete dataset in a machine-readable format and preferably it should be available for free download from the Internet.

Even if data is available under an open licence it could be published in variety of data formats. Sir Tim Berners-Lee (2006) suggested 5-star deployment scheme for Open Data which classifies openness of data according to the used format. The individual levels of the 5-star scheme are explained in Table .

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Table 1: 5-star deployment scheme for Open Data

Level	Description
1-star Open Data	Data available on the Web under an open licence in any format, e.g. a PDF document.
2-star Open Data	Data available on the Web under an open licence in a structured data format, e.g. an Excel spreadsheet.
3-star Open Data	Data available on the Web under an open licence in a non-proprietary open format, e.g. CSV file.
4-star Open Data	Data available on the Web under an open licence in a non-proprietary open format. URIs (Uniform Resource Identifiers) are used as identifiers of individual pieces of data.
5-star Open Data	Data available on the Web under an open licence in a non-proprietary open format. URIs are used as identifiers of individual pieces of data. Data is linked to other data to provide context.

Source: based on Hausenblas, 2015

5-star deployment scheme for Open Data promotes machine-readability of data as it makes reuse of data easier. 5-star Open Data, the highest level of openness according to Berners-Lee (2006), represents not only Open Data but also Linked Data. Linked Data is a set of principles for publishing and connecting data on the Web. Primary format of 5-star Open Data is RDF – Resource Description Framework (Schreiber and Raimond, 2014). Linked Data allows describing things in the world with structured data and connecting them using web technologies (Bizer et al., 2009).

According to Gray (2015, 11) open budget data can be defined as "public financial information used in the budget cycle that is freely available in a machine readable format to use, modify and share (as per opendefinition.org)". Publishing of budget data in a form of Open Data is a way how digital technologies could be used to make budget data available to the public. Gray (2015) argues that use of digital technologies to circulate and utilise budget data in a society could affect public debate, government accountability as well as public participation in decision-making about public funds.

Availability of budget data as Open Data is also an important maturity indicator of Open Data initiatives because it is one of the datasets or data domains that are used to benchmark countries in both the Global Open Data Index (Open Knowledge, n.d.) and the Open Data Barometer (World Wide Web Foundation, 2015).

3 Data and methods

Budgetary process is composed of four main phases: preparation, debate, execution and control and during its course several budget documents are compiled (Sedmihradská, 2015, 37). In our research we focused on two documents: the draft budget and the click-through budget.

The draft budget is the outcome of the early stages of the budget process and it enters the public part of the budget debate, in which both the council members and citizens can take part. In the Czech Republic it is obligatorily published before the approval in the legislative body (i.e., the town council). The published draft budget has several roles or functions: It is the basis for the debate and the decision making (i.e., council approval). It provides information about the local government activities, plans and priorities. It is an important tool of public accountability as voters can hold the officials accounTable for their fiscal action in the elections (Rickards, 1990, 73).

Czech legal regulation gives only minimal requirements and leaves significant space for local governments. The law on budgetary rules for local governments (Act no. 250/2000 Coll., §11-3) requires that the full (unabridged) version of the draft budget is published on the web or the electronic public notice of the local government at least 15 days before the budget debate in the council. While the mandatory content of an abridged version is specified (revenues and expenditures classified according to individual classes of the budget classification, i.e., tax revenues, non-tax revenues, capital revenues, grants, current expenditures and capital expenditures), the unabridged version is not. The level of detail of the budget classification used is not specified with the exception that binding indicators have to be indicated, but the structure of binding indicators is not specified by the law. Thus the regulation generally leaves the decision, how detailed the draft budget is and what its content or format is on the local government.

In the period January – March 2015 the draft budgets for the fiscal year 2015 were searched at the web pages of all 131 Czech towns with more than 10 thousands inhabitants. Finally, 77 draft budgets were collected and their format was evaluated according to five criteria (see below). The reason for inability to collect all the drafts is caused by the fact, that the legislation currently requires that the draft budget is published for a period of 15 days before the draft budget is debated in the town council. After that there is no requirement to keep the draft published, it is sufficient to publish the approved budget.

A quick comparison of the format of the draft budgets in 77 towns and the approved budgets in the remaining 54 towns showed significant differences and therefore we decided to do the analysis only for the homogenous group of the draft budgets.

The criteria for draft budgets evaluation were:

- Number of files.
- Type of file: doc, xls, pdf, which allows searching in the document itself (i.e. Ctrl+F function found a searched for term) and an image (either pdf or any other format of a scanned document which did not allow any search inside of the document).
- Presence of commentary, i.e. any narrative accompanying the data.
- Presence of comparison with the previous year, i.e., any information about 2014 regardless it was approved or amended budget or expected or real budget execution.
- Presence of multi-year budget outlook.

The analysis was undertaken through pivot Tables and the difference of means test (t-test).

The click-through budgets are various web based platforms which enable different, partly customized, views on budgets and management. In March 2016 at least 20 Czech towns with more than 10 thousands inhabitants used such a platform. Specific functions and characteristics of these platforms were identified.

4 Results and discussion

Current praxis in publishing of the draft budget differs significantly among the analysed towns (Table). The most common way (61%) is publication in a single file, either in pdf or as a scanned image. The only advantage of this approach is simplicity to the user who needn´t to open multiple files (up to 25 in one case or 15 in three cases). At the same time this approach allows to publish in a single file both Tables and narrative (in about 62%). If a single xls file is used, the narrative is missing. However further reuse of the data published as a pdf file or scanned image is limited as these formats do not allow easy manipulation and processing of the data.

Only 11 towns (14%) of municipalities use xls files, i.e. files which enable further elaboration of the data and could comply with the 2-star Open Data level in case they are legally open (Table). These Tables are mostly accompanied by a narrative presented in another file(s) and in other formats.

Table 2: Type and number of files presenting the draft budget

	Number of files				
Type of file	**1**	**2**	**more**	**total**	
pdf	27	6	8	41	53%
scanned image	20	2	3	25	32%
xls+doc		1	4	5	6%
xls+pdf		1	3	4	5%
xls	2			2	3%
total	49	10	18	77	

Source: authors

The size of the town plays some role: bigger towns published more often a narrative to the budget and the draft budget contains more often either the multi-year budget outlook or the comparison with previous year (Table). On the other hand the number of files or their format is not influenced by the size of the town.

Table 3: Characteristics of the draft budget in different size categories

Size category	10-15 thousands	15-30 thousands	30 thousands +	total
commentary	31,8%*	51,6%*	75,0%*	53,2%
outlook	9,1%*	25,8%	33,3%*	23,4%
comparison	36,4%*	61,3%*	58,3%	53,2%
number of files	3,0	3,2	2,9	3,1
xls	13,6%	12,9%	16,7%	14,3%
image	31,8%	38,7%	25,0%	32,5%
Number of towns	22	31	24	77

Note: *the difference of means test (t-test) showed statistically significant differences at 95% confidence level between marked groups of towns and variables
Source: authors

The draft budget is the budget document which receives the biggest attention both from the politicians and the public (Sedmihradská, 2015). On the other hand it is not yet the part of the financial management information system so it is not possible to rely on any automatic features of the system, even if they exist.

The quickly spreading praxis of click-through budget shows local interest to provide budget data also in other, new formats using digital technologies. In March 2016 at least 20 Czech towns used a click-through budget.

While there are several major providers of these platforms, the content and functions differ among the towns significantly. Regarding the time span the budgets cover from a single year (e.g., 2015 in Vsetín) to nine years (e.g., 2008-2016 in Hradec Králové). Some of the towns provide information about the approved budget only (e.g., Plzeň for 2016, but it may change in the course of the year), some towns show the budget execution in real time (e.g.,Znojmo shows the date from the previous day). Some of the towns use only the mandatory budget classification and some provide their own views in a form of the administration classification (e.g., in Olomouc) or based on major investments (e.g., Havlíčkův Brod). Some of the towns try to link budget data with data on public procurement (e.g., Nové Město na Moravě). The detail of the executed expenditures differs as well, some of the towns stay at the lowest level of the budget classification, but some go into a greater detail (e.g., level of individual suppliers shows Kroměříž or Zlín and level of individual invoices shows city district Praha 5). Some of the platforms allow to download some of the data in either pdf or xls file.

Some of the towns do not provide own clicking-based budget but they provide a link to the Monitor státní pokladny platform provided by the Ministry of Finance. This platform offers open budget data which are based on the regular reporting statements delivered by the individual local governments. The advantage of this platform is its uniformity across all the governments and Open Data format, but it only covers the approved, amended and executed budget with a delay of a few months, not the draft budget we focused on.

5 Conclusions

While budget transparency and Open Data are in the literature often viewed as complements, our survey among Czech towns with more than ten thousands inhabitants did not confirm that Czech towns follow this approach yet. At least some of the towns try to improve budget transparency which is demonstrated by the publication of the commentary to the draft budget or provision of the click-through budget but not the usage of the open budget data. Only 14 % of the published draft budgets in xls format. This format allows further analysis of the data in some spreadsheet application however it would qualify as 2-star Open Data at best.

Increasing accessibility of local budgets to the public can have various forms, but the format of the published draft budget can either promote or prevent them. Compilation of a Citizens guide to the municipal budget (Sedmihradská, 2016) done by one of the authors would never be possible if the data was not available in the xls format.

The resulting recommendation is quite straightforward: promote the concept of Open Data among local financial official. The format simply matters!

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Willingness to pay for improving health services in the Basque Country

Waleska Sigüenza*

Abstract. The aim of this work is to assign an economic value to health services in the Basque Country. For this purpose, a survey was conducted including a discrete choice experiment. A Mixed Logit Model has been specified in order to analyze stated responses and obtain economic values. The results indicate that the highest valued attribute of current public health is the quality of health professional's treatment and that there is heterogeneity in other individual preferences, such as: the waiting time for specialist, surgical operation and hospital comfort. Groups of individuals with different preferences have also been identified, namely self-employee, individuals with university degree and individuals with high income. The main contribution of this work has been to quantify, in monetary terms, the individual preferences with regard to health services in the Basque Country. This assessment could be used both in insurance business and politics of public resource allocation.
Keywords: Health services, Discrete Choice Experiment.
JEL Classification: I11, I18, C35.

1 Introduction

The motivation of this work lies in the growing concern for maintaining the balance between limited resources and increasing needs in the field of health care.

Advances in the field of health, with new technologies or new medical treatments, increase life expectancy and social welfare, but at the same time represent an important growth in health spending which involves more and more difficulties to policy makers.

In addition, the current economic situation pushes the Government to minimize spending on health care, resulting in a significant loss of global welfare.

Therefore, we understand that it is important on one hand to learn, related to health care, what are the individual preferences and in the other hand, to have tools that allow us to rate the global welfare loss due to cuts in health benefits.

The objectives are: to estimate, based on stated preferences, the change in the individual utility caused by marginal improvement of certain health services, to analyze the possible heterogeneity in individual preferences and to calculate people´s willingness to pay for marginal improvements in these health services.

2 Data

We have used a discrete choice experiment (DCE) (Erdem *et al.*, 2013; Huynh *et al.*, 2013; Whitty *et al.*, 2013), including a design of a survey that has allowed us to obtain information about the individual preferences of hypothetical changes in the factors that characterize the public health services (Louviere *et al*., 2000; Viney *et al*., 2002).

To each respondent are presented 12 hypothetical different scenarios (12 choice sets) to which respondents must express their preferences. Each of the 12 choice set are independent of the rest and all of them include three different alternatives (Rose y Bliemer, 2005 and 2013).

The three alternatives are characterized with the same attributes of the health care system. However, each one has different levels of such attributes as a result of a marginal improvement. Every different level has an associated cost (Figure 1).

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Table 1: Example of choice set

	Statu quo	Alternative 1	Alternative 2
Waiting time for specialist	3 months	1 month	3 months
Waiting time for surgical operation	8 months	5 months	8 months
Hospital comfort	LOW	LOW	HIGH
Quality of health professional's treatment	LOW	HIGH	MEDIUM
Dental coverage	LOW	HIGH	LOW
Cost	0€/month	30€/month	90€/month

Source: Own work

Thus, the alternative A represents the current situation (statu quo) without any marginal improvement and therefore with an associated cost zero. Instead alternatives B and C collect the effects of different performances in public health services in the Basque Country and have associated cost that translates into a monthly payment for the individual (Louviere *et al.*, 2000; Hensher *et al.*, 2005; Ryan *et al*., 2008; Street *et al.*, 2005).

3 Methods

In terms of the methodology, we have used a multinomial logit model and random parameter logit model (McFadden y Train, 2000; Hensher y Greene, 2003a y 2003b; Hensher *et al.*, 2005).. In both cases the dependent variable takes the following values

$$Y_i = \begin{cases} 1 & if\ the\ individual has\ chosen\ the\ option\ A\ (Statu\ quo) \\ 2 & if\ the\ individual has\ chosen\ the\ option\ B\ (Alternative\ 1) \\ 3 & if\ the\ individual has\ chosen\ the\ option\ C\ (Alternative\ 2) \end{cases}$$

4 Results

With the estimation of the multinomial logit model (Figure 2) we get a first approach to the information on the change of the individual utility against changes in health services.

The signs of the estimated coefficients are in line with expectations; that is to say, there will be a decrease in individual utility if the "*Waiting time for specialist",* the "*Waiting time for surgical operation*" or the "*Cost*" increases.

Table 2: Results from multinomial logit model

Variable	MNL Coefficient		SE
Waiting time for specialist	-0,155	***	0,047
Waiting time for surgical operation	-0,203	***	0,016
Hospital comfort	0,193	***	0,061
Quality of health professional's treatment	0,574	***	0,054
Dental coverage	0,283	***	0,067
Cost	-0,029	***	0,002

*$0.1 > p \geq 0.05$
**$0.050 > p \geq 0.01$
***$0.01 > p \geq 0.0001$

Source: Own work

On the other hand, there will be an increase in individual utility if the "*Hospital comfort*", the "*Quality of health professional's treatment*" or the *"Dental coverage"* improves.

Then, we have estimated a random parameter logit model and based on the estimated coefficients we have calculated the willingness to pay (Figure 3) for marginal improvements in health services Krinsky y Robb (1986).

Figure 3: Willingness to pay for marginal improvements in health services

	Waiting time for specialist	**Waiting time for surgical operation**	**Hospital comfort**	**Quality of health professional's treatment**	**Dental coverage**
Individual reference	-9,4 (-56,6 ; -0,8)	-4,8 (-16,3 ; -1,1)	4,2 (0,2 ; 83,8)	17,0	9,6
Self-employed		-21,8 (-73,8 ; -5,2)			
University Degree	-12,0 (-72,6 ; -1,021)				
High Income	-5,8 (-35,6 ; -0,5)				
Weighted WTP	**-8,7 (-56,7 ; -0,7)**	**-5,6 (-18,7 ; -1,2)**	**4,2 (0,2 ; 83,8)**	**17,0**	**9,6**

Source: Own work

We have carried out the simulation of these willingness to pay considering heterogeneity of individual preferences, both observed and not observed.

It is necessary to point out that the willingness to pay for the attributes "*Waiting time for specialist"* and "*Waiting time for surgical operation*" is negative by the definition of the attribute. Therefore, in these cases the estimated values should be interpreted as willingness to pay to avoid a marginal increase of the timeouts.

The willingness to pay to avoid an increase of a month in the "*Waiting time for specialist"* is located around 9€/month. This willingness to pay increases in the case of individuals with university degree and decreases if they are individuals with high income. The willingness to pay to avoid an increase of a month in the "*Waiting time for surgical operation*" is located around 5€/month. This willingness to pay is significantly higher for the self-employed.

If we look at the weighted average value of the willingness to pay, the higher value corresponds to the willingness to pay for a marginal improvement in the attribute "*Quality of health professional's treatment*" and the least for obtaining a marginal improvement in the "*Hospital comfort*".

At the time of the study, the willingness to pay for a marginal improvement in dental coverage was, approximately, like the cost of a dental insurance private with basic coverage (DKV Dentisalud, 2013).

5 Conclusions

Based on the results, we can conclude that we have obtained changes in individual utility in line with our expectations, observing a decrease in the individual utility if the *"Waiting time for specialist"*, the *"Waiting time for surgical operation"* or the *"Cost"* increases. In addition, we have found that there will be an increase in individual utility if the *"Hospital comfort"* the *"Quality of health professional's treatment"* or the *"Dental coverage"* improves.

On the other hand we have seen as the heterogeneity in individual preferences is partially explained by some social-demographic characteristics of our survey. We can conclude that the preferences of self-employed, people with university degree and individuals with high income are significantly different from those of the rest of individuals.

In terms of economic valuation of the public health services, made by individuals, we can say that the highest valued attribute of current public health is the "*Quality of health professional's treatment*", reflecting the importance attributed to the human factor (Gimeno *et al*., 2006; Murillo y Saurina, 2013).

With regard to the willingness to pay for a marginal improvement in the hospital comfort, it is surprising the low willingness to pay obtained because the literature includes the widespread dissatisfaction of individuals with respect to this attribute (Donabedian, 2001; Santiñá *et al*., 2002; Monteagudo *et al*., 2003; Herrera-Espiñeira *et al*., 2005; Herrera-Espiñeira *et al*., 2009). For this reason, we can conclude that either in the Basque Country there is not great dissatisfaction with respect to this attribute or it is not a very relevant variable.

We understand that the results of this work can be considered useful both from the point of view of a public and a private since they relate to the health care market in which coexist and compete both sectors.

With respect to the public sector and policies related to health care, if we know the economic value that individuals give to health services, it could prioritize the policies to improve health care based on the individual preferences (García-Altés *et al.*, 2011; Peiró *et al.*, 2011; López-Casasnovas y Soley, 2012). Whilst, if the target is cuts in health services, we could estimate the social cost of these cuts and chose those that involve less loss of social global welfare.

Meanwhile, insurance companies, in the design of their policies, could consider the willingness to pay obtained and develop a more attractive offer which fits better the consumer preferences.

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Chosen Issues of the Management of Longevity Risk in Polish Pension System

Marek Szczepański*

Abstract. Life expectancy has been rapidly increasing and remains uncertain in all OECD countries, including Poland. One of the many economic and social consequences of this process is the increase of the longevity risk in social security systems. The article focuses on the issues of managing longevity risk in the pension system in Poland, in particular - the construction of public and supplementary pension systems and its ability to adapt to the challenges associated with longevity risk. Particular attention has been paid to the analysis of public structures and supplementary pension schemes in the phase of payment of benefits (decumulation). The author argues that both the public pension system, as well as supplementary pension schemes in Poland, do not secure adequate protection against the risk of longevity. While in the public retirement system the aggregate longevity risk exists, the participants of additional pension systems are exposed to individual longevity risk. The limitation of these risks requires significant structural changes both in public and additional pension schemes in Poland.

Keywords: longevity risk, life expectancy, public and additional pension systems, social policy

JEL Classification: I 38, J 26**.**

1 Introduction: longevity risk in a pension system

Continued progress in living conditions and health standards has increased an average life expectancy in all OECD countries, including Poland (see Table 1). Life expectancy at birth now exceeds 79 years on average across the OECD. The 25 years between 1983 and 2008 saw an average rise in life expectancy of about six years (OECD 2011). Taking into consideration the longer perspective, Antolin (2007, p. 3) states that "the length of time that people are expected to live in most OECD countries has increased by 25 to 30 years in the last century". Max Planck Institute for Demographic Research (MPDR) reports on the remarkably sTable increase in life expectancy since 1840. A summary aggregate statistic (defined as the highest life expectancy of all countries in a given year) has been increasing steadily every decade, by about 2.5 years for women and 2.2 years for men (Vaupel, 2011, 2002, Zelenko, 2014, p. 36).

