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THE QUANTIFICATION OF THE SIGNIFICANCE OF EATR DETERMINANTS: EVIDENCE FOR EU COUNTRIES

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Abstract

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At present, corporate tax is applied in all EU Member States with the exception of Estonia. Nevertheless, the nominal corporate tax rate does not reflect the real tax burden. For determination of the effective tax burden for corporations, there are used effective corporate tax rates. The aim of the paper is to quantify the relation between the effective average corporate tax rate and nominal corporate tax rates, depreciations, loss compensation and selected investment incentives and to identify the significance of these factors based on the panel analysis. Based on the panel analysis it was found that effective average tax rate is only statistically dependant on nominal corporate tax rate, on tax loss compensation and on the depreciation tax rate of movable property, while in case of other factors, such as depreciation of immovable property, tax holidays and R&D incentives, the dependence is not statistically significant.

Keywords: effective average tax rate, depreciation methods, loss compensation methods, nominal corporate tax rate, investment incentives.

INTRODUCTION

Even though the corporate income tax represents one of the youngest tax in the taxation systems, there can be find different opinions on its existence in the economic theory discussed by Musgrave and Musgrave (1989) or James and Nobes (2010). Those opinions are aimed at the substance of the tax and reasons for its application within the taxation systems. However, 28 EU Member States are applying classical concept of corporate taxation.

The differences in nominal corporate tax rates within the EU Member States are still significant. Most frequently used indicators for measurement of effective corporate tax burden represent effective average tax rate (EATR) and effective marginal tax rate (EMTR). There are significant differences between the nominal and effective tax rates. The deviation is caused mainly by the existence of different depreciation methods and depreciation periods, group taxation schemes, different methods for inventory evaluation, different types of investment incentives, loss compensation methods, and the differences in the deductibility of costs and other tax reliefs and tax sales.

The aim of the paper is to quantify the relation between the effective average corporate tax rate and nominal corporate tax rates, depreciations, loss compensation and selected investment incentives (tax holidays and R&D incentives) and to identify the significance of these factors based on the panel analysis especially for transition economies. The analysis is done in the period of 1998–2013 (more recent data were not on the date of submission of the text available), therefore Croatia is not included in the analysis.

The Measurement of Effective Tax Rate

The nominal tax rate does not reflect the tax burden which in reality the taxpayer suffers, for there are many elements covered in the tax base. The effective corporate tax rate represents the measure for assessing the real tax burden and the impact on the economic activity. There can be found different approaches to the calculation of the effective corporate tax rate in the economic literature.

The basic distinction is macro and micro approach, which depends on the data used. Macro approach is based on the employment of the aggregate macroeconomic data such as national accounts. The micro approach is employing the data from the financial statements. Furthermore, based on the type of information, we can distinguish between backward-looking approaches and forward-looking approaches.

Macro backward-looking approaches

Macro backward-looking measures employ for the calculations of the effective corporate tax rates aggregate data for national economies.

Lucas (1990) and Razin and Sadka (1993) extended the concept of micro approach to the macro approach. They suggested the method, which produces effective tax rate using the tax payments and national accounts. That has further been modified and extended by Mendoza, Razin and Tesar (1994), who proposed for the measurement of effective tax rate the ratio of taxes on profits, incomes and capital gains of corporations on the gross operating surplus of companies. That was further developed by Carey and Tchilinguitian (2000) who argues, that Mendosa *et al.* (1994) assigned all self-employed income to capital (that is the model assumes, that households pay the same effective tax rate on capital and labour income) and suggest to assign the part of the income flow to labour and part to capital, for some countries does have dual income system that treat capital income differently from labour income and provide relief from double taxation of dividends.

Micro backward-looking approaches

The micro backward-looking methodology calculates the effective tax rate by using the data from the financial statements of the companies. As mentions Nicodéme (2002) the method allows to compare effective taxation of companies with different size in different sectors. Under that model ratio of the tax on pre-tax profit or gross operating profit is usually computed. On the contrary to the macro backward-looking measures, this approach uses real life data and it also possible to identify the items of the balance sheet having the significant influence on the corporate taxation.

The disadvantage of that model is that it does not isolate the characteristics of national tax system, since the taxes which are paid by multinational companies not only depend on the tax system of the home country, but also on the tax systems of countries, in which the company is active.

The economic literature using company level data begins with Stickney and McGee (1982). Research on that field using micro data was also done by Gupta and Newberry (2010), Plesko (2003), Janssen and Buijink (2000) and others. Detail survey on sector and size effects on effective corporate taxation in the European Union was done by Nicodéme (2002).