Table 1: Life expectancy in Poland and other OECD countries - comparison

Life expectancy at birth* in 2008 or latest year		Rise of life expectancy between 1983 and 2008		Rise of life expectancy between 1970 and 2011	
OECD (average)	Poland	OECD (average)	Poland	OECD (average)	Poland
79.3	75.6	6.0	4.5	10.1	6.9

Source: OECD Publishing, Paris (www.oecd.org/health/healthdata), and OECD Income Distribution and Poverty Database (www.oecd.org/els/social/inequality), [accessed: 15.03.2016] and Society at a Glance. Highlights:POLAND. OECD Social Indicators http://www.oecd.org/poland/OECD-SocietyAtaGlance2014-Highlights-Poland.pdf [accessed: 15.03.2016]

Note: * Life expectancy is defined as the average number of years that a person could be expected to live if he or she experienced the age-specific mortality rates prevalent in a given country in a particular year. It does not include the effect of any future decline in age-specific mortality rates.

The increase of life expectancy in Poland is even more impressive when we take into consideration longer period. For example, an expected lifetime period for men born in 1950 was 56.1 years and for women 61.7. Life expectancy for men born in 2014 was already 73.1 years and for women 81.1 years (see Figure 1).

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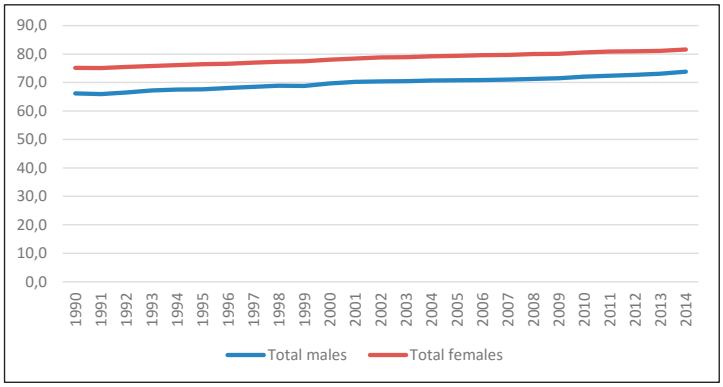
Figure 1: Life expectancy by sex in Poland in 1990-2013



Source: GUS, 2015. Life Expectancy Tables Poland 2014, GUS (Central Statistical Office of Poland), Warsaw 2015, http://www.stat.gov.pl [accessed: 10.03.2016]

The process of population aging in Poland is connected not only with increasing life expectancy (which is a positive phenomenon) but also with low fertility rate (which is rather a threat). At 1.30 children per women, Poland has the 3rd lowest fertility rate in the OECD (after Hunagy and Korea). This is lower than OECD average of 1.70 and much below the replacement level of 2.1 (OECD 2014).

The basis for further considerations is the proper definition of longevity risk, which is not the same as the demographic risk related to the aging of the population (Vostatek, 2014, p. 34). **Individual**, specific longevity risk can be defined of outliving one's pension savings. The second kind of risk is called the **aggregate** longevity **risk** (the trend risk). It consists of the fact that in a given cohort, the average life expectancy will be longer than expected and predicted in statistical forecasts. In other words, it is the risk of incorrect estimates of future trends in mortality rate. Bad estimation of life expectancy can undermine the sustainability of a pension scheme. Together, both specific and aggregate longevity risks form **total longevity risk** (Blake Borrows, 2001, p. 340, Blake, 2006, Rejda, 2001, Pitacco, Denuit, Haberman, Olivieri, 2009).

Demographic risk results from long term population trends, sometimes called demographic change. Demographic change means population ageing with the perspective of shrinking. While ageing is a global phenomenon, shrinking is local. Demographic change is the result of declining fertility rates and increasing life-expectancy; migration in some countries is locally compensating or accelerating these developments but in Poland migration to other EU countries (over 1.2 mln since joining EU in 2004) made the demographic risk for social security systems even worse.

Improvement in mortality rate and life expectancy is uncertain and the outcomes of future life expectancy pose many kinds of threats to social security systems as well as for individuals. In each demographic cohort there are people living longer than expected. From the point of view of pension economics, this basically positive phenomenon is connected also with certain risks (Antolin, 2007, p. 3), such as the risk of outliving one's pension savings – the individual longevity risk. Bad estimation of life expectancy can undermine the sustainability of a pension scheme (the risk addressed to pension provider – public or private) or negatively influence the wealth of pension benefits (risk addressed to pensioners). This kind of risk is called the aggregate longevity risk (the trend risk). It consists of the fact that in a given cohort, the average life expectancy will be longer than expected and predicted in statistical forecasts. In other words, it is the risk of incorrect estimates of future trends in mortality rate. Together, both specific and aggregate longevity risks form total longevity risk (Blake Borrows, 2001, p. 340, Blake, 2006, Rejda, 2001, Pitacco, Denuit, Haberman, Olivieri, 2009).

The risk of longevity, which refers to the phase of paying out pension benefits (pension capital decumulation) affects both public pension systems as well as the supplementary pension schemes (occupational or individual pension schemes). The degree of vulnerability of pension systems to longevity risk depends on their structure, and especially on the methods of calculating benefits (pension formula) and the method of payment of pension benefits. In order to manage longevity risk, it is particularly important to properly define the risks of old age covered by pension security.

2 Longevity risk the Polish pension system

Since the comprehensive, systemic reform introduced in 1999, the Polish pension system for employees and the self-employed has consisted of three pillars (see Table 2). The first pillar refers to mandatory notional-accounts defined contribution (NDC) scheme (Jarocińska et al, 2014, pp. 21-22). The total pension contribution rate amounts to 19.52% of gross wages (pillar 1 + pillar 2). The contributions (premiums) are financed equally by both employer and employee. 16.60 p.p. of pension contributions is transferred to pillar 1 (being written down on individual accounts of those insured and sub-accounts) and 2.92 p.p. goes to open pension funds (pillar 2), if the insured person is a member of OFE (Open Pension Fund). If not, all 19.52% are transferred to the first pillar (Rutecka, 2014, p. 130).

Table 2: The architecture (design) of the three pillar Polish pension system

Pillar 1	**Pillar 2**	**Pillar 3**
Mandatory	Mandatory/Voluntary*	Voluntary
PAYG	Funded	Funded
Basic pension benefit	Basic pension benefit	Additional/Complementary Pension benefit
Notional Defined Contribution (NDC)	Defined Contribution (DC)	Defined Contribution (DC)
Managed by public institution: Social Insurance Institution (ZUS)	Privately managed: Open pension funds (OFEs) managed by Pension Fund Societies (PFSs)	Privately managed: Individual and group (occupational) pension savings managed by different financial institutions

Source: own elaboration

Note: * Open Pension Funds (OFEs) have been introduced in 1999 and used to be obligatory since 1999. Since 1 April 2014 they are voluntary. The role of the second pillar has been marginalized.

While the first pillar (PAYG) is in the accumulation (savings) phase, a pension system is more sensitive to the risk of demographics which increases with the aging of the population, the funded pillar is subject to different (demographically less correlated) kinds of risk (including investment risk). The diversification of pension risk in the Polish pension system, however, was not only to be applied to the phase of its consumption (decumulation), which carries the risk of longevity. Both PAYG and the funded pillar are not immune to aggregate longevity risk in the pay-out phase of pension system.

Merging pension payments from the first and the second pillar in one state institution (ZUS) does not eliminate the aggregate longevity risk.

At the level of social security in the current Polish pension system, the individual longevity risk – assuming ownership of a reasonably long period of contribution – does not exist. Pensions are paid by the state until death – in a form of life annuity. The elimination of individual longevity in the public (base) pension system does not eliminate the aggregate longevity risk, which must be covered by the Social Insurance Institution and by the State which is responsible for paying pension benefits out of obligatory public pension scheme. The increasing life expectancy in Poland as a consequence of rising living standards, advances in medicine etc. in conjunction with declining birth rate and the increasing migration (the case of Poland – after joining EU about 1.5 million Polish citizens have migrated to other EU Member States to find better jobs and living conditions) is a very serious challenge for the public pension system financed (after the reduction of funded part of the system since 2011) mainly by the PAYG method. From the point of view of ZUS (and public finances) the risk of incorrect estimates of life expectancy trend (the aggregate longevity risk) lies in the fact that the given demographic cohort would live longer than the forecast provided annually by the Central Statistical Office (GUS). Since the pension reform in 1999, the amount of pension benefit in Poland has been calculated by dividing the accumulated pension capital (pension obligations) by the expected number of months of life for the given demographic cohort. The 1999 introduction of the defined contribution formula does not provide automatic financial stability and does not protect against the risk of longevity. When a certain demographic cohort will live longer than predicted, the aggregate longevity risk must be covered by the Social Insurance Institution (ZUS).

To a large extent, longevity risk affecting the people of a given year of beneficiaries (the demographic cohort) reduces the risk of a shorter than expected life span of other retirees receiving pensions. It is known that in every age group there are people living shorter than the average life expectancy, as well as those living longer than expected. It is difficult to assume that these two groups will always balance one another. Nevertheless, the risk of longevity cannot be completely eliminated, and the State (directly or indirectly) must take responsibility for the elderly, for whom the benefits of the public pension system are often the main or the sole source of income. Even

a part of the longevity risk in public pension system in Poland is not offset by any financial instruments (such as longevity SWAPS or longevity bonds). The Polish capital market does not offer such longevity hedging. Very few insurance companies operating in Poland offer insurance with life annuity payments and none of them is ready to take risk from the public pension system (for example in a form of a longevity SWAP).

The subject of the aggregate longevity risk is neither broadly discussed in Polish scientific literature nor in practice of the public pensions provider (the Social Insurance Institution). On the contrary, the most serious political discussions concern the restoration of the statutory retirement age (65 for men and 60 for women) in force as of 2014, and so the withdrawal of recently introduced reform on a gradual equalization of the retirement age for men and women of 67 years. Of course, again the shortening of the statutory retirement age only increases the aggregate longevity risk and generally the risk for public finance in Poland.

As for the additional voluntary pension systems functioning under the third, voluntary pillar, neither in the system of group savings for additional pension in the workplace (occupational pension systems – PPE, available since 1999), nor in individual systems (individual retirement accounts – IKE, operating since 2004, or individual retirement savings accounts – IKZE, since 2011) is there any product offered in the form of a retirement annuity. Legal regulations on occupational pension plans (Law of 20 April 2004 ... Art. 42), IKE and IKZE (The Act of 20 April 2004 ... Art. 34) provide that the payment of money may take place at once or in installments after a retiree reaches the age of 60 (occupational pension plans or individual retirement accounts) or 65 years (in individual accounts of retirement security). Any payment of installments will last until the depletion of savings accumulated in occupational pension plans, IRA or in individual accounts of retirement security, and not in the form of benefits payable for life. There is quite a realistic scenario, according to which a person saving for retirement will receive an additional one-time payment at the age of 60 or 65 years of age and by living unusually long such person will deplete this additional fund and in the last phase of life his or her standard of living (based solely on funding from the public pension system) will be significantly lower. Such a structure of payments from the third pillar of the pension system in Poland does not protect against longevity risk.

3 Final conclusions and recommendations

Public pension system in Poland is sensitive to longevity risk and this exposure is likely to enlarge in the nearest future (in 10-20 years' time) and as well as in the long, foreseeable horizon (till 2050). The reduction of the funded pillar in public pension scheme since 2011 and a retreat to the pension system prior to 1999 based almost exclusively on the PAYG financing method have caused a significant increase in longevity risk and an increase in the risks of damage to long-term sustainability of the pension system. But it is worth to mention that the longevity risk is relevant also for the funded part of the public pension system (especially in pay-out or decumulation phase of the pension capital gathered in pension funds).

The anticipated withdrawal from the extension and equalization of the statutory retirement age for men and women in the public pension system in Poland would increase the aggregate longevity risk and the systemic risk of the whole pension system in Poland – in both short and long term.

The purpose of the payment of benefits should be to ensure an optimal level of life for beneficiaries continued throughout the duration of life. The right solution to this problem requires the development of an algorithm and parameters to determine the optimal value of benefits. Actuarial risk is associated with the adoption of poorly estimated parameters (e.g. longer life expectancy in terms of months for a given demographic age group as the basis for the calculation of benefits in the new pension system). When pension payments are realized directly from the accumulated capital, a pensioner begins to bear a risk. Above the minimum guaranteed by the state, the level of benefits is determined by the amount of capital held and by legally defined algorithm for determining the scope of the provision. The adoption of the algorithm, which in the sphere of assumptions departs from reality, can provide two kinds of results.

The too slow decumulation of capital in the population reduces the beneficiaries' level of consumption and causes the transfer of non-consumed pension capital to the next generation. On the other hand, a too high payout level may end up with prematurely depleted capital and result in the realization of longevity risk. The problem then is a decline in living standards of pensioners and a burden for the state because of payments of minimal guaranteed pensions.

Therefore, the necessary missing link in the pension system is to create an institution of national actuary, which will be properly prepared for precise forecasting of demographic trends and appropriate calculation of base pension benefits on the basis of further life expectancy. This will enable a more effective management of both demographic and longevity risks.

Longevity risk is relevant also for the additional, voluntary pension schemes (called in Poland the third pillar) Additional pension systems (occupational pension systems – PPE, individual retirement accounts – IKE, individual retirement saving accounts – IKZE) do not protect the savers against longevity risk as they do not offer life annuities. In many countries, a widely used solution is to buy an annuity at the starting point of withdrawal of

accumulated additional pension capital. However, in Poland a life insurance with perpetuity payments is very poorly developed, and its availability is limited. As there are no additional systems in Poland with defined benefits – like the occupational pension systems in Western Europe or the U.S., aggregate longevity risk does not affect those employers who offer pension schemes.

The general conclusion that can be drawn from the analysis of the public and supplementary pension schemes in Poland: both the public pension system, as well as supplementary pension schemes in Poland, do not secure adequate protection against the risk of longevity. While in the public (the base) retirement system the aggregate longevity risk exists, the participants of additional pension systems are exposed to individual longevity risk.

The limitation of these risks requires significant structural changes both in public and additional pension schemes in Poland. Changes in the public pension system (including the introduction of the institution of the state actuary, the possible use of derivatives allowing for the transfer of the part of longevity risk to private institutions, such life insurance companies) should minimize the aggregate longevity risk. The introduction of compulsory conversion of savings accumulated in additional pension systems into a stream of annuity payments should reduce an individual's risk for participants' longevity of such systems.

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Old-age pension entitlement with respect to the minimum insurance period

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Abstract. The paper provides a comparative analysis of the minimum insurance period that entitles a person to the old-age pension in selected European countries, Canada and the United States. Based on the results, it presents the potential changes in the minimum insurance period in the Czech Republic. The subsequent analysis of the pension institution (ČSSZ) data file evaluates the impact of two possible variants of reforms of minimum contribution period for the pension entitlement of individuals in the time of their retirement with respect to both: men and woman. The following analysis provides a quantification of the impact of such changes on the balance of the Czech pension system.

Keywords: old-age pensions, gender equality, pension rights, pension reform.
JEL Classification: H55, J26, G22

1 Introduction

In order to qualify for the old-age pension, applicants are required to attain the statutory retirement age, however most pension systems impose additional conditions in terms of pension entitlement. The old-age pension is usually conditional upon the specific length of participation in the system or permanent residence in the country. In the Czech Republic, insured persons were entitled to the old-age pension as of the end of 2010 if they had been insured for at least 25 years and achieved the statutory retirement age. Under Act No. 306/2008 Coll,, amending the Pension Insurance Act No. 155/1995 Coll., the minimum insurance period has been gradually extended since 2010 from 25 years to the target of 35 years, which should be attained in 2019. In 2016, insured persons are entitled to the old-age pension upon reaching the retirement age as long as they have been insured for 32 years. Until 2010, insured persons who failed to complete the minimum insurance period upon reaching the retirement age were entitled to obtain the old-age pension 5 years later upon having completed at least 15 years of insurance. This requirement has also become stricter: the minimum insurance period for such persons was prolonged from 15 to 20 years of insurance in 2016. At the same time, Act No. 306/2008 Coll. stipulates that insured persons who failed to fulfil the conditions above are entitled to the old-age pension if they reached the retirement age in 2014 and have completed at least 30 years of insurance excluding non-contributory periods. (Periods counted towards the insurance period even though the contributor does not pay contributions.) Insured persons who fail to meet these conditions are also entitled to the old-age pension if they reach 65 years and fulfil the conditions for disability pension as laid out by the Pension Insurance Act. The impact of the aforementioned changes will be further strengthened by reducing the inclusion of majority of non-contributory periods into the minimum insurance period, in particular the exclusion of study years from the insurance period.

The minimum insurance period for the old-age pension entitlement is defined in publications of the European Commission as "a qualifying condition according to which the entitlement to benefits is subject to the person concerned having completed the minimum period of insurance, (self-)employment or residence" (Missoc Database, 2015). These publications use also the term "qualifying period" which can be considered akin to the aforementioned Czech concept. The insurance period refers in particular to the time during which the contributor pays into the system. The logic of participation being a prerequisite for an entitlement leads to the requirement for a certain minimum participation. Nevertheless, there are specific exceptions from this concept. In particular the non-contributory periods (Holub, 2004) allow for the participation of economically inactive persons under certain conditions.

According to the EC Joint Report on Pensions (2010) the increase in minimum contributory years could exclude from benefit claim people with interrupted employment careers and shorter insurance periods, among whom women are overrepresented, as they are more likely to hold part-time jobs and take career breaks due to family responsibilities. Such effects of the increase in minimum contributory years in European countries are discussed also in the report of IRS (2011), but further analysis and quantification of the effects based on original data have not been provided. With respect to the Czech Republic, Šatava and Juranda (2014) pointed out at the gradually implemented strict design of the institution and quantified the impact of extending mandatory insurance period in their model analysis. However, they present the impact the reform based only on an estimation of the contribution period constructed on bases of SILC database. The reason was a lack of access to the data collected by the pension institution. Indirect signals of the effect of the increase in minimum contributory years in the Czech

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Republic are tested also in the analysis of "Fond dalšího vzdělávání" (MPSV, 2015) concluding that the Czech pension institution publishes only very limited data related to the topic.

The purpose of this paper is to provide an international comparison and to suggest the alternative design of the minimum insurance period for the entitlement to the old-age pension in the Czech Republic based on the results of the comparison analysis. Employing data generously provided by the Czech pension institution, the paper aims to quantify the possible impact of implementation of the measures for the women and men concerned. At the same time, it aims to answer the question what are the costs associated with the solutions suggested with respect to the pension system balance sheet.

2 Methods

Design of the institution of sharing pension rights

In order to suggest an alternative minimum insurance period design, we have compared the legal systems of other developed countries. The information obtained from the publications of the ASISP expert network and from the MISSOC pension system database was sorted according to the type of social security system (Esping-Andersen, 1990), adding a standalone category of transition countries in the CEE (Krebs, 2015). Afterwards, potential alternatives of the minimum insurance period were defined. Based on approaches to the minimum insurance period in foreign countries, we defined alternative variants of the institution design for the Czech Republic.

Quantifying the impact of variants

The quantification of the impact of variants is limited to the impact on the pension entitlement of retiring people and the identification of changes in total expenditures for old-age pensions which would have resulted from each variant in 2014. The calculation has two steps: the first is an analysis of the impact of the variant in the year of its introduction, while the second operates on the assumption that the reform has been anchored in the legal system for a certain period so that measures would have a cumulative impact.

The analysis relies on the "Česká správa sociálního zabezpečení" (ČSSZ) data file, which permits to analyse pensions granted between 2010 and 2014 according to the insurance period in the moment in which the old-age pension was granted (ČSSZ a). We have excluded pensions to people serving beyond the retirement age, pensions granted in a higher age and disability pensions converted to old-age pensions. When analysing the data file, the pensions were first sorted by the insurance period separately for males and females. The file was also sorted by the type of retirement (retirement at the statutory retirement age and early retirement). Based on the development of the insurance periods in previous years, a trend in the development of pension period was identified. Using the structure of the file that showed the insurance periods of people who reached the retirement age in 2010, a model file was created for 2014. The assumption was that the structure of participation in the pension insurance did not change for individuals retiring between 2010 and 2014. Afterwards, the pension for each model segment was calculated assuming that the pension was granted according to the legal framework of 2014. The second step identifies the change in total expenditures for old-age pensions that would have resulted from each variant on the basis of data of ČSSZ (2010, 2011, 2012, 2013, 2014). We have determined the percentage of people who would not become entitled to the pension, while the structure corresponds to the two types of retirement. The impacts were adjusted for year-on-year changes in the share of early retirees and people serving beyond the retirement age in the total number of newly granted pensions. Subsequently, we have calculated the expenditures for old-age pensions for each variant. The costs of the measures in the year of introduction have thus been identified. Consequently, we have had to reflect the impacts under the assumption that the reform has been anchored in the legal system for a certain period so that measures would have a cumulative impact. This has been achieved by multiplying the impact of the measures by the number of recipients in each category for each year under effect of the measure. The assumption was that people not entitled to pension would cease to participate later. The annual costs each variant are equal to the sum of the aforementioned components.

3 Analysis Results

Comparative analysis, discussion, and possible solutions

With regard to the public pension system, 22 of 29 countries require some minimum insurance period as a condition for an entitlement to old-age pension benefits. In countries whose social security is designed on the Beveridge or Scandinavian concepts, the minimum insurance period does not exceed 10 years. In Bismarckian countries, it ranges from 4 to 20 years, but typically it is set to 10 or 15 years. In earnings-related pension schemes of these countries which are governed strongly by a principle of the income solidarity, the minimum insurance period tends to be longer. In transition countries of Central and Eastern Europe, the situation is very similar to the Bismarckian countries. With one exception, the minimum insurance period does not exceed 20 years in these countries. The only country with a comparably strict minimum insurance period like in the Czech Republic is Bulgaria. According to the new legislation, the target minimum insurance period is 40 years. Like in the Czech Republic, pension can

be granted five years after reaching the statutory retirement age when the minimum insurance period (15 years in this case) is fulfilled. In most countries, early retirement, too, is granted upon the minimum insurance period. Many countries apply a stricter requirement, though. Most frequently, the minimum insurance period is fairly long (up to 30 years), or non-contributory periods are counted to a limited extent. Poland and Malta apply the institution of the minimum insurance period as a condition for a minimum pension. As regards the development of the regulation of the minimum insurance period in the past two decades, no clear trend can be pinpointed. While in some countries of Central and Eastern Europe (Romania, Slovenia) the conditions have become stricter, countries that have strengthened the link between the contributions and the benefits (Sweden, Poland, Italy, Austria) tend to abolish or mitigate the requirement.

If the minimum insurance period is not earned, the person is not entitled to the old-age pension from the public pension scheme upon reaching the statutory retirement age. Such a person is entitled to protection against poverty from other sources which developed countries guarantee to all inhabitants regardless of their age and situation. In most observed countries, however, there is a special scheme guaranteeing a minimum income for the elderly regardless of their participation in the old-age pension system. While some countries defend the lack of the scheme guaranteeing the minimum income in old age by claiming that the public scheme sufficiently covers all people in the retirement age, not least thanks to a very short minimum insurance period (Denmark, Germany), it cannot be concluded that the existence of such a special scheme in the social security system is related to the minimum insurance period.

The conducted comparative analysis showed that in foreign earnings-related pension schemes governed by a strong solidarity principle (similarly to the Czech pension scheme), the minimum insurance period tends to be stricter. Even when taking this into account, the comparative analysis clearly shows that the design of the minimum insurance period in the Czech Republic is very strict as compared to other countries. This applies to the basic minimum insurance period of 35 years under Section 1 (29) of Act No. 155/1995 Coll., on Pension Insurance as well as to the alternate condition under Section 2 thereof which makes it possible for the insured person to qualify for the old-age pension 5 years after attaining the statutory retirement age as long as the insurance period is at least 20 years. The absence of a special scheme protecting people in retirement age from poverty underscores the strictness of the minimum insurance period in the Czech Republic. If the Czech Republic decides to align the minimum insurance period with foreign approaches, we suggest that the following modifications be considered:

Under variant 1, the minimum insurance period would be changed so that it does not exceed 20 years. This way, the Czech Republic would not deviate from what is common in other countries. The problem associated with a major share of non-contributory periods in the total insurance period for some insured persons and in the Czech Republic in general (see Holub 2008) could be addressed by adopting a rule under which non-contributory periods that are counted towards the minimum insurance period could be at most equal to other relevant periods counted towards the requirement (like in Austria). Alternatively, only child care period could be counted towards the minimum insurance period.

Variant 2 envisages a shortening of the minimum insurance period under Section 1 (29) of the Pension Insurance Act to 20 years so that the Czech Republic is comparable with the monitored countries. This variant works with the minimum insurance period equal to 35 years as regards to the entitlement to an early pension under Section 31 of the Act. Many countries use such strict requirements for early retirement.

Variant 0.1 simulates the impact of the target minimum insurance period length (35/20 years) calculated for 2014.

Quantification

As shown in Table 1, all variants of design of the minimum insurance period have a very small impact on the total balance of the pension account. Assuming a long-term application, however, cumulated effects in the expenditures for old-age pensions would reach higher values in 2014 (see Table 2). In order to provide an image of gender aspect of the implementation of the measures suggested, the Tables describe impact for males at the retirement age, females at the retirement age, males retiring early and females retiring early.

Table 1: Impact of each variant of the minimum insurance period on the pension entitlement of retiring persons and the expenditures for old-age pensions in the year of introduction (2014)

	Persons without entitlement to the old-age pension (%)				Impact on the expenditures of the pension system	
	Males at the retirement age	**Females at the retirement age**	**Males retiring early**	**Females retiring early**	**CZK millions**	**As % of expenditures for old-age pensions (2014)**
Variant 0.1	-1,08%	-2,20%	-3,37%	-6,15%	- 139,54	- 0,08%
Variant 1	+0,71%	+1,93%	+2,45%	+3,90%	+139,53	+0,05%
Variant 2	+0,71%	+1,93%	+ 0,00%	+ 0,00%	+98,89	+0,03%

Data source: ČSSZ (2010-2014) and own calculations

Table 2: Long-term cumulated impact of each variant of the minimum insurance period on the expenditures for old-age pensions (2014)

	In CZK million	As % of expenditures for old-age pensions
Variant 0.1	- 1683,82	- 0,30%
Variant 1	+ 841,03	+0,27 %
Variant 2	+ 504,61	+0,17 %

Data source: ČSSZ (2010-2014) and own calculations

4 Conclusions

The comparative analysis showed that the regulation of the minimum insurance period varies across countries significantly, but important similarities in some approaches can be seen when analysing it by the type of social security system. The purpose and design of the old-age pension systems is related to how the conditions for the pension entitlement are defined and to the handling of cases in which the minimum conditions are not met. In earnings-related pension schemes, the minimum insurance period for the entitlement to the old-age pension tends to be stricter in countries that rely on the income solidarity. In schemes governed by the equivalence principle, the minimum insurance period is generally very short. The Czech pension system is characterised by a very high degree of the income solidarity. Despite compared to the countries with strict minimum conditions for the pension entitlement, the target design of the institution is exceptionally severe in the Czech Republic. Such a conclusion is reinforced by the absence of a special scheme protecting people in retirement age from poverty if they are not entitled to the old-age pension because they have not completed the minimum insurance period.

Therefore, the Czech Republic should consider a reform of the institution of the minimum insurance period so it is compatible with foreign approaches. On the bases of the comparative analysis, we suggest two alternative variants of the institution modification:

Variant 1 presumes the reduction of the minimum insurance time to 20 years so that the Czech Republic is comparable with the monitored countries. The problem of a significant share of non-contributory periods in the total insurance period for some insured persons is addressed by introducing a rule that only child care period is credited with regard to the minimum insurance period condition. The model evaluation of the variant showed that in 2014 number of men granted with pension entitlement would increase by 0,71% with respect to those at retirement age and by 2,45% with respect to men granted with early retirement. The effect would be significantly stronger in case of women: number of newly granted pensions at retirement age and early pensions would increase by 1,93% respective by 3,90%. Quantifying the impact of the introduction of the variant 1 has shown that additional costs would amount only to 0.05% of expenses of the system on old-age pensions during the first year after. The total additional annual cost of the system would gradually increase by 0,27 % of expenses on the old-age system with the long-term application.

In line with foreign practices, variant 2 employs a relatively strict minimum insurance period for early retirement pension entitlement and a significantly shorter minimum insurance period for retirement age. Such a solution would give an access to pension benefits to a large part of people at retirement age while maintaining the motivating elements for people under retirement age. The variant envisages a reduction in the minimum insurance period to 20 years, and assumes that the early retirement would possible only for those who earned at least 31 years. Model analysis shown that with regard to men, the number of newly granted pensions at retirement age would increase by 0,71%. With regard to women, the number of newly granted pensions at retirement age would increase by 1,93%, Numbers of newly granted early pensions would not be affected. Additional costs of the

measure would be 0.05% of expenses of the system on old-age pensions during the first year after. The total additional cost of the system would increase by +0,17 % of expenses on the old-age system with the long-term application.

Since the model analysis was conducted assuming that the pension was granted according to the legal framework of 2014, it was important to provide also an image of increasing the minimum insurance period to 35 years, which is the target minimum insurance period length in the Czech Republic. If this target legal framework took place already in 2014, the number of newly granted pensions of men and women at retirement age would decrease by 1,08% respective by 2,20%. Numbers of newly granted early pensions of men and women would be affected even more. They would decrease by 3,37% respective by 6,15%. Hence gender aspect of the gradual increasing the minimum insurance period is very significant. Implementation of the target length of the minimum insurance period in 2014 would save 0,08% of expenses of the system on old-age pensions during the first year after. The total savings of the system would gradually increase by +0,30 % of expenses on the old-age system with the long-term application.

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Risk of Investment to Higher Education

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Abstract: The aim of this paper is to estimate risk connected with investment to education and particularly with university education. As the literature overview shows, schooling is a risky investment and the rates of return to this investment show substantial variance. The analysis of link between investment to education and risk is carried out on data of ESS5 survey collected in the year 2010 in 21 European countries using quantile regression**.** The paper uses a particular measure of risk: the difference of returns in different deciles of earnings. In the second part of the paper, authors measure expected rates of returns of university students at selected Czech HE institutions as they follow from questionnaire survey in the years 2010-2012. Results of analysis show that risk connected with investment to education is substantial and that this risk is expected by university students.
Keywords: quantile regression, risk, investment, higher education
JEL Classification: J24, J31, I26

1 Introduction

The accumulation of human capital is crucial to economic prosperity. Nowadays economists and decision makers pay a lot more of attention to the investment in human capital, namely in the education in connection with different aspects. Mass (and quality) higher education seems justified for several reasons in order to favour economic growth. One of them being the current speed of technological change that makes high-skilled individuals more important than ever as a determinant of economic performance. In connection with higher education individuals can either go to work or go to school for five years. To invest into university education means also to overtake a risk with uncertain rates of returns.

Based on ideas of Levin at al. (2006) an excellent education can be taken as a less risky for individuals and it brings benefits not only for the individuals themselves but also for the taxpayer and society. On the other hand poor education leads to higher individual risk connected with large public and social costs in the form of lower income and economic growth, reduced tax revenues, and higher costs of such public services as health care, criminal justice, and public assistance. Therefore, the efforts to improve educational outcomes for at-risk populations as a public investment yield benefits in excess of investment costs (Levin, at al. 2006). It supports the idea of the finance theory which suggests that higher expected returns compensate for the expected risk. In other words there is a positive relationship between returns and risk, i.e. the higher the risk the higher the returns (Markowitz, 1952). Also risk averse investors have to be compensated in higher expected returns when facing investment with higher risk (Fišerová, 2011).

2 Literature overview in risk to educational investment

Belfield looks on education as a part of the micro-economic theory of consumer choice to enrol. As he points out it is important to investigate the substantive significance of barriers to investment in education directly. On borrowing constraints, there is some evidence that the enrolment rate for education is sensitive to the availability of capital. More evidence is available on the consequences of uncertainty and intractability on the demand for education. According to Groot and Oosterbeek (1992) uncertainty (risk) is based on duration of demand for schooling. Post-education earnings are not known with certainty, yet job opportunities rise with schooling because one can accept a job below one´s education level but not above it. Increase in risk cause individuals to substitute away from human capital. Moreover, salaried workers are more encouraged to invest in time-shortening human capital than are hourly paid less secure workers (Belfield, 2000).

The aspect of risk of investment in education is not only a phenomenon individuals. Also firms´ human capital investments carry a high risk of a loss of value. This risk may take several forms like depreciation or obsolescence of skills and abilities, employee turnover, non-conforming behaviour, requirement of skills different than those possessed by the current employees; need to cut down the numbers and so on. Managers need to manage these risks in order to stabilize returns from the firm's human capital (Bhattacharya 2003).

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The high risk and low liquidity are caused mainly by the fact that investment in education cannot be sold (Becker, 1993). Therefore the expected return, which reflects the level of risk and compensates for it, should be higher (Pereira and Martins, 2001). Psacharopoulos (2004) suggests that the benchmark of the rate of return for education is 8.7%. Therefore when investments in education return around 9% it can be said that there is no under-investment in education, i.e. no opportunity costs for individuals and society (Fišerová, 2011).

The individual returns are not fully known to students until they enter labour markets and this means that they take a high risk doing a university education. Risk is undoubtedly a crucial determinant in any financial investment decision, however it is often neglected in the human capital investment decisions. Comparing to other aspects of investment in education relatively little research papers discuss issue of risk-return trade-off for different human capital investments. Palacios-Huerta (2003) was one of the first who empirically analysed risk properties of various human capital returns. He presents an empirical comparison of risk adjusted human capital investments to financial investments (Palacios-Huerta, 2003).

Investment in higher education brings very high variance of risk and the risk of unsuccessful graduation is the crucial one. Once students enter the university some of them do not graduate, income differences between graduates even in the same field of study can be large. Also educational and job mismatch represents a risk of lower wage premium gained from getting a university degree. Even the risk to become unemployed does exist (Wigger, 2001). Moreover the level of unemployment of graduates differs significantly between developed countries in Europe which differentiate a level of risk in different European countries. For example in the Czech Republic the rate of unemployment of graduates was around 20% comparing to Portugal or Spain where unemployment of graduates exceeded 50% in 2014 (Eurostat, 2014). Table 1 brings the most important types of ex-ante risks from higher education.

Table 1: Types of ex-ante risks of higher education

Ex-ante risk of higher education
Performance in education
Uncertainty regarding the successful completion of the chosen educational level
Market risk in terms of the future value of education based on the demand for and supply of those with the particular level of education
Uncertainty regarding the position in the post-education earnings distribution
Availability of capital for those who plan to study

Source: Hartog, 2004, Belfield, 2000

There is no doubt that university graduates may overtake a risk of investment in higher education in the sense of lower wage premium and also lower rates of return. Pereira and Martins (2004) were those who studied the relationship between risk and returns to education using data from 16 countries. They found that there is a positive relationship between risks and return, as suggested by finance theory, and that the risk-return trade-off is rather large. They identified a compensation to face the risk associated with the investment in education to be a 1 percentage point (pp) increase in the average return to education for a 2 pp increase in risk (Pereira and Martins, 2004, Fišerová, 2011).

Becker (1993) suggested adoption of the analysis of utility maximisation and the use variance in the rates of return as a measure of risk. Utility maximisation shows a scope for the study of expected risk of the investment in human capital since clearly there is likely to be a point when investors are no longer willing to accept risk to increase their returns. Although the differences in terms of the rates of return among individuals, levels of education and the fields of education have been stressed in the literature, the implications of the dispersion of the returns to education has often passed without further comment. This seems to be the reason for the lack of empirical focus on the risk associated with the investment in human capital (Hartog and Diaz-Serrano, 2014). This study attempts to assess ex ante perceived risk and returns based on a basic human capital investment model that compares two future earnings streams. The risk could be estimated by measuring the ex post variability of the ex-ante returns. Ex post variability in expected returns is however not the same as the ex-ante risk expected by an individual since the dispersion of the returns is likely to reflect individual heterogeneity (Hartog et al., 2004). If the unobserved individual heterogeneity were to bias the results, the likely possibility is that the risk estimated by ex post variation of the expected returns may be higher than the ex-ante individual risk (Fišerová, 2011).

3 Data – description and basic statistics

To analyse the relation between risk and investment to higher education the authors used two sets of data, European Social Survey 5 data and expected earnings of university students at selected Czech HE institutions as they follow from questionnaire survey in the years 2010-2012 (reflecting the period of the economic crisis). The data of ESS5 survey used by authors of this paper for comparison of returns and connected risks were collected in the year 2010 and carried out in 26 countries. Original number of respondents in all surveys together was 52,458. For this paper there were used data from 21 EU countries, dataset containing 11,137 respondents. Basic statistics of this dataset is in the Table 2.

Table 2: Distribution of education, age and earnings – all respondents (standard deviations in parentheses)

	All	Male	Female
Respondents	11 137	5 393	5 744
Education years, mean	12.70 (2.43)	12.53 (2.43)	12.86 (2.43)
Gross earnings, monthly, €	1957.25 (1758.51)	2300.26 (1997.99)	1635.77 (1426.97)
Age, years	41.94 (11.65)	41.69 (11.87)	42.18 (11.44)

Source: ESS5, own calculations

For the second part of our analysis, we used data from the university students at selected Czech HE institutions as they follow from questionnaire survey in the years 2010-2012 counted together. The surveys among first year students were focused on expectations of their earnings after their graduation and also earnings after 10 years later. These data are a part of a long range survey which started at these institutions in the year 2001 and included higher education institution in the Czech Republic and abroad.

4 Methodology and Data Analysis

For the first step of our analysis, the effects of risk connected with the investment to higher education were estimated using a Mincer's earnings equation based on the following equation:

$$\ln w_i = \alpha_1 SCH_i + \alpha_2 EXP + \alpha_3 EXP^2 + \alpha_4 GEN + u_i \quad (1)$$

where: $\ln w_i$ is the natural logarithm of gross earnings, α are regression coefficients, SCH_i is the number of years of schooling, EXP are years of experience, GEN is a dummy variable for the gender of the respondent (Male=1, FEMALE=0), X_i is a set of other variables assumed to affect earnings and u_i is a disturbance term (index i is for individual i).

To compare traditional ordinary least-square regression with quantile regression, firstly authors carried out Ordinary Least Square (OLS) regression data. Using above mentioned model with ESS5 for all selected countries, we obtained results as follows Table 3.

Table 3: Returns on investment to education in all EU countries together, OLS regression

	R	R Square	Adjusted R Square	Std. Error of the Estimate
	.406[a]	.165	.165	.82972

		B	Std. Error	Beta	t	p
	(Constant)	5.489	.040		135.616	.000
	SCH (Education)	.085	.002	.339	38.225	.000
	EXP (Experience)	.032	.002	.424	13.512	.000
	Experience square	.000	.000	-.292	-9.292	.000
	GEN (Gender)	.365	.016	.201	22.996	.000

Source: ESS5, own calculations

Quantile regression applied to returns to education to analyse the influence of risk in heterogeneous groups of workers is an important feature of our research. To measure and analyse heterogeneous patterns of return to education and the risk of the investment on data used in the paper we the authors use quantile regressions. As i.e. Koenker and Bassett (1978) or Pereira and Martins (2004), who used modified Mincer equation, quantile regression estimates the equation through certain points of the distribution (quantiles) will be used. This has the advantage of giving the influence of the covariates at different points of the curve (Pereira and Martins, 2004).