Micro forward-looking approaches

Forward-looking measures of effective tax rate are based on the neoclassical theory of investment. They rely on theoretical features of the tax system to calculate the implicit tax rates. The grounds in that field were laid in the study by King and Fullerton (1984), which was built on the research done by Hall and Jorgenson (1967) and King (1974).

Devereux *et al.* (1998) use two measures of the company effective tax burden – EMTR and EATR. The EMTR is specific to a marginal investment that will produce cash flows subjected to taxation. EATR can be defined as the difference between the pre-tax net present value and the post-tax net present value of the investment, namely represents the relevant tax burden of profitable investments. According to the Devereux *et al.* (1998) EATR measures summarizes the distribution of tax rates for an investment project over a range of profitability. Therefore the term average relates not to the taxpayer but to the investment.

Determination of the Empirical Model and Panel Dataset

The method developed by Devereux *et al.* (1998) represents one of the most complex methods of micro forward-looking measure, for it sets two indicators determining the tax burden for corporations – EMTR and EATR.

The EATR is used mainly in case of comparison with investments in given type of industry. It is not complicated to determine EATR indicator. When net present value is not equal to zero, for EATR is defined as:

$$EATR = \frac{NPVBT - NPVAT}{NPVBT} \tag{1}$$

where *NPVBT* represents net present value before taxation and *NPVAT* net present value after taxation. As can be clearly seen from the equation above, the problem arises in case of such investment projects, where *NPV* is equal to zero.

EATR is usually used in case of specific types of investments which are more profitable than marginal investment as mentioned Finkenzeller *et al.* (2004). Therefore it represents the indicator, which influences the decisions of investors about investments placement. EATR is calculated as follows:

$$EATR = \frac{NPVT}{NPV} \tag{2}$$

where *NPVT* represents net present value of tax and *NPV* net present value of investment.

The *NPVT* indicator can be defined as ratio, where the nominal corporate tax rate τ is multiplied by the sum of costs on capital p (or gross return on investment) and exponential depreciation rate δ, divided by the sum of cost on capital and exponential depreciation rate $p + \delta$. The result is decreased by the present value of future decrease in tax *A*. Net present value of future decrease in tax *A* is defined as the ratio of the corporate income tax multiplied by the depreciation rate and the sum of corporate discounted tax rate and depreciation rate according to the following formula no. 3:

$$\frac{\tau \times \varphi}{\rho + \varphi} \tag{3}$$

NPV is defined as the ratio of costs on capital p and corporate discounted tax rate increased by the exponential depreciation rate $\rho + \delta$.

$$EATR = \frac{NPVT}{NPV} = \frac{\dfrac{\tau \times (p+\delta)}{p+\delta} - A}{\dfrac{p}{\rho+\delta}} \tag{4}$$

If we take into account the gross return on marginal investment before taxation p^o in EATR, than it can be written following:

$$EATR = \frac{p^\circ}{p} \times EMTR + \left(\frac{p - p^\circ}{p}\right) \times \tau \tag{5}$$

where p^o represents the gross return on investment (that is before taxation), p the net return on investment (that is after taxation) and τ the nominal corporate tax rate. In case of marginal investment, it is considered that $p^o = p$.

According to the equation (5) the rate of return equal to the cost of capital is taxed at *EMTR* whereas the economic rent is exposed to the nominal corporate tax rate. *EMTR* indicator expresses the influence of corporate tax on new (marginal) investments. Those are defined as investments into the new additional projects, bringing the return on an investment which is worth from the view of the investor.

Based on the detailed technical description by Devereux *et al.* (1998), adjusted EATR can be defined as the difference between the required gross return on investment before taxation p^o and net real return on investment after taxation p divided by the gross return on investment p^o. The relation shows the following formula no. 6:

$$EATR = \left(\frac{p^\circ - p}{p^\circ}\right) \tag{6}$$

The result of the formula falls into the interval *<0;1>*. The higher values the result reaches, the higher are costs on capital, which leads to the decrease in new or even current investments. The lower values the result reaches, the lower are costs on capital. This leads to the increase of the current investments and inflow of the new investments into the country, but only in short-term perspective (due to the fact that the investments are marginal). In long term perspective, the rate does not reflect the tax attractiveness of the country for the investor. Therefore EATR is used for comparative analysis in the paper.