Using methodology of Pereira and Martins (2001), we used the results of quantile regressions on Mincer equation (1) for individual countries so as to be able to compare their different returns and risks. We use the difference between the coefficient of education at the last decile and the first decile as the proxy for the risk (as we assume that subjects do not know where they will end up in the distribution after they enter the labour market we used absolute values of this difference). Large difference between the first and last deciles in the estimated coefficients means that return is much higher in the upper than in lower decile and the individual faces a high risk; if the difference is small, there is almost no risk. The Table 4 shows the results from the estimation.

There is relatively strong positive relationship between the return to education and the risk involved in the decision to invest to education. According to Pereira, Martins (2001), this relationship was at the time of their calculation (years 1993-1995, 16 OECD countries) stronger. We also used ranking of countries according to decreasing OLS returns and increasing values of risk to avoid the problem of linearity (see Pereira, Martins 2001), then we summed ordered values. If the ordering would be inverse, the sum would be 22; however our results show, that most of the countries are within one standard deviation from the average. Outliers are Slovenia and United Kingdom (high return, low risk) and Greece, Ireland and Sweden (low return, high risk). The exact and empirically proved explanation for their position in our analysis is outside the scope of this paper.

Table 4: Returns on investment to education; first and last deciles, 21 EU countries

Country	OLS Returns	First Decil Returns	Last Decil Returns	Absolute Diff. 90-10	Rank Abs	Rank OLS	Sum Rank OLS+Rank Abs
Slovenia	0.193	0.186	0.181	0.49%	3	1	4
Germany	0.150	0.183	0.122	6.16%	18	2	20
Hungary	0.145	0.116	0.183	6.72%	19	3	22
Estonia	0.124	0.076	0.155	7.92%	20	4	24
United Kingdom	0.120	0.112	0.111	0.10%	1	5	6
Portugal	0.117	0.117	0.149	3.23%	13	6	19
Cyprus	0.110	0.134	0.119	1.45%	10	7	17
Belgium	0.105	0.119	0.085	3.46%	16	8	24
France	0.104	0.098	0.111	1.35%	9	9	18
Poland	0.103	0.079	0.113	3.43%	15	10	25
Ireland	0.099	0.039	0.127	8.87%	21	11	32
Lithuania	0.099	0.086	0.091	0.57%	5	12	17
Netherlands	0.098	0.099	0.093	0.64%	6	13	19
Bulgaria	0.093	0.099	0.079	1.99%	11	14	25
Denmark	0.091	0.083	0.091	0.78%	7	15	22
Spain	0.088	0.065	0.097	3.26%	14	16	30
Finland	0.087	0.089	0.092	0.29%	2	17	19
Czech Republic	0.084	0.088	0.083	0.51%	4	18	22
Slovakia	0.083	0.096	0.083	1.31%	8	19	27
Sweden	0.078	0.074	0.099	2.46%	12	20	32
Greece	0.060	0.041	0.085	4.36%	17	21	38
						Mean	**22**
						S.D.	**7.89**

Returns appear in %; countries are ranked according to the OLS return.
Source: ESS5, own calculations

For comparison of quantile regression of individual 21 EU countries, we calculated quantile regression of our model for all EU countries together (11 137 respondents) and we obtained results for nine deciles (from 0.1 to 0.9). In the Table 5 we present only first and last deciles as they are important for our analysis.

Table 5: Returns on education in different quantiles in all EU countries together

Quantile	Constant	QR Education	QR Experience	QR Exp. Square	QR Gender
0.1	4.859	.093***	.029***	-.001***	-.371***
	(.108)	(.008)	(.004)	(.000)	(.033)
0.9	6.501	.106***	.034***	.000***	-.310***
	(.051)	(.003)	(.002)	(.000)	(.016)

*** p < 0.01; ** p < 0.05; * p < 0.1; Bootstrapped errors in parentheses
Please note that in the quantile regression was used coding FEMALE=1, MALE=0
Source: ESS5, own calculations

In the second step of the analysis, the authors measured risk of investment in higher education based on expected rates of return of students in a selected period of 2010 -2012. In total there were analysed 1218 answers between these years. Table 6 shows that students perceive their ex ante risk of the investment to education measured as the difference between last and first deciles of dispersion of returns but in stronger way than is ex post risk (see Tables 4 and 5). On the other hand, their expected return on investment to education (8.8 % for return after graduation and 11.3 % for return 10 years after graduation) show similar pattern to ex post OLS regression results. It means that their aversion to risk is low when compared with results of real dispersion of earnings (see Table 4).

Table 6: Expected returns on investment to education; first and last deciles, students EF TUL

	Expected returns to education for average wage without experience								
Year	**Valid Cases**	**Mean**	**Std. Error of Mean**	**Std. Deviation**	**First Decil Return**	**Last Decil Return**	**Absolute Diff. 90-10**	**Skewness**	**Std. Er. of Skewness**
2010	653	0.089	0.002	0.060	0.028	0.149	0.121	1.145	0.096
2011	340	0.086	0.003	0.052	0.025	0.149	0.123	0.432	0.132
2012	225	0.089	0.003	0.050	0.036	0.149	0.112	0.387	0.162
2010-2012	**1218**	**0.088**	**0.003**	**0.054**	**0.030**	**0.149**	**0.119**	**0.655**	**0.130**
	Expected returns to education for average wage with ten years' experience								
2010	644	0.113	0.003	0.082	0.037	0.201	0.164	2.435	0.096
2011	323	0.109	0.004	0.076	0.028	0.201	0.173	0.738	0.136
2012	221	0.116	0.004	0.065	0.037	0.201	0.164	0.620	0.164
2010-2012	**1188**	**0.113**	**0.004**	**0.074**	**0.034**	**0.201**	**0.167**	**1.264**	**0.132**

Source: own calculations

5 Results and discussion

The aim of the paper is to analyse results of quantile regression searching for the influence of the risk of investment in education. Results in this paper are compared with data got by Pereira and Martins (2001) where these authors used the results of 16 countries to test the positive relationship between return to education and the risk involved in this investment. Pereira and Martins results (2001) confirm in most of the countries the pattern: higher risk – higher returns. In nearly all countries. the rate of return in 0.1 quantile is lower than the rate of return gained in 0.9 quantile.

Comparing this results the authors get different values for the rates of return with quantile regression of ESS5 data from 21 countries. The difference between 0.1 and 0.9 quantile varies between some countries and brings a negative value comparing 0.9 quantile to 0.1 quantile. Generally speaking most of results of quantile regression show that coefficients in our model obtained in obtained by OLS conventional least square regression are different from coefficients for deciles ranging from 0.1 to 0.9 for dispersion of wages. Based on the literature review we should expect a lower rate of return in 0.1 decile comparing to 0.9 decile. It is possible to confirm this results in most ofl selected EU countries.

Returns to education are the lowest in the first decile (9.3 %) and go to 10.6 % in ninth decile (with the maximum in fourth decile). Our tentative explanation of this result is that wages around median bring to relevant workers most economic effects. However this explanation is only our previous view of reasons for this result.

6 Conclusions

In this paper we analyse and compare the influence of risk aspect on returns to education in selected EU countries. Empirical results are based on data from European Social Survey (ESS5) in 2010. The authors use comparison of these results with the previous study carried out by Pereira and Martins in 2001). Comparing of results in 0.1 and 0.9 deciles the quantile regression reports to heterogeneity of results for individual EU countries.

Explanation of these different returns to education show that there may be two main factors influencing this rate of return variance which was not described in the previous literature sources. First of all recession in Europe in 2010 may reflect and influence mainly people with higher earnings in private sector (9th quantile). Their earnings were affected by the crisis more than those with lower and middle earnings (first and fourth quantiles), i.e. mainly employees in the state sector which were not affected by the crisis. It caused a negative variance between 0.1 and 0.9 rate of returns in quantile regression in some countries.

Other explanation is based on comparison of social schemes in different EU countries (as in Germany or the Czech Republic). In these countries for the lower income groups show the same or very similar rates of return because of social transfers they can get during the recession from sTable social schemes. Those with higher earnings which cannot reach this compensation are more affected and their rates of return decrease.

From the practical point of view data presented in this paper show, among other, the influence of the economic crisis as one of the risk aspect of education. The penalty is identify in the group of better paid individuals where during the period of economic crisis rates of return decrease comparing to lower paid individuals.

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The Fiscalization of Child Benefits

Jaroslav Vostatek*

Abstract. The distortions of the Czech public pensions are seducing to treat pension contributions as if they were an income tax. This includes the proposal of the Pension Commission to differentiate the pension contribution rates according to the number of dependent children. Its proponents ask to finance the opportunity costs of raising children by these tax rebates. Such extreme requirements do not fit in the typical conservative social model, let alone any other family policy models. In comparison with background, the Commission's proposal is very modest. A simple and effective child benefits reform involves a shift to substantially higher and universal benefits that would bring even more to the respective party's electorate. The further fiscalization of Czech child benefits is ineffective. Czech and international experience has shown that Czech child benefits can be effectively provided both by the social administration and the tax administration.

Keywords: child benefit, tax expenditure, tax rebate, public administration, pension contributions

JEL Classification: H24, H55, H53

1 Introduction

The fiscalization of child benefits means a shift to the use of the tax system, especially the income tax, to support families with children instead of direct public benefits. In some countries, this fiscalization has occurred under the influence of social policies promoting workfare (work for welfare): the recipients of social benefits are supposed to "work off" these benefits with gainful activities, if possible, or with community service. In this regard, it is often emphasised that tax expenditures have their own logic: this involves "make work pay" tax expenditures (OECD, 2010).

The fiscalization of child benefits in OECD countries in past decades is a fact but the question remains as to whether this does not merely involve a new disguise for the post-war policy of low-income targeting and selectivity in the area of child benefits (Ferrarini et al., 2012). We investigate the extent to which it is possible to explain the fiscalization of child benefits using the theory of welfare regimes. The aim of the paper is to analyse the developments in this context and especially the current status of child benefits in the Czech Republic and the proposal for the introduction of tax rebates; we will also mention the current problems associated with the administration of child tax credits. We use a graphic analysis of the influence of the separate benefits on the total amount of this support. On this basis we also submit a proposal for the rationalization of child benefits.

Child tax allowances (deductions from the income tax base), introduced by the Czech tax reform of 1993, were replaced with refundable tax credits from 2005. The differentiation of tax credits according to the number of dependent children was introduced in 2015. Child allowance was universal up to 1995, income-tested since 1996 and differentiated according to the age of children since 2008. Families with income up to a multiple of 2.4 of the family existence minimum are entitled to the child allowances. Nowadays about 90% of children are entitled to the child allowance; its amount is about half in comparison with the child tax credit.

The Pension Commission has proposed to increase the basic rate of the pension insurance contribution by 1% of the wage, the rate shall remain unchanged for insured individuals with one child (a rebate of 1% in comparison with the new basic rate): the rebate for 2 children is 2.5% of the wage, for 3 children it is 5% and for 4 or more children it is 7.5%. This applies to both parents, provided they both pay contributions for pension insurance. This proposal is a modest variant of the Christian-Democratic Party's program (a 3% wage rebate for each child, for both parents). The aim of the proposal is the reduced taxation of families, especially of those with higher earnings. We analyse the Commission's proposal in the context of the family policy social models and we especially show its impacts on the overall fiscal support for families with children in relation to their earnings.

2 Child benefits social models

We may distinguish several family policy welfare regimes (social models) in the OECD countries (Thévenon, 2011; Schleutker, 2014). Classic liberals consider the birth and upbringing of children to be an exclusively private matter where the state should not intervene; these liberals only acknowledge general social assistance for those

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who are unable to take care of themselves. Modern liberals (for example. Beveridge) recommend universal benefits for children at the subsistence level along with the presumed existence of progressive income taxation.

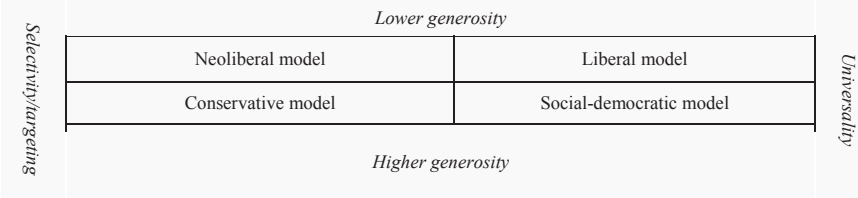
Neoliberals push through income tax credits for low-income families only. The neoliberal social model can be illustrated by the Earned Income Tax Credit in the USA, where the credit is zero if the family income is zero, it quickly rises with increasing earnings up to the "break-even point" where the tax credit is independent of earnings and then it relatively quickly falls back down to zero. Some countries combine two approaches: universal child benefits and tax credits for low-income families. In our country, we have been left with an unfortunate combination of these benefits by our (neo)liberal governments: child benefits are income-tested and tax credits are universal.

Conservatives have always sponsored family promotion, including the classic division of labour in the family. The conservative income tax model respects the ability to pay of families, the optimum solution is a progressive tax on the family income with allowances for the taxpayer and the family members; the family subsistence level may not be taxed. The alternative is a (progressive) taxation of family income per capita. Nowadays, conservatives also acknowledge child benefits as a supplement, a replacement for the deductible from the income tax base. According to a ruling of the German Constitutional Court, the tax exemption of a child's subsistence level can also be realised in the form of child allowance; at the same time, however, support for families with children only represents part of the child allowance which exceeds the deductible (Lenze, 2008). Income-tested child benefits are used in a number of countries of this type.

Social democrats emphasise equal chances for everybody, irrespective of family and market; they prefer the dual-earner model. Social democratic social policy supports relatively high, universal child allowances and rejects tax expenditures of any type. The provision of public services for families with children for free or for a small fee is more important in this model than pecuniary benefits. Income tax is progressive. A number of the elements of social democratic family policy have also been adopted by "conservative" France and Germany.

The four child benefit social models are depicted in Figure 1. Two classification criteria are applied here: one is the universality in contrast to the selectivity/targeting. The other is the lower or higher generosity of these benefits. The social democratic and (modern) liberal models "make do" with one benefit: universal child allowance. The neoliberal model is also associated with one benefit: an income tax credit for low-income families. The conservative model uses income tax (deductibles or splitting); eventual universal child allowance is also derived from the tax theory.

Figure 1: Typology of social models of child benefits



Source: author.

Refundable tax credits might be taken as a compromise between social democratic and conservative social models; much mainly depends on the basic condition for the entitlement to the tax credit: the credit may be subject to tax residency only (i. e. income may be zero, too). Refundable tax credits and child allowances may only differ in the public administration: whether they are administered by the tax administration or the social security administration. Tax credits are, of course, usually income-tested throughout the world (Ferranini et al., 2012).

Nowadays, the tax rebate exists in Germany only, to a merely symbolic extent: in the social long-term care insurance: insured individuals without children pay a 0.25% p. p. higher premium rate. A tax rebate might be a tool of social policy in the conservative model and its practical non-use can be explained by its distinct preference for higher income groups.

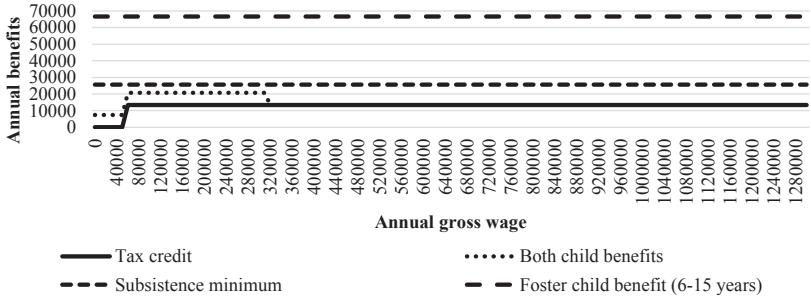
Non income-related child benefit is still the most popular vehicle for delivering the child benefit package. Only 7 (out of 22) countries do not have any non income-related child benefits. 13 countries have income-related child benefits or social assistance for employed families. The main shift has been towards using the income tax system to distribute resources to families with children. Out of all 22 countries only Austria, Denmark, Finland, Ireland, Israel, Norway, Portugal and Sweden have no recognition of the needs of children in their income tax arrangements (Bradshaw and Finch, 2002). The fiscalization of child benefits therefore did occur in the previous period, nevertheless the universal child allowance are still the generally most significant benefit.

3 Czech child benefits and family incomes

The Czech mix of universal child tax credits and income-tested child allowances does not belong to any of the social model of child benefits. It is a mixture of three models: the social democratic, conservative and neoliberal models. We have child allowances, but they are rather low and income-tested. We also have tax credits but with a minimum earnings threshold. On top of that, unemployed pensioners are not eligible for the tax credit for raising children. In a four-member family type with one breadwinner and two children aged 2 and 7 years, the sum of child allowances and tax credits in our country amounts to 20% of the net average wage in industry (Turková, 2014). State support of this family type is the highest one in an international comparison with 18 OECD countries (Ferrarini et al., 2012). At the same time, however, these two benefits for the children aged 2 and 7 amount to a total of 3,544 CZK per month which is less than the official Czech subsistence level for these two children in a family (3,880 CZK per month). This is the Czech reality with which we may but need not be satisfied: this depends on the concept of the entire social policy, which citizens, parties or the government proceed from.

The general costs for children are significantly higher than the official Czech subsistence minimum for them. Supporters of the differentiation of insurance premiums based on the number of dependent children had argued that the costs for children are significantly higher in families with higher earnings and they had required some sort of compensation for the opportunity costs brought about by caring for children. The fundamental political question is, however, whether the state support for children should be directly proportional to the earnings of the parents or whether it should be uniform for all children (universal) or whether it should be indirectly proportional (higher support for low-income families). Targeted support for families with higher or high earnings does not fall under any social model: this can be considered to be antisocial from the point of view of all the models. The higher amounts of the tax allowances for taxpayers with higher incomes in conservative systems are in fact based on the expected progressiveness of the income tax rates.

Figure 2: Dependency of a tax credit and an allowance for 1 child aged 6-15 on the annual gross wage



Source: author.

We show the annual state support for families with children in the Czech Republic using a family with one child aged 6 to 15 in Figure 2 under the conditions in 2015. The child tax credit (13,404 CZK) is independent of the wage (from half of the minimum wage upwards). In the case of lower-income family, this benefit is supplemented with an allowance of 7,320 CZK. We have also added the subsistence minimum for one child (25,680 CZK) and the allowance to cover the needs of a child aged 6-12 in the foster care (66,600 CZK), which can be considered to constitute the theoretical maximum which the state is prepared to pay for the individual child care, alongside the child allowance and child tax credit; the foster parent also receives a remuneration.

The current level of state support for families with 4 children aged 6-15 is slightly higher: even here, the sum of the tax credits and allowances does not reach the subsistence minimum for four children at the amount of 102,720 CZK. In the case of families entitled to child allowances, the "gap" between these two amounts here is 10,224 CZK per year.

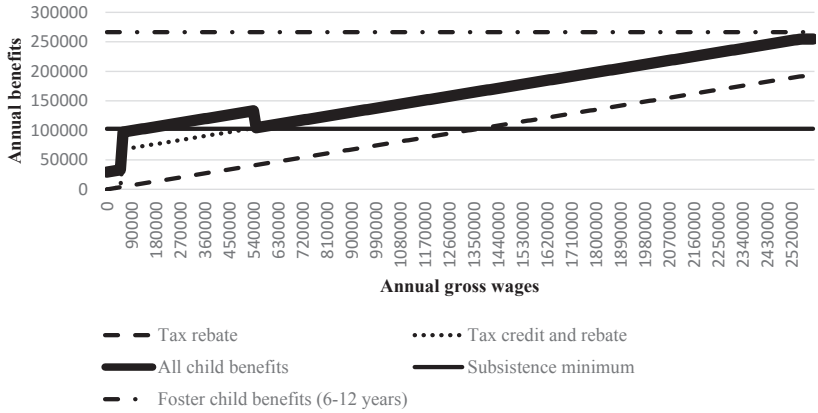
4 Child benefits reform proposals

The rebate on pension insurance contributions proposed by the Commission has a fully different concept than the child allowance or tax credit. The tax rebate is scheduled for both parents, provided they are insurance contribution payers, the rebate is capped by an earnings ceiling valid for insurance contributions (currently 400% from the national average gross wage).

The proposed rebate on insurance contributions is but a mere fraction of the tax credit for the absolute majority of families with one child. The rebate comes out at less the half the tax credit for the majority of families with one child. The highest possible rebate is 2,129 CZK, i.e. 1.9 multiple of the tax credit and also 99.5% of the child's subsistence minimum. The preferential treatment of parents with high earnings is apparent, however it can be postulated that the mentioned state support is essentially of little interest to such parents.

Figure 3 shows the benefit presented by the rebate for families with four children under the conditions of 2015: the annual gross wage stated here is the sum of the earnings of both parents. In this case, the rebate is a mere fragment of the tax credit for the majority of families, too. Both of these types of state support are of the same amount, if the parents earn a total of 70,240 CZK. We expect that the rebate will not provide motivation to raise more children even in the exceptional cases of families with high earnings.

Figure 3: Dependency of a tax rebate, a tax credit and an allowance for 4 children aged 6-15 on the annual gross wages of both parents



Source: author.

The proposal to introduce the differentiation of the pension insurance contributions is a de facto proposal to increase the income taxation of those insureds who are not raising any children. Under the existing Czech conditions, the paid insurance contributions bear no relation to the provided pensions and as such they constitute receipt for the state budget just like income tax or value added tax.

The child tax credit is usually justified in our country as a motivation towards gainful employment. Mazars (2014) considers child tax credits to be one of the most effective forms of financial assistance because they motivate people to find a job, their administration is undemanding and the income is not tested. "The non-socialist alternative to the government concept for family policy" (Občanský institut, 2005) is more thorough in its conclusions than Mazars: it requires the transformation of child allowances into tax credits. According to this concept, family support in the form of a tax credit "increases the awareness of economic autonomy and eliminates the feeling of the dependency of families on the social security system. At the same time, it also reduces any difficulties associated with the redistribution … within the … the state budget. The amount of the tax support for families should be dependent upon the families' income situation, because this involves a tool of horizontal solidarity between childless people and families." The existence of the child allowance stops making sense due to the fact that the tax credit is provided in the form of a uniform contribution. In the case of those individuals who are not gainfully employed, the function of securing the subsistence minimum for dependent children is assumed by the social assistance pillar. According to this concept, the tax credit should be increased to the subsistence minimum (Občanský institut, 2005). This "non-socialist" concept for child benefits has thought them to the end – with one exception: it ignores unemployed pensioners with dependent children.

A fundamental question is, how the universal tax credit differs virtually from the universal child allowance. We must, of course, take into account the Czech precondition of minimal gainful activities (at the extent of half the minimum wage), which fits the neoliberal model, albeit that universal tax credits do not fit into this model. Moreover, the Czech precondition of minimal gainful activities is of little practical significance from a purely economic point of view because families with no income are entitled to a social assistance benefit which respects the subsistence minimum for these children.

All that therefore remains of the arguments used against universal child allowances and in favour of universal tax credits is the problem of the administrative demands. According to this argument, an advantage of tax credits lies in the fact that it saves the "isolated" agenda of child allowances, which are administered by the Labour Office in our country. In the case of tax credits for employees, it is "sufficient" to take the child's birth certificate to the company's personnel department. However, a modern public administration should not distinguish between universal child allowances for all children and the benefits constructed in the same way, but hidden in the income tax. Throughout the history of Czechoslovakia, child allowances were sickness insurance benefits paid out by personnel departments … and there may also be something similar from a technical point of view today. Universal child allowances may be administered by the public tax administration, just like universal child tax credits. For example, Australia, Canada and New Zealand have tax benefits that can be paid directly (Bradshaw and Finch, 2002). Given the identical structure of benefits, the essential thing is effectiveness, including tackling fraud in this area.

In 2015, the Czech Ministry of Finance discovered that negative income taxation due to refundable child tax credits was being abused; the tax administration has now created a system of records of dependent children. Recent discussions have confirmed that the Czech debates about tax benefits and child allowances have only been built on convictions and general impressions. On the other hand, "international evidence is compelling in showing that universal benefits, alongside a broad range of universal services, deliver the best supports for all the children… No one has ever identified any labour market disincentive effects or poverty traps" (Harvey, 2014).

The simplest rationalisation of the current two Czech child benefits is to merge them into one universal benefit. In the case of one child aged 6-15, the sum of these two benefits amounts to 1,927 CZK per month. Even with regard to the political interests associated with the proposed introduction of a tax rebate, we do not expect that there will be any targeting of this merged child allowance. For the same reasons, it is possible to consider increasing this benefit to the subsistence minimum in the 6-15 age group which represents 8.04% of general assessment base in pension insurance. A universal child allowance at this level is lower than the basic (universal) amount of the Czech pensions, parametrised at the level of 9% of the same assessment base. This expresses the preference for meeting the needs of senior citizens over children, which is typical for an entire range of countries and can be explained by the relative importance of senior citizens at the ballot box.

Figure 2 shows that the introduction of a universal child allowance at the amount of the subsistence minimum would mean an increase in the income of families with one child, usually by 413 CZK per month. In comparison with the proposed tax rebate, the universal child allowance is more advantageous given family earnings up to about 97,500 CZK per month, which represents two wages at the level of about 1.8 multiple of the national average. At the cut-off point where the entitlement to the current income-tested child allowance ends the proposed universal child allowance should only be advantageous by about 155 CZK per month.

The introduction of a universal child allowance at the subsistence minimum level instead of two benefits would also be advantageous for families with 4 children. The proposed tax rebate would be more advantageous (in comparison with the universal child allowance at the amount of the subsistence level for 4 children) from a total parents' income of about 39,200 CZK per month. However, this would not have to be "detrimental", as there are foreign practices topping up the universal child allowances with benefits for larger families or differentiating the universal child allowance according to the number of children. The counterproposal to the differentiation of the insurance contributions according to the number of children could therefore be the introduction of universal child benefits at least at the subsistence minimum level, for example, instead of the existing income-tested child allowances and the child tax credits.

5 Conclusions

The Czech state support for families with children is not rational. It is possible to simply increase the effectiveness of the child allowances and tax credits. Using experience gained from abroad, it is particularly possible to recommend universal child allowances set at the level of the subsistence minimum level. This system could be effectively monitored not only by the social security administration, but also by the tax administration. This would also mean more money for most families with higher incomes which the Pension Commission has targeted with its proposal to introduce rebates on pension insurance contributions. The main advantage for individuals and families with higher and high incomes in our country is the non-existence of the progression of the income tax rates, in comparison with western countries. The proposal for the introduction of rebates on pension insurance contributions is an attempt to weed out an otherwise bad system of state financial support for families with children.

The advantage of universal child allowances over tax credits is currently also the fact that their realisation does not require the introduction of the taxation of pensions; the cancellation of child tax credits would immediately remove the discrimination against pensioners in relation to the income tax credit. Universal child allowances fully conform to the social democratic and liberal social models, so it should be relatively easy to push the proposed reforms through the current government. The "hankering after" the conservative social model, which takes greater account of families with higher earnings, is admittedly understandable but for all that the basic variant for the

realisation of this model using tax deductions does not make sense under Czech conditions because there is no flat income tax rate. The conservatively oriented section of the Czech political spectrum could mention that, for example, Germany has significantly shifted towards the social democratic model in this respect.

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Critic Factors of the University Hospitals´ Economic Stability in the Czech Republic

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Abstract. The article deals with the problems of economic stability of the government allowance organizations. The aim of this article is to identify the critic factors of economic stability of ten university hospitals during 2010 – 2014. The Z-Score Emerging Markets Model was used for the needs of the economic stability modelling. The Pearson´s correlation coefficient was chosen for the mutual linear two-dimensional dependency analysis. The Z-Score Analysis results have shown that six of the university hospitals were located within the safe zone during the watched period; two university hospitals were in the grey zone and two hospitals showed their results on the grey and critic zone border. Analysis of the Z-Score results has proved that the X_4 factor has the most significant influence on the results value. The X_4 factor is given by the ratio of equity to the foreign sources. Minimal influence has been found with the X_2 factor (given by the ratio of the after-tax profit and the retained profits to the total assets). The article has shown that the legal form of the allowance organization is not appropriate in healthcare, because of majority financing of these organizations from the public health insurance (reimbursement of the provided health care services) and of inflexible management that is bound to rigid procedures from the state.

Keywords: Allowance organizations, university hospital, economic stability, Altman Z-Score, Correlation Analysis
JEL Classification: G30, I18

1 Introduction

There is no doubt that organizations operating in the public sector, especially in health care, belong to the significant economic subjects of the national economy. The special and together the most significant segment of health care is represented by those hospitals that, besides the bed and ambulant care, provide a range of specialized health care services and research activities. The university hospitals belong to this segment. They represent the most significant centres of complex health care and also the focuses of health care trends and development in the Czech Republic. Functioning of the university hospitals has large economic resource requirements. These resources undermine the requested professionality and health care quality, and also education and research. These facts are illustrated by the national statistics (ÚZIS ČR, 2010 – 2014). These statistics show that the volume of annual revenues from the healthcare insurance companies - numbers of beds, numbers of physicians and nurses and also the numbers of the in-patients - assign the university hospitals to the largest hospitals in the Czech Republic. It is then logic that the sustainable functionality, accessibility and quality of these hospitals is in a no small measure influenced by their economic stability.

67% of the Czech Republic hospitals are public – they are owned by the state, regions or municipalities. They have variant legal forms – allowance organizations or trading companies. The resting 33% of hospitals are owned by the non-government non-profit or private subjects (Vrabková and Vaňková, 2015; Gajdošová, 2016). The university hospitals, together with other 30 specialized health care institutions (e.g. Institute for Clinical and Experimental Medicine, Masaryk Institute of Oncology in Brno) have the legal form of an allowance organization. This legal form arouses many questions. According to Ježek (2011) the Czech Republic non-profit hospitals´ contemporary legal form – the allowance organizations – is outdated and is waiting for an ineviTable transformation into some kind of a modern form of a hospital or a trading company. This view is hold also by Havlan (2008), who states that the government allowance organizations belong to the transitional kind of category, waiting for its transformation. Škarabelová (2014) alerts to the allowance organizations´ inflexibility, including their advantaging at the expense of the non-government non-profit subjects in raising the public funds (e.g. the specific grants). We also can highlight that advantaging of the allowance organizations negatively influences the horizontal competition, therefore the health care efficiency and quality in the given region. Martini, Berta, Mullahy and Vittadini (2014) stress the importance of the hospital care competition on the horizontal level in contrast to quality and efficiency in Lombardy (Italy). Stabile and Thomson (2014) show that the European countries

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governments exercise a balanced attitude to the financial support of the hospital care (subsidies, incentives), regardless of whether the health care provider is private or public.

The problems of the university hospitals´ unsatisfactory legal form – the state allowance organization – have been the subject of frequent discussions at the political level. These discussions have not once finished into concrete proposals of legislative changes. These proposals were combined with the conditioned legal form consisting of the non-profit character of the university hospitals and with such a legal status that enables a direct state control.

The article goal is to define the **critic factors of the university hospitals´ economic stability in 2010 – 2014.**

The economic stability, sometimes called the economic condition, predicates of the organization´s endurance rate against the extreme economic impacts. The economic stability is generally measured by the partial indicators, e.g. the profitability, liquidity, activity and indebtedness. These indicators also are methodically included to the aggregate indicators, which include e.g. the Altman Z-Score (Knápková, Pavelková and Šteker, 2013) or, in the case of hospitals, the evaluation of the hospitals´ financial health (HealthCare Institute, 2015). The Altman model enables a short- and medium-term projection of the economic stability and belongs to the most widely used models of the financial analysis. Whereas this model has been made in the US economy conditions, its usage in the conditions of the Czech economy is questionable. Nevertheless, the Altman Model in different variations is often used for the financial stability evaluating, especially of banks and companies, in the Czech Republic conditions. Kalouda and Vaníček (2013) tested applicability of the Altman Model to the Czech Republic conditions. They have found out that this model brings the comparable and quality results in testing of the organizations´ bankrupt prediction – just like the models that have been specially adjusted to the Czech economy conditions (e. g. IN – the Neumaier Couple Credibility Index). Also the other authors using the Altman Z-Score (Synek and Kislingerová, 2010; Růčková, 2011; Zmeškal and Dluhošová, 2011) adhere to the view that the Altman Model is suiTable for the needs of the non-profit organizations in the Czech Republic, too. But they also add that its usage is questionable, respectively with regard to the specific accounting procedures and to the discriminatory factor construction coming from the US conditions and companies´ results. An example of an evaluation of the hospitals´ economic stability using the Altman Model are the articles by (1) Langabeer (2006) evaluating in economic stability of the chosen teaching hospitals US; (2) Ramamonjiarivelo, Weech-Maldonado, et al (2015) evaluating in conditions of the chosen privatised US hospitals; (3) Karakolias and Polyzos (2016) measuring in economic stability of a financial distress projection model in private general clinics in Greece.

2 University hospitals

The university hospitals´ mission and tasks are defined in the §111 of the Act No. 372/2011 Coll., on health services and the terms and conditions for the providing of such services, as last amended. The university hospitals provide the health care services and also realize research and development. The clinical and practical education is realized in the vocational workplaces. The legal form and the management rules of the university hospitals as the government allowance organizations are set by the Act No. 218/2000 Coll., on budgetary rules and on amendments of some related acts, as last amended and by the Act No. 219/2000 Coll., on the property of the Czech Republic and the representation of the Czech Republic in legal relations, as last amended. The government allowance organizations are the state´s means to allocation of the public financial resources to provide mixed and pure public goods. A hardback on their founder is a curiousness of this legal form. The Czech Republic university hospitals are founded by the Ministry of Healthcare and the Ministry of Defence.

Financial management of a state allowance organization should be multisource. The amount of the allowance on functioning from the founder should then depend upon the provided services and the investment needs of the organization. In case of the university hospitals this allowance was in the space of 0.1 – 2 % of the total revenues during the reporting period 2010 – 2014. Exceptions are those university hospitals that were not able to cover the loss-making from their reserve funds. The founders provided a higher functioning allowance to these university hospitals in the given years (see Table 1 – the transfer revenues compared to the total revenues, UH2 and UH9). It is obvious that the university hospitals receive the largest part of the financial resources from the main activities, it means from the payments of the healthcare insurance companies. The average proportion of the revenues from the healthcare insurance companies to the total revenues makes 80 - 85%. In Table 1 there is the loss of revenues from the healthcare insurance companies (revenues from the services sales to the total revenues) visible with the UH2 and UH9. The university hospitals´ profit is made by both – the main activities profit and profit from the other activities, after taxes. If a university hospital management results in a loss, the founder (the Ministry of Healthcare, in case of the Military University Hospital it is the Ministry of Defence) has an obligation to discuss the way of its consideration, no later than the end of the following year. Usually the loss is considered from the university hospital´s reserve fund, from another activity profit or from the founder´s budget. The founder may also set some levy and penalty for breach of the budgetary discipline to the university hospital. This is paid from the reserve fund to the founder´s budget.

Sustainability, functionality and effectiveness of the government allowance organizations in the healthcare conditions have not only been discussed for several years but have also been one of the main reasons for several government legislative proposals. One of the proposals had even a practical form – the Act. No. 245/2006 Coll., on public non-profit in-patient health establishments. This act took effect on the 31st of May 2006, nevertheless it has never been applied (it was abandoned by the Act No. 466/2011 Coll.). Some of its enactments (§ 34 paragraph 3 letter a), paragraph 6, § 40, annex) had become an object of a constitutional complaint, that was upheld by the Constitutional Court of the Czech Republic (see the Constitutional Court Finding No. 483/2006). The university hospitals draft act was another concrete proposal that was approved by the Government Resolution from the 26th of January 2011. Nevertheless it has never been legislatively realized. The latest proposal for the change of the healthcare institutions´ status was submitted, as a bill to the Government, by the Minister of Healthcare in October 2015. The common feature of all of the above-mentioned proposals for a change of the healthcare institutions´ legal status is the unsuited legal form of the allowance organization. In case of the university hospitals this legal form squares not only the rigidity of the financial management but also the rigidity of the top management motivation.

Merlíčková Růžičková (2013) go into the government allowance organizations' management. They see problems; inter alia, in the assets depreciation that can burden the costs, especially if the founder doesn´t cover the higher demands by the allowance and if even the allowance organization´s own revenues don´t suffice. Another problem they see in the financial resources fixture to the supplies. The average proportion of the university hospitals' depreciation on their total costs during 2010 – 2014 is visible in Table 1. It moves from circa 1.5 to 10%. Lovětinský and Mylková (2011) highlight the peculiarities when accounting on the government allowance organization funds. The accounting can influence the profit to be higher. The accounting and the gains of a university hospital do not necessarily mean liquidity of the university hospital or guarantee the solvency.

An outline of the Czech Republic university hospitals, including their chosen financial results, is presented in Table 1; namely the average values of the period 2010 – 2014. This outline puts the finishing touches and also supplements the later-mentioned results of the financial analysis according to the Z-Score Model Emerging Markets. In Table 1 we can see the two largest costs items. One of them is the material consumption that in average makes 31 – 41% of total costs during the reference period. Another item is the labour costs, in average 27 – 33% of the university hospitals´ total costs during the reference period.

Table 1: Average value of the chosen proportion indicators in 2010 - 2014

Proportion (%)	UH1	UH2	UH3	UH4	UH5	UH6	UH7	UH8	UH9	UH10
Current assets to total assets	18.90	14.14	25.51	26.40	21.06	18.92	23.48	19.65	21.49	34.33
Foreign sources to total liabilities	6.60	9.57	13.48	14.02	15.77	17.05	25.22	26.20	33.97	30.79
Labour costs to total costs	29.34	30.85	32.52	32.66	31.14	31.20	29.86	29.42	32.35	27.16
Material consumption to the total cost	30.78	31.28	40.05	33.67	33.31	39.53	39.82	40.68	32.90	39.98
Depreciation of tangible fixed assets to total costs	9.85	8.99	5.16	5.64	6.85	5.23	4.75	4.77	1.47	3.08
Revenues from services sold to total revenues	84.99	73.44	88.39	89.59	85.79	85.52	82.32	82.14	74.93	86.40
Income from transfers to total revenues	1.51	14.97	1.28	0.46	0.56	0.73	0.62	1.32	7.09	0.62

Note: University Hospital of Motol (UH1), Military University Hospital Prague (UH2), University Hospital of Hradec Králové (UH3), University Hospital of Pilsen (UH4), University Hospital of Ostrava (UH5), University Hospital of Olomouc (UH6), University Hospital of Královské Vinohrady (UH7), University Hospital of Brno (UH8), University Hospital of St. Anne Brno (UH9) and General University Hospital in Prague (UH10).

3 Methodology

Economic stability of ten university hospitals during 2010 – 2014, whose outline is set in Table 1, is assessed according to the Altman Z-Score (see 1). The data sources were the university hospitals´ balance-sheets and their profit and loss statements that had been published by the MONITOR – a specialized information portal of the

Ministry of Finance of the Czech Republic. These data come from the State Treasury System (IISSP – Integrated Information System of the State Treasury) and are actualized regularly. The data actualization is carried out from the State Accounting Information Central System once a quarter; and from the Budget Information System once a month. MONITOR then, according to the § 21 of the Act No. 563/1991 Coll., on Accounting, as last amended, ensures publishing of the allowance organizations´ financial statements.

The results of the Z-Score and of the individual variables were examined for the mutual linear relationship (see 3.2). The Pearson´s correlation coefficient and correlogram were used for this purpose.