Based on the review of literature in theoretical background and in accordance with the tax theory, the authors consider the decision of the investors on investment placement in the country *I* as the function of tax factors *T*, other economic factors *AE* and non-economic factors (for example compliance costs of taxation or corruption) *OD*, that is:

$$I = f(T, AE, OD) \tag{7}$$

where EATR is influenced mainly by the change in nominal corporate tax rate *NCITR* and other tax factors *OTD* as is expressed in formula (8):

$$EATR = f(NCITR, OTD) \tag{8}$$

Due to the aim of the paper to quantify the relation between the effective average corporate tax rate and nominal corporate tax rates, depreciations, loss compensation and selected investment incentives (tax holidays and R&D incentives), we enlarge the formula as following:

$$EATR = f[NCITR, DMP(STRL), DRE(STRL), L, R\,\&\,D, TH] \tag{9}$$

where *NCITR* is a nominal corporate income tax rate, *DMP(STRL)* represents a depreciation of movable property (straight-line method), *DRE(STRL)* express a depreciation of real estate (straight-line method), *L* represents a loss compensation, *R&D* is a research and development incentive and *TH* represents tax holidays.

The quantification of the significance of EART determinants was done with the application of the panel analysis. The basic econometric model which was later modified is formulated as follows:

$$EATR = \alpha + \beta_1 NCITR_{it} + \beta_2 DMP(STRL)_{it} + \\ + \beta_3 DRE(STRL)_{it} + \beta_4 L_{it} + \beta_5 R\,\&\,D_{it} + \\ + \beta_6 TH_{it} + \delta_i + \varepsilon_{it} \tag{10}$$

where *NCITR* represents a nominal income corporate tax rate expressed as a percentage, *DMP(STRL)* means an average straight-line depreciation rate for movable property expressed as a percentage, *DRE(STRL)* represents an average straight-line depreciation of real estate expressed as a percentage (buildings), *L* means a number of years of loss carry forward (in case of the EU Member State which enables an unlimited losses compensation, 100 years was determined as the upper limit for duration of the enterprise), *R&D* represents an amount of the deduction of the costs on research and development expressed as a percentage and *TH* means a number of years for which the taxpayers can use the tax holidays. The β-constants represent constants of the respective variables specific for the country *(i)* and time *(t)*, α-constant represents a constant of the entire regression model and δ_i parameter represents fixed effects in the i_{th} observation. The ε_{it} represents the residual component in time *t* and country *i*.

The panel analysis was constructed on models with fixed effects because the entities were not randomly selected. A test of unit roots was performed to enhance the informative capacity of the models and to eliminate non-stationarity of the time series. Specifically, IPS test was performed. According to Baltagi (2005), it generally provides more satisfactory results than other tests, for example the LLC test. The IPS test was formulated according to Asteriou and Hall (2007). As some time series exhibited the non-stationarity according to the IPS test, it was necessary to find a suitable method for its elimination. For this purpose the method of first differences was applied.

The aim of the specification of panel models was to explore the dependences between explanatory and explained variables in selected groups of countries. There was examined short-term dependence, since a sufficiently long period of time was not available for an explanation of the long-term dependencies.

All the data used for the research were of the quantitative and secondary character. They are based on the information from the publication Taxation Trends in the European Union published in 2011, 2012 and 2013 by Denis *et al.* (2014), Fantini *et al.* (2011) and Fantini *et al.* (2012). Furthermore, the data were also collected from European Tax Handbook or Global Corporate Tax Handbook published over the period 1998–2013 (Kesti, 1998–2010, Gutiérrez, 2012, Gutiérrez, 2013, Schelleckens, 2011). The data were collected for the sample of 27 EU Member States in the period 1998–2013. In order to preserve the consistency and comparability of the data, the variables of models were chosen in relation to the technical outline of EATR (the statutory corporate tax rate), the investment criteria which are generally known and important for investors from a tax perspective and the frequency of variables and their availability in the EU Member States (depreciation rates, loss compensation methods, R&D incentives and tax holidays).

Empirical Results

The development of NCITR and EATR

As was already mentioned above, corporate income tax is levied as a percentage from the tax base. Due to the lack of corporate taxation harmonization within the EU, the methods of construction of the tax bases differs according to the national taxation systems applied in individual EU Member States. Therefore at present, companies are facing 28 different methods of tax base construction. Due to this fact, the nominal corporate tax rate cannot reflect the real tax burden of the companies and cannot be used for comparative analysis.