The Z-Score Model Emerging Markets

The Altman Z-Score Discriminant Analysis (the so called Bankruptcy Model) was used for the aggregate the financial analysis of the chosen government allowance organizations; adapted to the needs of the emerging markets. The original discriminant analysis equation has been adapted by Altman, namely in the case of increase of the analysis discriminant coefficients' values and in the case of decrease of the proportion indicators. For this article needs the index is marked as Z´´ (see 1). According to Altman (2000) this particular model is also useful within an industry where the type of financing of assets differs greatly among firms and important adjustments, like lease capitalization, are not made. In the emerging market model, we added a constant term of +3.25 so as to standardize the scores with a score of zero (0) equated to a D (default) rated bond.

The original model including other modifications has been described by the author (Altman, 2000).

The Z Score Model Emerging Markets Discriminant function:

$$Z'' = 6.56X_1+3.26X_2+6.72X_3+1.05X_4, \quad (1)$$

where

Z = overall index, a_n are the discriminant coefficients, X_n are the independent variables:

$$X_1 = \frac{working\ capital}{total\ assets}$$

$$X_2 = \frac{after-tax\ profit + retained\ profits}{total\ assets}$$

$$X_3 = \frac{EBIT}{total\ assets}$$

$$X_4 = \frac{equity}{foreign\ sources}$$

According to the resulting Z´´ index value there are three zones of the organization financial stability: (1) the safe zone: Z´´ > 2.60; (2) the grey zone: Z´´ ∈ <1.10; 2.60>; (3) the crisis zone: Z´´ < 1.10.

The Correlation Analysis

The Pearson´s Correlation Coefficient (2) has been chosen for the mutual two-dimensional linear dependence analysis of two variables, similarly as in the testing by Široký, Friedrich and Maková (2012). The correlation coefficient "r" can take values from the interval r = <-1; 1>, where the correlation coefficient value sign determines the correlation direction. The direct correlation is when r > 0, the indirect correlation is when r < 0. The *x* and *y* variables are linear independent when r = 0, then they are seen as uncorrelated.

$$r = \frac{\sum_{i=1}^{n}(x_i-\bar{x})(y_i-\bar{y})}{\sqrt{\sum_{i=1}^{n}(x_i-\bar{x})^2\sum_{i=1}^{n}(y_i-\bar{y})^2}} \quad (2)$$

The H_0: R=0; H_1: R≠0 hypothesis were verified by the correlation coefficient significance *t* (3).

$$t = r\sqrt{\frac{n-2}{1-r^2}} \quad (3)$$

The testing statistics *t* is compared to $t_{krit}(0.975; n-2)$. If *t* is higher than the Student´s Division Quantile $t_{krit,}$ the H_0 is rejected.

4 Results

The Z´´ results in the particular years 2010 – 2014 are presented in Table 2. The Figure 1 histogram shows the interval distribution and the values of the relative frequency Z_H (n=50) in the particular classes. In Table 2 the university hospitals are sorted according to the Z´´ best average results (2010-2014). The most of the university

hospitals were in the safe zone - from the financial stability classification zones – 80% of UHs in 2010, 70% of UHs in 2011, 80% of UHs in 2012, 70% of UHs in 2013 and 70% of UHs in 2014. The UH1 and UH2 with their distinctly best Z´´ results differ from the other eight UHs. Grounds for this statement are given later in the particular indexes analysis (X_1-X_4). The lowered economic stability to the grey zone was found by one of the ten UHs (10%) in every particular year of 2010 – 2012. In 2013 the number of threatened UHs increased to 2 (20%) and in 2013 to 3 (30%). In 2010, 2012 and 2013 there were 10% of UHs in the crisis zone, then 20% of UHs in 2011 and 0% of UHs in 2014 were in the crisis zone (see Table 3).

Table 2: Z´´ Results, 2010-2014, n=10

UHs	2010	2011	2012	2013	2014
UH1	16.63	14.73	14.40	16.62	14.34
UH2	6.52	9.73	11.18	13.74	15.69
UH3	7.19	7.17	7.64	7.85	8.07
UH4	7.44	5.52	7.18	8.24	8.65
UH5	4.24	5.53	6.12	6.58	8.48
UH6	5.39	5.78	6.24	4.74	5.31
UH7	3.29	2.51	2.95	3.23	4.35
UH8	4.36	4.36	3.31	1.36	1.65
UH9	1.56	1.07	1.20	0.63	1.68
UH10	0.85	0.67	0.66	1.61	1.76
Mean	5.75	5.71	6.09	6.46	6.70
Standard Deviation	4.19	3.98	4.12	5.08	4.79

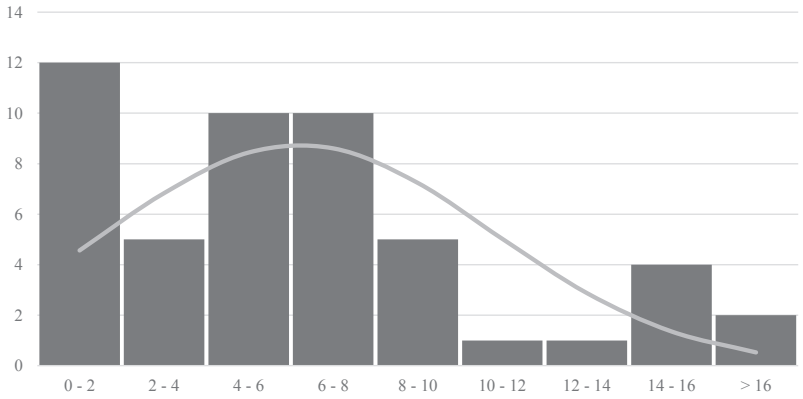
Source: Own calculation.

Table 3: Summary of interpretation of under Z´´

Classification	2010	2011	2012	2013	2014
Distress Zone (<1.10)	1 (10%)	2 (20%)	1 (10%)	1 (10%)	0 (0%)
Grey Zone (1.10 - 2.60)	1(10%)	1 (10%)	1 (10%)	2 (20%)	3 (30%)
Safe Zone (>2.60)	8 (80%)	7 (70%)	8 (80%)	7 (70%)	7 (70%)
Total	10 (100%)	10 (100%)	10 (100%)	10 (100%)	10 (100%)

Source: Own calculation.

Figure 1: Histogram Z´´ (2010-2014); (n=50)



Source: Own calculation.

The X_1 index – the working capital to the total assets ratio is a measure of the net liquid assets of a university hospital relative to the total capitalization. The working capital value is a result of the difference between the

current assets and the short-term liabilities. If the result X_1 index is positive, then the current assets are bigger than the short term liabilities. The higher the X_1, the higher the proportion of the current assets (inventories, short-term receivables and short-term financial assets) to the total assets. The university hospitals (H8, H9 and H10) that show the negative X_1 index are at risk of inability to repay their short-term liabilities (see appendix). The UH1 has the best X_1 index (liquidity) in every year.

The X_2 index is a ratio of the after-tax profit and the retained profits to the total assets. Altman (2000) states that the retained earnings are the account which reports the total amount of reinvested earnings and/or losses of an UH over its entire life. The account is also referred to as earned surplus. The negative X_2 index means that in the given year the UH shows a loss or a zero profit or its profit is reduced by the undivided losses from the previous years. The appendix Table brings 44% of the negative X_2 index results. Vice versa, 56% of the X_2 index results show either a zero or a very small profit of the UHs. The best X_2 index result is the $UH6_{(2014)}$ that is given by the zero after-tax profit in 2014 and the positive balance of retained earnings from the previous years.

The X_3 index is the proportion of EBIT (earnings before interest and taxes) to the total assets. The negative X_3 index means that in the given year the UH has the total costs higher than the total earnings. This ratio is a measure of the true productivity of the UH´s assets, independent of any tax or leverage factors. Since a firm's ultimate existence is based on the earning power of its assets, this ratio appears to be particularly appropriate for studies dealing with corporate failure. Furthermore, insolvency in a bankrupt sense occurs when the total liabilities exceed a fair valuation of the firm's assets with the value determined by the earning power of the assets. The H3, H8 and H10 had the worst X_3 index results in 2013.

The last X_4 index obtains the highest nominal value by all of the researched UHs. This index is given by the equity to the foreign sources ratio. The measure shows how much the university hospitals´ assets can decline in value (measured by market value of equity plus debt) before the liabilities exceed the assets and the firm becomes insolvent. It is obvious that e. g. the University Hospital of Motol has its equity more than thirteen times larger than its foreign sources. And on the other hand the General University Hospital in Prague has its equity just 1.6 times larger than its foreign sources.

The results of the two-dimensional correlation between Z'' and the $X_1 - X_4$ variables are shown in Table 4. The results of the correlation between two $X_1 - X_4$ variables are shown in Table 5. The results were interpreted with the understanding that the correlation shows only the quantitative relationship between two variables; and doesn´t explain its cause. Significance of the correlation coefficient with the p- value (see *p val*) tests the H_0 hypothesis on the $\alpha = 0.05$ significance level. If the *p*- val is higher than 0.05, the H_0 hypothesis is accepted. This hypothesis says that there is no linear dependence between the variables. Otherwise, when the p- val result is lower than the chosen significance level α, the H_0 hypothesis is rejected in favour of the H_1.

Intensity of the linear dependency (correlation) was set according to the *r* value:

- 0.0 – 0.2 very weak correlation < 5%;
- 0.21 – 0.4 weak correlation < 20%;
- 0.41 – 0.7 medium correlation < 50%;
- 0.71 – 0.9 strong correlation < 80%;
- 0.91 – 1.0 very strong correlation > 80%.

Table 4: Correlation between the Z´´(2010-2014) and $X_1 - X_4$ variables (2010-2014)

	r	*t*	*p val*	significance
Z´´ and X_1	0.7366	7.5448	0.000	***
Z´´ and X_2	0.0088	0.0609	0.952	0
Z´´ and X_3	0.2864	2.0713	0.044	*
Z´´ and X_4	0.9929	57.6792	0.000	***

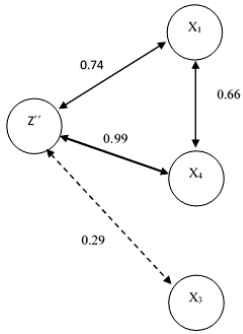
Note: *** significant correlation, * little significant correlation.

The detected linear relationship is shown in a scheme (Figure 2). A very strong correlation was proved between the Z´´ and the X_4 index. A strong correlation was proved between the X_1 and X_4 indexes; and a weak correlation was proved between the Z´´ and X_3.

Table 5: Correlation between $X_1 – X_4$ variables (2010 – 2014)

	r	t	p val	significance
X_1 and X_2	0.2164	1.5356	0.131	0
X_1 and X_3	0.2329	1.6592	0.104	0
X_1 and X_4	0.6614	6.1094	0.000	***
X_2 and X_3	0.0876	0.6093	0.545	0
X_2 and X_4	-0.0733	0.5094	0.613	0
X_3 and X_4	0.2503	1.7914	0.080	0

Figure 2: Scheme of the linear dependency among the researched variables



Source: Authors.

On the base of the conducted two-dimensional correlation analysis between the Z´´ and the particular variables $X_1 – X_4$ we can say that, in the case of the university hospitals, the result Z´´ value is influenced by the partial variables very differently. The most significantly the Z´´ result is influenced by the X_4 variable, which is a result of the equity to the foreign sources ratio. The Z´´ value bears on the X_1 index. It is a result of the working capital to the total assets ratio. The X_3 variable, given by the ratio of earnings before interest and taxes to the total assets, influences the Z´´ result significantly less than the X_1 and X_4 variables. On the other hand the X_2 variable - the ratio of the after-tax profit and the retained profits to the total assets – influences the Z´´ result the least. An example of this can be the results of the UH8. In 2010 – 2012 the UH 8 showed the negative X_2 values, yet the Z´´ values pointed at the safe zone of the economic stability in these years. In 2013 and 2014 the UH8 showed zero X_2 values, and the Z´´ values pointed at the worsened economic stability (the grey zone).

5 Conclusion and Discussion

The article monitored the financial stability of all of the ten university hospitals in the Czech Republic during 2010 – 2014 with the aim to identify its critical factors by the means of the specific Altman Z Score – Emerging Markets Model.

The results of the Z Score EM show that six (60%) of the university hospitals (UH1-UH6) were, during 2010 – 2014, in a good financial condition (stability), i.e. in the safe zone. The University Hospital of Královské Vinohrady (UH7) showed a one-year (2012) deviation as a deterioration of the financial stability (to the grey zone). Whereas the University Hospital of Brno (UH8) showed a rapid deterioration of the financial stability to the grey zone in 2013 – 2014 compared to years 2010 – 2012. The University Hospital of St. Anne Brno (UH9) and the General University Hospital in Prague (UH10) showed the worst results on the grey and crisis zones border. The results slightly improved during the time.

The factors of the university hospitals´ economic stability can be classified into the positive critic factors and the negative critic factors. The results of the Z Score EM analysis show that the X_4 factor (given by a ratio of equity to the foreign sources) influences the Z´´ the most. The equity is given by the property value (buildings,

parcels and device). The property is in the ownership of a founder who has entrusted the property in a foundation deed to a university hospital to manage it. Nevertheless, with the growing property value, the maintenance and reproduction costs of the university hospitals grow up. The tangible fixed assets depreciation corresponds to this, to a certain extent. The foreign sources are made, in majority, by the short-term liabilities. The foreign sources are a negative critic factor, if they are equal to and greater than circa 30% of the total liabilities.

The finishing financial stability value of the university hospitals is significantly influenced by the X_1 factor that is given by the working capital to the total assets ratio. It is visible that this factor value is again influenced by the amount of fixed assets that makes the largest part of the total assets. Nevertheless, this factor primarily indicates the level of the university hospitals´ liquidity. As critic seem those short-term receivables that make almost 75% of the current assets of university hospitals with worsened financial stability. These receivables are in majority against the health care insurance companies. The short-term liabilities are a risk factor, namely when they are higher than the current assets, respectively the short-term receivables.

The X_3 factor influences the financial stability of the university hospitals slightly. This factor reflects the earnings before interest and taxes to the total assets. This factor seems to be critic only with the negative profit. It is necessary to underline that the allowance organizations are the non-profit organizations and their main goal is to provide quality health care, therefore achieving a profit isn´t a primary purpose of this legal form. If a university hospital makes a loss, it is covered from the reserve funds or by the founder.

In response to the higher mentioned, it is clear that the X_2 factor has a minimal influence on the financial stability, because it is given by the ratio of the after-tax profit and the retained profits to the total assets.

The realized evaluation of the university hospitals´ financial stability was carried out with the understanding that these hospitals are the government allowance organizations; and this legal form raises many questions. Its suitability in the healthcare conditions is questioned. This is demonstrated by the draft law on the non-profit healthcare organizations (from 2015) that supposes transformation of the university hospitals to a new legal form. The aim of the draft law is a more transparent and more efficient management of the new form of the university hospitals. The current legal form of the government allowance organization fails mainly in the institutional provision for the university hospital´s activities. The fundamental weaknesses are seen mainly in the so called tied funding which disables an efficient cash flow management; in restrictions on disposal of assets and in possibilities to motivate the hospitals key employees. Another problem of the current university hospitals´ legislation is a fully dysfunctional relationship between the university hospitals and the universities.

In conclusion it is possible to state that a government allowance organization isn´t a suiTable legal form for the healthcare; both because of their majority financing from the public health insurance, and inelastic management that is bound to the rigid procedures from the founders.

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The aspects of the "black list" institute in public procurement of the Czech Republic

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Abstract. The authors present their results concerning analysis of actual situation in the context of Act No 137/2006 Coll., On Public Contracts due to the "black list" institution that was adopted to the Czech law in 2010 as an instrument to prevent suppliers (tenderers) from submission of faked qualification requirements. The paper tries to explain the problematics of the black list institute and try to explain other circumstances that should be deduced out of this institute. The authors summarize the effect of the black list to the suppliers for its 5 years history. The blacklisting is used in other countries but the authors tried to think out if this is the right way in the Czech Republic environment and the right motivation to the Czech suppliers to submit the fair bids in the tenders.

Keywords: Public procurement, factors of competition, blacklist, qualitative analysis.
JEL Classification: B22

1 Introduction

Public contracts are a significant part of expenses of every state budget. Only in the Czech Republic (CR), the estimated "flow-through" of public contracts is 500 to 600 billion CZK every year. For some firms, public contracts are an important, and many times the only source of income. The matter of public procurement in the Czech Republic is frequently discussed by the professional community. The matter decided by the Office for Protection of Competition (OPC), as the supervising authority over public procurement, and the matter frequently judged by courts. In the territory of the Czech Republic, the matter of public procurement is provided namely by Act No 137/2006 Coll., On Public Contracts, as amended (in further text the Law or PCL). The main reason for regulation of the public sector and public contracts is to ensure parallel operation of public markets and private markets. Lawmakers are now becoming aware of a special nature of public markets and focus on creation of such conditions which will be similar the conditions of private markets operation (Bovis, 2007, Jurčík, 2013).

Some authors associate increased efficiency of public procurement with the possibility of an easier access of small and medium enterprises to the public contracts market (Nakabayashi, Lundberg, 2013, Loader, 2013, Man et all, 2014). According to authors, an important role in the final result of a tender fall also to the method for assessment of bids chosen by contracting authorities in tenders when, for example, the method quality-to-price is recommended, allocating certain value of money to a certain quality level which should be, as such, more transparent and should guarantee a higher rate of comparability of bids in relation with their quality and price (Bergman, Lundberg, 2013). In view of the authors, it is important to mention also the fact that efficiency of public contracts itself is based, last but not least, on the "quality" of the legislation framework for public procurement. Some authors concentrate on criticism of, for example, so called European public procurement law (Korthals et al, 2010, Jurčík, 2014). In the field of public procurement, an important role is that of the rate of corruption which strongly devalues the quality of economic competition in individual countries. Therefore, some of authors deal with the influence of corruption in public contracts on economic competition (Ateljevic, Budak, 2010).

Blacklisting can be defined as the procedure where competitors are disqualified from participating of tendering projects (Transparency International Czech Republic, 2007). This could after examination happen if a competitor is found to have been drawn in the use of dishonesty to lock any procurement contracts, or to have failed to assemble contract obligations. A "Blacklist" register is often consolidated in one place, and countries may choose either to make this list available to the public, or only to contracting authorities, who will consult the list prior to making any public purchase. Best practice would require such lists to be publicly accessible and binding on public procurement decisions within the respective jurisdiction (Transparency International, 2006).

Many countries have introduced blacklisting systems due to corruption, but few have established a public and central register or database of all competitors that have been blacklisted. However, public blacklists are available in some countries, including Bangladesh, Brazil, Pakistan and Uganda. In the United States, state and government agencies usually have an online register of for all blacklisted companies, but a public database is still lacking at

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the federal level. Despite the use of blacklists, there is very limited evidence of the impact of such lists in reducing corruption.

The blacklisting countries may have different aims for introducing blacklisting as part of their anti-corruption efforts. Blacklisting may be used as (UK Anti-Corruption Forum, 2007):

- a form of (administrative or criminal) sanction to those companies and individuals involved in dishonesty
- a preclusion to dishonest behaviour. As blacklisting competitors can suffer severe economic losses if prohibited from contracting with the public administration, and experience serious reputation damage if the list is made available to the wider public. They may also lose commerce opportunities if other companies are looking for partners or subcontractors that have not been involved in corruption or other wrongdoing
- an incentive for companies to establish appropriate anti-corruption policies and to cooperate with authorities in cases of wrongdoing; such efforts may be considered as mitigating factors when deciding on the length of debarment or on the criteria for delisting, for example
- as a means to strengthen and promote open and transparent procurement processes, and support honest competitive bidding (Moran et al., 2004).

In the Czech Republic, the "Blacklist" register was established in 2010, as an amendment to Act No 137/2006 Coll., On Public Contracts. Those suppliers who, during the procurement procedure fail to submit transparent and truthful information are put on the blacklist, which might affect the proceedings. The "Blacklist" register is a register of competitors who are disqualified from performing public contracts. The instrument uses the Office for the Protection of Competition as a penalty in an administrative offence, to demonstrate falling compliance with the submitted information. Subsequent to a final decision of the Office for the Protection of Competition, the disqualification is reported by the Ministry for Regional Development; then it is written to a publicly accessible list, the "Blacklist" register.

Effectiveness of blacklisting in public procurement processes is tough to evaluate. It is complex issue, to assess how effective blacklisting system and mechanism are. Unfortunately, there is very limited amount of information. For that reason, there are no real assessment of the impact of such mechanisms on corruption in public procurement. It can be assumed that existence of the "Blacklist" register will solve corruption-related issues in public procurement, particularly in countries where corruption is systemic (Trepte, 2005). But debarment is certainly an important step in the fight against corruption (Moran et al., 2004).

It is expected that the consequences of blacklisting, such as reputational damage, economic losses, etc., would act as a prevention for competitor engagement in corrupt behaviour, and would thus help to enhance transparency and fairness in public procurement. In fact, research conducted by the Humboldt-Viadrina School of Governance (Schöberlein et al., 2012) shows that companies find that restrictions on business opportunities and operations, such as blacklists, are considered to be the most effective mechanisms to motivate business to fight corruption. According to 32 per cent of respondents, reputational considerations are a key factor for business to engage in the fight against corruption; for 60 per cent of those surveyed, negative publicity, such as "naming and shaming" approaches, offers a strong incentive. Furthermore, 88 per cent of the respondents agree that business representatives with a history of corruption should be excluded from contracting with the public administration (Schöberlein et al., 2012, Ochrana, 2014). However, in countries where debarment policies are in place, there are no assessments on whether it has helped to improve corporate behaviour or not. At a more technical level, the introduction of debarment mechanisms that are accompanied by a national electronic list of debarred firms and individuals could facilitate information-sharing among government bodies, development agencies and even across countries, reducing operating costs as well as enhancing efficiency and transparency in procurement procedures (Jennett, 2006).

2 Material and Methods

The PCL in the CR provides the rules for spending of public funds on construction works, supplies and services. Each of the above mentioned types of expenses has different rules in some aspects requiring utilization of different modes of the PCL. Acquisition of scientific and research equipment (appliances) falls, according to the PCL, into the category of supplies (Section 8 of the PCL). For the purpose of this article, we will understand acquisition of scientific and research appliances as a supply within the meaning of the PCL.

The PCL in the CR is now based on the directives of the European Parliament and the European Council and their amendments. The quality of the mentioned directives is the subject of further expert discuses. For example (Allain, 2006), who criticizes some provisions included in these directives. The CR and other member states of the EU are obliged to transfer the wording of those directives into their public procurement legislation. In relation with the treated matter, however, the directives do not provide reasons for cancellation of tenders; it is therefore an exclusive competence of member states to set the rules for cancellation of tenders independently. At the same time, the directives do not provide any special exceptions for purchase of research equipment and it is therefore again up to the member states to provide the rules for such purchases.

The methodology of this article is derived directly from the very formulation of the PCL, while the main method of the whole work is an analysis of the specific part of the PCL whose wording strongly impacts suppliers in tenders. The method of the article therefore is to define the starting points of the problem; the problem is identified, specified and described, its impacts assessed and finally, proposals formulated for solution of the problematic situation. Method of comparison is also used in this article. In the article, also practical experience was utilized of various decisions of the Office for Protection of the Competition for the Czech Republic.

The aim of this paper is to introduce a legal provision for the creation of Blacklist Register of suppliers who abuse the tender legislation demands, subsequently evaluate critically what were the results of introduction of the Blacklist Register and mention which countries have already introduced blacklists of conspirators. It is truth that in other sector of competition there are exists other lists of enterprises which they have special rights if there are on the special lists or there are excluded from possibility of to be producers (Jurčík, 2015). The special and individual blacklists are involved in new procurement law also.

3 Results

In the Czech Republic, there is a strong debate, if "Blacklist" register should be cancelled or not, at present time. On the sixth meetings of the Government Council for Coordination of the fight against Corruption, there was completed a draft amendment to the Public Procurement Act. Questions were focused on the issue whether to maintain "Blacklist" register, a list of natural and legal persons prohibited from performing public contracts, or cancel it altogether, as proposed by the Ministry for Regional Development.

The Ministry for Regional Development argues that mechanisms in the New Public Procurement Act are considered to be sufficient. The current form of the new European register contradicts the EU Procurement Directives that enforce implementation of the recovery process capability, which allows suppliers to demonstrate that they have taken sufficient measures to remedy previous offence. According to the ministry it is necessary to assess each company's individual wrongdoing and allow it to provide evidence of correction its inaccuracy. Therefore, supposedly does not apply a general penalty, a publication of the names in the register.

As we can find out on the web site of the information system of public procurement in the CR (Věstník rejstříku osob se zákazem plnění veřejných zakázek, 2015) there is actually 8 suppliers that are not able to do public tender in the CR. Historically there was about 10 suppliers at all but 2 of them has been replaced out of this black list after 3 years when they were arrested to do the public tenders in the CR. Table 1 shows the actual content of the black list in the CR.

Table 1. Register of suppliers prohibited participation in public contracts

Supplyer	ID	Address	Date of entry	End date	Decisions of the OPC that occurred the enrollment*
BETONSTAV TEPLICE a.s.	63149435	Brno, Minská, 3173/38	19.03.2013	19.03.2016	ÚOHS-S614/2012/VZ-5098/2013/514/JNv
GREEN PLACE s.r.o.	24289647	Niměřice, 26/0	04.06.2015	04.06.2018	ÚOHS-S159/2015/VZ-13663/2015/521/ZKu
Ing. Pavel Kafka	72007915	Havlíčkův Brod, SNP, 1148/0	13.08.2014	14.08.2017	ÚOHS-R26/2014/VZ-16775/2014/321/PMa
KHP montáž, s.r.o.	27681891	Praha, Viktora Huga, 377/4	13.03.2013	13.03.2016	ÚOHS-S677/2012/VZ-5072/2013/511/MFl
MIPRO SECURITY, s. r. o.	63489538	Brno, Hudcova, 74/	29.11.2012	29.11.2015	ÚOHS-R189/2011/VZ-21818/2012/310/DBa
SCS 2012 s.r.o. v likvidaci	25215213	Praha, Holečkova, 789/49	25.03.2013	26.03.2016	ÚOHS-R253/2012/VZ-4598/2013/310/PMo
STAFI CZ s.r.o.	26867664	Krnov, Vrchlického, 1194/20	15.09.2015	17.09.2018	ÚOHS-S0217/2015/VZ-25209/513/EPi
UPC Česká republika, s.r.o.	00562262	Praha, Závišova, 502/5	09.11.2012	09.11.2015	ÚOHS-S437/2012/VZ-19899/2012/512/MHr

(Source: Authors, Věstník rejstříku osob se zákazem plnění veřejných zakázek, 2015), *All decisions mentioned above are available on www.compet.cz

The current approaches to verification qualification requirements by CA's in the public tenders

Actual wording of the PCL gives CA the possibility to start "blacklisting" the supplier that submitted some false qualification requirement in his tender bid (these document were not truthful). The most common is the falsification of the so called technical qualification requirements (actually all blacklisted suppliers has made a falsification of the technical qualification requirements) so in other text we would like to focus on this problematic.

Of course there is a possibility to falsify some basic or profess qualification requirements but this is not so "easy" because these are documents issued by the local authorities (Tax Offices, Courts etc.). Actually we can speak about three possibilities how CA can start the "blacklisting" process:

1. CA tries to verify the references (technical qualifications) that were submitted by supplier in the tender bid directly with the holder of the reference (most often another CA) and if CA has some doubt about the originality of the reference he can decide to send (or to do not send) the initiative to the OPC that has the competence to start the administrative proceedings against such a supplier.
2. CA sends the initiative to the OPC without verifying the originality of the reference that were submitted by supplier in the tender.
3. CA has possibility to call the supplier to change the false reference and submit original reference.

In the context of possibilities that are mentioned above the authors think that the most elegant procedure in this case is written in the first point. The procedure when CA requires the verifying of submitted reference from the holder of such reference and can be perceived as the least risky and the most transparent way. Disadvantage in the second way of procedure authors see the fact that during the OPC investigation the CA should not continue in the procurement procedure because in this moment CA cannot be sure that the investigated reference is really fake or if it is original one. The third possibility of CA how to solve the problem with potentially false reference that were submitted as a part of tender bid is to let the supplier change this reference for a new original one with using § 59 sec. 4 of the PCL.

What about fulfilling the merit of an administrative delict

Supplier commits an administrative delict under § 120 para. 1 point. a) of the Public Procurement Act, as amended (the "Act") that "... if he submits in order to comply with qualification information or documents which do not correspond with real projects or matters and should or could affect the assessment of the qualifications of suppliers in the procurement procedure .... . "

From the above it follows that, for the elements of the administrative offense under § 120a. 1 point. a) Act no. 137/2006 Coll., on Public Procurement, as amended, must be cumulatively met two legal conditions, namely:

a) Submission to demonstrate compliance with qualification information or documents that do not correspond to reality, and
b) The possibility of influencing or affecting the assessment of the qualifications of suppliers in the procurement procedure due to the following information and documents submitted

In the context of the text mentioned above authors of the paper would like to mention that it is needed to distinguish two different situations. First of these situation is when the supplier submit more references than was demanded by CA in his tender bid and one or more of them will show as false but there will be still enough original references to fulfil the qualification requirements settled by CA. This is the situation where in the authors opinion does not fulfill the merits of an administrative delict. The second situation is when the CA during the assessment process find out that one (or more) references that were submitted by supplier in his tender bid is false and the supplier as a consequence of that does not prove that qualification at all. Ca in this moment should use the application of § 59 sec. 4 of the PCL and call the supplier to "change" or refill the qualification by another reference that will be original and not false. Authors think that this second case leads to fulfilment of an administrative delict because the risk of CA in the situation with proving qualification by false document should not be dependent on application of § 59 sec. 4 of the PCL from the CA.

The „black listing" process

In general we can divide the process of so called "blacklisting" into these steps:

- CA identify suppliers reference that seems to be suspicious
- CA should try to verify this reference by its holder (most often other CA)
- CA should give a chance to supplier to vindicate the originality of the reference (for example submission of the Agreement etc.), too.
- If the CA identify suppliers reference as a fake than it should (but we do not find that it is a duty of CA) send an initiative to the OPC that can initiate an administrative proceedings with the supplier (in this case the supplier will be a participant in this proceedings).
- The OPC has also duty to check the originality of the reference even he has information from the CA that has made the verification at some time before the OPC (we think that this duplicity causes unnecessarily extension of the proceedings).
- At the end of the administrative proceedings there is a decision of the OPC where it is postulated neither that the supplier offends administrative delict or not. In the first case is such a supplier assigned to a black list register that is operated by Ministry for Regional Development through information system of public procurement (ISVZ).

- Of course supplier has a possibility to submit an appeal to the second stage of the OPC that can this decision confirm, cancel or change but there are other possibilities to make an appointment (County Court or Supreme Administrative Court).

Analysis of the specific decision of the OPC (one example for all)

This administrative proceedings mentioned below were proceeded with a part of big international provider of internet and satellite services called UPC that proved its qualification through faked references. The OPC, the question of fulfilment of the conditions referred to in point b) dealt with egg. In decision No.: ÚOHS-S437/2012/VZ-19899/2012/512/MHr, which came into force on 8. 11. 2012. Note 30. In the preamble to the decision, the Office stated that "... about a pair of reference deliveries in question was to demonstrate the authority specified key qualifications so that they can have an impact on the actual assessment of the qualifications of the supplier. Although the authority excluded UPC Czech Republic s.r.o. from the tender, the wording of the law makes it clear that signs of an administrative offense committed by the supplier are filled even then, when negotiations contractor is liable to affect the assessment of the qualifications of the supplier. ... "

In this case, the contracting authority demanded, among other things. 3 reference contracts, and the information and documents to 2 out of 3 reference contracts which demonstrated the candidate's qualifications were found to be inadequate by the facts. It is with this in mind Authority concluded that the false documents were capable of affecting the assessment of the qualifications of the supplier. A contrary, one can conclude that the Authority would have not reached the same conclusion, i.e. did not find the administrative offense pursuant to Section 120 paragraph 1 point. a) a supplier of the Act, if part of a tender in addition to "false" documents and other "true" documents and information which the contracting authority has demonstrated the required qualifications contractor.

4 Conclusion and Discussion

The foregoing adds that the Authority is still in its previous decisions dealt with a case where the applicant presented to demonstrate the fulfilment of qualifications such document or information which, although did not correspond to reality, but further exploration would be such. Found that the submitted document or information was not "false" to the extent that it could not meet the minimum level of technical qualification requirements specified by the contracting authority.

This is a case where the contracting authority egg. set a minimum required level of major contracts to CZK 100 mil., The contractor would submit evidence or information to support implementation of the contract in the amount of CZK 200 million, but the authority would have found that the contract that the supplier wishes to demonstrate compliance with qualification were in fact carried out "only" in the amount of 150 mil. CZK. I personally believe that in such a case, the Office also could not deduce the fulfilment of the legal requirements, at least the potential impact of "false" documents and information to assess the qualifications of the supplier by the contracting authority, since it is impossible to conclude that the "lie" or "falsity" has reached such an extent that It could be stated that the contractor has not implemented the contract in such an amount that the authority did not reach the required minimum level of technical qualification requirement. In this case, therefore, it was possible to unequivocally state that the contractor submitted information and documents to prove fulfilment of qualification do not correspond to reality, but there would obviously have to fulfil the second character merits an administrative offense supplier which is the possibility of influencing or affecting the assessment of the qualifications of the supplier within the procurement procedure by submission of such information and documents.

The Authority in its decision-making practice did not address the case where a "false" document or information was intended by the contractor to demonstrate the fulfilment of qualifications. The fact that the contractor was then able to prove compliance with the qualification, in such a case was entirely dependent on the conduct of the contracting entity, which has no connection with the original vendor negotiations and can therefore not in any way affect his criminality (max may influence the amount of a fine). In this case, the "original false" documents and information that certainly could affect the assessment of the qualifications of the supplier by the contracting authority. Moreover, this interpretation is also supported by the reasoning of the above cited decisions of the Authority, which states that "... the mere possibility of influencing the conduct of the supplier qualification assessment by the contracting authority is irrelevant whether that influence actually occurred. A contrary interpretation, i.e. if the supplier was tied to a particular course of action contracting authority and was dependent on whether the authority establishes or detect incorrect information and documents would also be totally inconsistent with the purposes of this provision. Thus, to prevent suppliers to submit to demonstrate compliance with qualification information or documents which do not correspond to reality and could thus inaugurating the sponsor of error in the assessment of qualifications in order to subsequently obtain public contracts.... "

How we can see in the text mentioned above the question is if the black list institute in the Czech law has fulfilled expectations that have been inserted into it. We can only state that historically after 5 years of existence

of the black list there were only 10 suppliers registered into this system in the Czech Republic. Whereas every year there is statistically signed an agreements with thousands and thousands of suppliers in the Czech public procurement environment we can tell that this institution not fulfilled expectations of the government. The other approach to this situation is that the Czech suppliers in their tender bids do not specify so called fake references and we can say that they are honest. This option but in the opinion to the authors seems to not be relevant.

Other possibility why the black list institute did not fulfil the expectations should be the fact that only faked qualification requirements are sanctioned by the OPC. There is much more parts of the tender bids where the suppliers can "lie" (the bidding price, technical conditions etc.). Limited range of the reasons for black listing should be also one of the reason why there were not many suppliers registered in the black list. It will be inspire to follow up the trend in using the black list institute in the CR or in the other countries and actually we are waiting for new public procurement law that is nowadays approved by the Czech government called the Act on procurement procedures and we will see if the black list institute will continue in the Czech legislation. In the last few months it seems that new Czech public procurement law that is actually in the legislative process does not transpon the black list institute from the actual PP law.

The authors think that the black list institute should be really used more effectively than it is in the CR PP law. We can mention some countries where the black list systems are rather developed even these countries do not belong among the developed once for example Brasil (South America), Tanzania, Rwanda (Africa) or Pakistan and Bangladesh (Asia). These countries have free access to their blacklist databases for general public at all! There are also some countries that use the black list institute in their PP law and do not allow the access for general public but only for CAs. In this group of countries we can mention for example Germany or United States of America.

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Impacts of Public Support of Renewable Electricity Generation in the Czech Republic

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Abstract. The paper is focused on an analysis of the impacts of public support of renewable electricity generation in the Czech Republic, mainly on the analysis of the impacts of both feed-in tariffs and grants on the renewable electricity generation. Firstly, the overview of public support of renewable electricity generation in the Czech Republic is briefly described, than the literature overview is presented. For the purposes of the paper, the methods of correlation and regression analysis are used. Based on the results, we can say, that there is the dependence mainly between minimal feed-in tariffs for electricity from biomass and generation of electricity from biomass. Regarding grants, there is the dependence between grants for electricity from biogas and generation of electricity from biogas.

Keywords: public support, renewable electricity generation, feed-in tariffs, grants, Czech Republic.
JEL Classification: H23, Q48

1 Introduction

We can find different kinds of public support of renewable energy sources in the Czech Republic. In the current policy and legislative documents, the objectives of providing public support of renewable electricity generation in the Czech Republic are to reduce the energy intensity of generating units while maintaining long–term stability and availability of energy for the commercial sphere, to reduce the domestic economy's dependence on imported energy commodities, to decrease the consumption of fossil fuels as a primary energy source and to support small and medium–sized enterprises in the area of using renewable sources of energy. A further objective is to exploit the significant potential of energy savings and use of renewable sources of energy.

Regarding economic instruments supporting renewable electricity generation in the Czech Republic, there are currently the following instruments of public support (MIT, 2015): grants on investments, feed-in tariffs, green bonuses, tax exemptions, tax reductions and refund of taxes.

Regarding grants on investments, we can distinguish the public support from (MIT, 2015):

State programs - State programme for supporting of energy savings and use of renewable energy sources regulated by the Ministry of Industry and Trade, New green savings programme regulated by the Ministry of the Environment and Programme for the replacement of boilers regulated by both the Ministry of the Environment and selected regional offices.

Operational programmes – Operational programme OPPIK regulated by the Ministry of Industry and Trade, Operational programme OPŽP regulated by the Ministry of the Environment and Operational programme OPRV regulated by the Ministry of Agriculture.

Regarding feed-in tariffs and green bonuses, there are annual tariffs for producers of both electricity and heat generated from renewable energy sources.

Regarding the exemption, reduction or refund of taxes, we can find special tax depreciation for renewable energy sources, exemption for electricity generated from renewable energy sources (since 1.1.2016 with limited power installation up to 30 kW) from electricity tax, exemption for land connected with particular power station from property tax (excluding photovoltaic energy) and exemption for buildings after changing the heating system from fossil fuels system to a system using RES for five years from property tax (MIT, 2015).

Focusing on relevant scientific papers in this area, we can find studies analysing and evaluating public policies and public support of renewable energy sources and their success in European countries as a whole (Albrech et al., 2015, Marques and Fuinhas, 2012) or selected USA countries (Bedsworth and Hanak, 2013); however the most of the studies are represented by national case studies evaluating national economic instruments and national public policies supporting renewable energy sources, for example in Romania (Zamfir et al., 2016), Lithuania (Bobinaite and Tarvydas, 2014) or Spain (Ortega et al., 2013).

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In the Czech Republic, Ryvolová and Zemplinerová (2010) focused on the economics of renewable energy sources, precisely on the analyses of the costs of growth of wind energy supply. Zimmermannová and Menšík (2013) analysed impact of environmental taxation introduction on electricity generated from renewable energy sources. Průša et al. (2013) analyzed consumer loss in Czech photovoltaic power plants in the period 2010–2011 and Janda et al. (2014) focused on the total historical and future costs of supporting photovoltaic electricity generation in the Czech Republic. The model estimation of these costs is accompanied by methodologically unified comparison with cost of the support of other renewable energy resources.

We can see that in the Czech Republic we can find mainly studies focused on analysis of electricity generated from wind and photovoltaic, on the other hand there is a lack of studies analysing simultaneously the development of electricity generated from renewable energy sources in general and the development of public support of renewable electricity, including analysis of economic impact of this public support in more detail.

Therefore the main goal of this paper is to analyse the impacts of public support of renewable electricity generated from all kinds of renewable energy sources in the Czech Republic, precisely the impact of feed-in tariffs and grants. Partial goal is to find out the possible dependency between 1) electricity from selected renewable energy sources and relevant feed-in tariffs and 2) electricity from selected renewable energy sources and relevant grants.

2 Methodology

For the purposes of this paper, we use data from Energy Regulatory Office (ERO, 2016), precisely feed-in tariffs for electricity from renewable energy sources in CZK per MWh in the period 2003 – 2014, Ministry of Industry and Trade (MIT, 2016), precisely gross production of electricity from renewable sources in MWh in the period 2003 – 2014, Ministry of Finance (MF, 2016), precisely grants for energy saving and renewable sources in thousand CZK in the period 2010 – 2014 and State Environmental Fund (SEF, 2016), precisely grants for investments from the Operational Programme OPŽP for renewable energy support in thousand CZK in the period 2008 – 2014.

Research presented in this paper is based on standard economic methodology, precisely the methods of analysis, comparison, deduction and synthesis, together with methods of correlation and regression analysis (see Hendl, 2012).

For the purposes of correlation analysis, we use Pearson's correlation coefficient:

$$r = \frac{\sum_{i=1}^{n}(x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum_{i=1}^{n}(x_i - \bar{x})^2 \sum_{i=1}^{n}(y_i - \bar{y})^2}} \quad (1)$$

For the purposes of regression analysis, we use linear regression model:

$$y = \alpha + \beta x + e \quad (2)$$

For the purposes of the main target achievement, we defined the following research assumptions:

1. Renewable electricity generation is positively influenced by minimal feed-in tariffs;
2. Renewable electricity generation is positively influenced by grants.

3 Minimal feed-in tariffs

For the purposes of the analysis of economic impacts of feed-in tariffs on generation of renewable electricity we use the following variables: generation of electricity in MWh from small water electricity (SWE), biomass in total (BMT), chips (CH), cellulose (CEL), plant materials (PM), pellets and briquettes (PB), liquid biofuels (LB), biogas in total (BGT), municipal wastewater treatment plants (MWTP), industrial wastewater treatment plants (IWTP), biogas stations (BGS), landfill gas (LG), biodegradable fraction of solid municipal waste (BFSMW), wind power plants (WPP), photovoltaic power plants (PPP) and maximal feed-in tariff for small water electricity (MF SWE), maximal feed in tariff for biomass in total (MF BMT), maximal feed-in tariff for biogas in total (MF BGT), maximal feed-in tariff for wind power plants (MF WPP) and maximal feed-in tariff for photovoltaic power plants (MF PPP).

The results of the correlation analysis for the Czech Republic are showed in the following Table 1.

Table 1: Correlation analysis – feed-in tariffs vs generation of renewable electricity

	Year	SWE	BMT	CH	CEL	PM	PB	LB	BGT	MWTP	IWTP	BGS	LG	BFSMW	WPP	PPP	MF SWE	MF BMT	MF BGT	MF WPP	MF PPP
Year	1																				
SWE	0,507899	1																			
BMT	0,984616	0,450814	1																		
CH	0,972862	0,430129	0,992731	1																	
CEL	0,961461	0,449123	0,947453	0,933471	1																
PM	0,831693	0,458026	0,801615	0,770215	0,699894	1															
PB	0,8721	0,38398	0,923151	0,898439	0,785921	0,757759	1														
LB	0,501105	-0,03471	0,527731	0,538596	0,409531	0,598861	0,500996	1													
BGT	0,881286	0,372719	0,816334	0,803684	0,859222	0,723603	0,650234	0,39782	1												
MWTP	0,964572	0,648268	0,953513	0,943497	0,888675	0,862995	0,868346	0,547945	0,793455	1											
IWTP	0,852316	0,329493	0,817378	0,816854	0,859931	0,664849	0,639082	0,395285	0,931482	0,769566	1										
BGS	0,86958	0,359478	0,803176	0,790157	0,848888	0,712244	0,637241	0,389563	0,999669	0,778573	0,929047	1									
LG	0,908719	0,599149	0,897728	0,902378	0,864412	0,785894	0,759802	0,467085	0,670781	0,923301	0,666913	0,651805	1								
BFSMW	0,865806	0,244533	0,845311	0,836453	0,774233	0,810141	0,784124	0,734526	0,875265	0,825883	0,821505	0,870426	0,700129	1							
WPP	0,982026	0,443459	0,983099	0,973156	0,944675	0,776354	0,902025	0,53623	0,84737	0,944703	0,802248	0,836285	0,860386	0,860029	1						
PPP	0,86301	0,227979	0,84379	0,835999	0,769749	0,809901	0,784221	0,731736	0,876422	0,820449	0,818813	0,871883	0,692876	0,999226	0,859066	1					
MF SWE	0,973503	0,55311	0,963899	0,945109	0,924019	0,844854	0,880259	0,482988	0,771556	0,962455	0,75299	0,756007	0,947824	0,793653	0,950414	0,78756	1				
MF BMT	0,917983	0,436844	0,952833	0,94389	0,897019	0,692618	0,910435	0,461675	0,662343	0,898096	0,646636	0,646826	0,862776	0,699826	0,95359	0,698034	0,934736	1			
MF BGT	0,907686	0,42123	0,942054	0,93317	0,877938	0,708029	0,903144	0,450389	0,64907	0,887995	0,631399	0,633607	0,852192	0,682589	0,9433	0,681648	0,930007	0,995855	1		
MF WPP	0,99285	0,440895	0,984027	0,966258	0,961156	0,818877	0,890825	0,509967	0,888514	0,941735	0,85032	0,878465	0,862491	0,877172	0,988954	0,876032	0,956184	0,923266	0,913705	1	
MF PPP	0,85711	0,398028	0,864648	0,846503	0,871018	0,701148	0,758617	0,372265	0,591953	0,80453	0,582606	0,574735	0,90956	0,599489	0,83395	0,592201	0,915493	0,893013	0,893952	0,843775	1

Source: Own work.

You can see, that there is a strong positive correlation mainly between maximal feed in tariff for biomass in total (MF BMT) and generation of renewable electricity from biomass, precisely from biomass in total (BMT), chips (CH), cellulose (CEL), pellets and briquettes (PB).

It is clear, that we can focus in more detail on relationship between generation of renewable electricity from biomass in total (BMT) and maximal feed-in tariffs for biomass in total (MF MBT) in the following step, using regression analysis. The following Table 2 shows us the results of the regression analysis, where the independent variable is maximal feed-in tariffs for biomass in total (MF MBT) and the dependent variable is generation of renewable electricity from biomass in total (BMT).

Table 2: Regression analysis – feed-in tariffs vs generation of renewable electricity from biomass

Regression statistics	
Multiply R	0,95283294
Value of Reliability R	0,907890612
Adjusted Value of Reliability R	0,898679674
Error of the Mean	176249,5223
Observations	12

ANOVA

	Df	*SS*	*MS*	*F*	*Sig.*
Regression	1	3,0619E+12	3,06E+12	98,56657	1,69822E-06
Residues	10	3,1064E+11	3,11E+10		
Total	11	3,3725E+12			

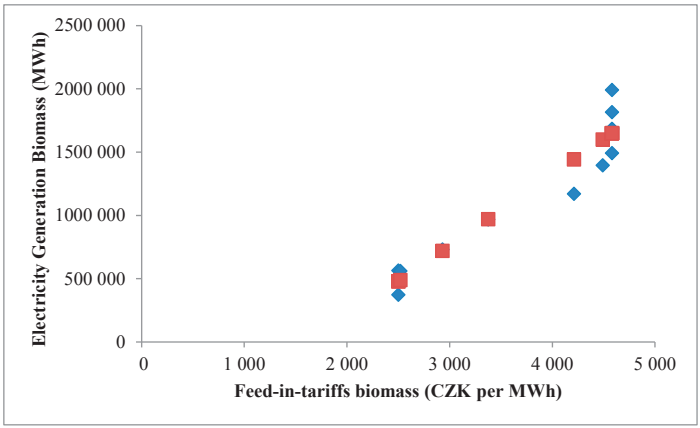
	Coefficients	*Std, Error*	*t*	*P*	*Lower Bound 95%*	*Upper Bound 95%*
Constant	-930645,54	220829,421	-4,21432	0,001788	-1422684,153	-438607
Biomass	563,59	56,7674064	9,92807	1,7E-06	437,1051007	690,0764

Source: Own work.

We can write the following regression equation: **Y = -930645,54 + 563,59*feed-in-tariff for biomass** (3)

The Figure 1 shows us the results in the graphical expression.

Figure 1: Regression analysis – feed-in tariffs vs generation of renewable electricity from biomass



Source: Own work.

Based on the results, it is obvious, that when we have generation of renewable electricity from biomass in total (BMT) in MWh as the dependent variable and maximal feed-in tariffs for biomass in total (MF MBT) in CZK per MWh as independent variable, there can be observed the following relationship between the variables: feed-in tariffs for biomass increase by 10 CZK per one MWh of generated electricity causes increase of generation of renewable electricity from biomass by approximately 5636 MWh.

4 Grants

For the purposes of the analysis of economic impacts of grants on generation of renewable electricity we use the following variables: generation of electricity in MWh from small water electricity (SWE), biomass in total (BMT), chips (CH), cellulose (CEL), plant materials (PM), pellets and briquettes (PB), liquid biofuels (LB), biogas in total (BGT), municipal wastewater treatment plants (MWTP), industrial wastewater treatment plants (IWTP), biogas stations (BGS), landfill gas (LG), biodegradable fraction of solid municipal waste (BFSMW), wind power plants (WPP), photovoltaic power plants (PPP), investments grants from State Environmental Fund (SEF GI), non-investments grants from State Environmental Fund (SEF GN), total grants from State Environmental Fund (SEF TOT), grants under the account MF 2115 Energy saving and renewable sources paid by Ministry of Industry and Trade (MF MIND), grants under the account MF 2115 Energy saving and renewable sources paid by Ministry of the Environment (MF MENV), grants under the account MF 2115 Energy saving and renewable sources paid by State Environmental Fund (MF SEF) and grants under the account MF 2115 Energy saving and renewable sources in total (MF TOT).

The results of the correlation analysis for the Czech Republic are showed in the following Table 3.

Table 3: Correlation analysis – grants vs generation of renewable electricity

	Year	SWE	BMT	CH	CEL	PM	PB	LB	BGT	MWTP	IWTP	BGS	LG	BFSMW	WPP	PPP	SEF GI	SEF GNI	SEF TOT	MF MIND	MF MENV	MF SEF	MF TOT
Year	1																						
SWE	0,238948	1																					
BMT	0,945093	0,072852	1																				
CH	0,905892	-0,1484	0,963138	1																			
CEL	0,919874	0,317465	0,829529	0,801268	1																		
PM	0,832105	0,084359	0,887606	0,803634	0,64413	1																	
PB	0,459072	0,099673	0,647955	0,518328	0,184132	0,684118	1																
LB	0,311817	-0,38657	0,402634	0,452183	0,128101	0,605437	0,272622	1															
BGT	0,969463	0,264753	0,852394	0,83876	0,950617	0,697759	0,253591	0,172145	1														
MWTP	0,92436	0,340728	0,902266	0,801712	0,803603	0,924609	0,573018	0,502916	0,829825	1													
IWTP	0,881558	0,097798	0,861223	0,889055	0,941054	0,581306	0,248288	0,176359	0,890847	0,724255	1												
BGS	0,967989	0,267058	0,849488	0,835839	0,950597	0,693985	0,249657	0,166176	0,999976	0,826801	0,889878	1											
LG	0,912337	-0,07097	0,869729	0,910098	0,754361	0,807692	0,385624	0,570746	0,872533	0,841572	0,772631	0,869818	1										
BFSMW	0,883786	-0,03314	0,894011	0,895167	0,672044	0,878794	0,569127	0,659176	0,785959	0,891737	0,702443	0,782029	0,967083	1									
WPP	0,9843	0,246914	0,915214	0,866734	0,863497	0,874406	0,467017	0,408592	0,942382	0,951662	0,797206	0,940518	0,934323	0,919667	1								
PPP	0,884557	-0,05817	0,897394	0,902163	0,67009	0,886549	0,570008	0,655132	0,788239	0,884793	0,699083	0,784387	0,970507	0,998823	0,920047	1							
SEF GI	0,876046	0,28531	0,695771	0,679931	0,874289	0,665996	0,051939	0,239823	0,935977	0,780704	0,725977	0,936479	0,818772	0,707124	0,892709	0,712531	1						
SEF GNI	0,316742	0,288208	0,036944	0,029575	0,254321	0,213342	-0,30556	0,157102	0,423512	0,304395	0,025377	0,425394	0,405405	0,295909	0,42743	0,298762	0,670798	1					
SEF TOT	0,872779	0,286454	0,690614	0,674814	0,870291	0,663184	0,047874	0,239769	0,933501	0,778056	0,720439	0,934022	0,817023	0,704966	0,890629	0,710364	0,999961	0,677337	1				
MF MIND	-0,56839	0,520298	-0,42892	-0,52789	-0,26145	-0,86692	0,267622	-0,41455	-0,54139	-0,53858	-0,20836	-0,53932	-0,87668	-0,87042	-0,74421	-0,87999	-0,66383	-0,64926	-0,6662	1			
MF MENV	0,740219	-0,05234	0,728668	0,676355	0,898291	0,386849	-0,54549	0,059963	0,707574	0,82583	0,915235	0,705237	0,51456	0,399391	0,625629	0,374395	0,584859	-0,07001	0,578	-0,07349	1		
MF SEF	0,700591	-0,01844	0,676629	0,625445	0,879436	0,359966	-0,5835	0,081906	0,673559	0,824093	0,882583	0,671244	0,476358	0,361915	0,593352	0,334778	0,571909	-0,05734	0,565357	-0,04156	0,997106	1	
MF TOT	0,735704	-0,04803	0,724168	0,671408	0,89645	0,381386	-0,54647	0,059138	0,703473	0,823514	0,912929	0,701147	0,50851	0,393355	0,620593	0,368186	0,581221	-0,07253	0,574364	-0,06696	0,999972	0,997539	1

Source: Own work.

You can see, that there is a strong positive correlation mainly between grants from State Environmental Fund and generation of electricity from biogas in total (BGT) and biogas stations (BGS); moreover between grants under the account MF 2115 Energy saving and renewable sources and generation of electricity from industrial wastewater treatment plants (IWTP).

It is clear, that we can focus in more detail on relationship between generation of renewable electricity from biogas in total (BGS) and grants from State Environmental Fund on renewable energy sources in total (SEF TOT) in the following step, using regression analysis. The following Table 4 shows the results of the regression analysis, where the independent variable is grant on renewable energy sources from State Environmental Fund in total (SET TOT) and the dependent variable is generation of renewable electricity from biogas in total (BGS).

Table 4. Regression analysis – grants vs generation of renewable electricity from biogas

Regression statistics	
Multiply R	0,933501
Value of Reliability R	0,871425
Adjusted Value of Reliability R	0,84571
Error of the Mean	359083,9
Observations	7

ANOVA

	Df	*SS*	*MS*	*F*	*Sig.*
Regression	1	4,37E+12	4,37E+12	33,88773437	0,002112694
Residues	5	6,45E+11	1,29E+11		
Total	6	5,01E+12			

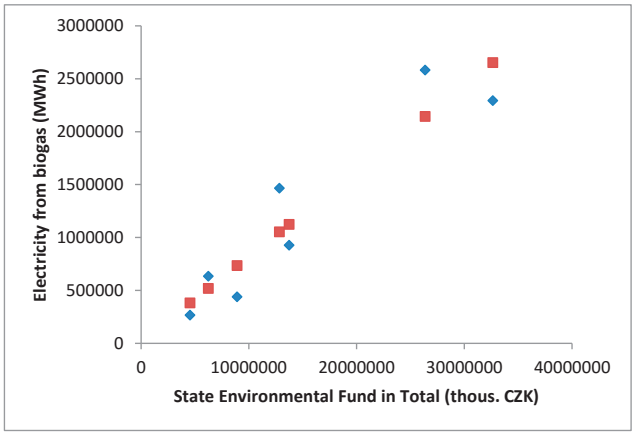
	Coefficients	*Std, Error*	*t*	*P*	*Lower Bound 95%*	*Upper Bound 95%*
Constant	15920,51	248956,6	0,063949	0,951488801	-624042,9306	655883,9
RES	0,080741	0,01387	5,821317	0,002112694	0,045087486	0,116395

Source: Own work.

We can write the following regression equation: **Y = 0,080741*grants for RES** (4)

The Figure 2 shows us the results in the graphical expression.

Figure 2: Regression analysis – grants vs generation of renewable electricity from biogas



Source: Own work.

Based on the results, it is obvious, that when we have generation of renewable electricity from biogas in total (BGS) in MWh as the dependent variable and grants on renewable energy sources in total from State Environmental Fund in total (SEF TOT) in thousand CZK as independent variable, there can be observed the following relationship between the variables: grants on renewable energy sources increase by 1 million CZK causes increase of generation of renewable electricity from biogas by approximately 80,741 MWh.

5 Discussion

In the methodology chapter, we defined two research assumptions, so firstly we should focus on them.

1. Renewable electricity generation is positively influenced by minimal feed-in tariffs – we can say that this assumption can be confirmed in case of electricity generated from biomass;
2. Renewable electricity generation is positively influenced by grants – we can say that this assumption can be confirmed in case of electricity generated from biogas.

Focusing on presented analysis in more detail, it is obvious, that the first problem is caused on the one side by data structure, on the other side by data availability. Regarding feed-in tariffs, there is mainly problem with data structure and regular annual changes in feed-in tariffs. Therefore the same kind of electricity generation has different public support in different years. For the purposes of renewable electricity support analysis, we can use maximal feed-in tariffs or the last year feed-in tariffs. Moreover, the development of time series of feed-in tariffs is different for particular renewable electricity. For example time series for feed-in tariffs for wind electricity is in the period 2003 – 2014 firstly growing, than decreasing. The most sTable, with the lowest fluctuations, is the time series for feed-in-tariffs for biomass, therefore we can say that the results for electricity generated from biomass are valuable.

The second weakness of our research is connected with the data in the area of grants. There is a problem with availability of longer time series of particular grant support, moreover there are different time series from different offices with different structures and different periods. Some of the data are not available directly, only on request. Regarding impact of grants on investments to renewable electricity generators, there can be delay between granting some project and final electricity generation. Based on the consultations with responsible officers from Ministry of Industry and Trade, the delay can take one, two or even three years. If the grant recipient has own financial sources, the delay is not so long.

Regarding the following research, the more detailed analysis should be done, since there is a lack of analyses in the area of renewable electricity sources and public support of energy sector in the Czech Republic.

6 Conclusions

The main goal of this paper was to analyse the impacts of public support of renewable electricity generated from all kinds of renewable energy sources in the Czech Republic, precisely the impacts of feed-in-tariffs and grants.

Partial goal was to find out the possible dependency between 1) electricity from selected renewable energy sources and relevant feed-in-tariffs and 2) electricity from selected renewable energy sources and relevant grants.

Based on the results, we can say, that there is the dependence mainly between minimal feed-in tariffs for electricity from biomass and generation of electricity from biomass. Regarding grants, there is the dependence between grants for electricity from biogas and generation of electricity from biogas.

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