The effective average tax rates represent real tax burden of the corporations. The effective average tax rate reflects also the influence of other aspects of taxation systems, which determine the real tax burden for corporations. Due to this fact, the effective average tax rates are possible to use for the international comparison of the taxation systems.

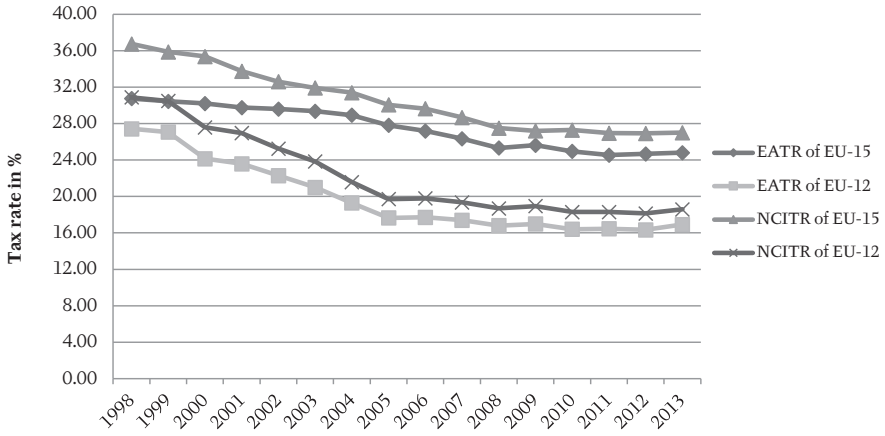
The development of nominal corporate income tax rates (NCITR) and effective average tax rates (EATR) in the EU Member States is shown in the Fig. 1. As can be seen from Fig. 1, the corporate income tax rates in Europe were cut since the mid-nineties, from 34 percent average tax rate to present 23 percent tax rate. The financial and economic crisis in 2008 firstly slowed down this trend and finally stopped it. The reason for that was the introduction of a series of surcharges in several EU Member states in reaction to the financial and economic crisis.

Over the last decade, a significant downward trend in the effective corporate tax levels can be observed on the EU level. In that period, the differential in effective tax levels between the EU-15 and EU-12 Member States with transition economies increased due to intensified tax cuts as noted Fantini *et al.* (2011) and Fantini *et al.* (2012). However, the latest data show a stabilisation.

Testing the dependence of EATR on NCITR

As can be seen from the above mentioned Fig. 1, the differences between NCITR and EATR vary from 0 to 9 of percentage points. In order to test the dependency of NCITR and EATR, the correlation analysis was employed. The values of the correlation coefficient between NCITR and EATR are presented bellow in Tab. I.

The development of the nominal corporate income tax rate shows concordance with the development of the effective average tax rate. The calculated amounts differ in individual EU Member States. Even though that in some countries the values of correlation coefficient indicates very significant dependency (Bulgaria, Denmark, Romania, Luxembourg, the Netherlands, Poland



1: *The development of NCITR and EATR in the EU in 1998–2013*
Source: Own calculations.

I: *Correlation coefficient between NCITR and EATR in 1998–2013*

State	Correlation coefficient	p-value	State	Correlation coefficient	p-value
Belgium	0.9214	***	**Luxembourg**	0.9997	***
Bulgaria	0.9999	***	**Estonia**	0.9590	***
Czech Republic	0.9672	***	**Hungary**	0.8006	**
Denmark	0.9976	***	**Malta**	0.0000	–
Germany	0.9477	***	**The Netherlands**	0.9982	***
Greece	0.7887	**	**Austria**	0.9922	***
Spain	0.9832	***	**Poland**	0.9956	***
France	0.8931	**	**Portugal**	0.9852	***
Ireland	–0.9288	***	**Slovenia**	0.9642	***
Italy	0.8715	**	**Slovakia**	0.9995	***
Cyprus	0.9846	***	**Finland**	0.9341	***
Latvia	0.9832	***	**Sweden**	0.8701	**
Lithuania	0.9757	***	**The United Kingdom**	0.9644	***
Romania	0.9998	***			

Notes: Asterisks denote significance at the 1 percent (***), 5 percent (**) and 10 percent (*) levels.
Source: Own calculation.

and Slovakia), in case of the other EU Member States it indicates insignificant dependency (Malta) or it even indicates negative dependency (Ireland) which means that the growth of NCITR was accompanied by a fall of EATR. This negative dependency can be explained by the existence of industrial zones in the Ireland. The insignificant dependency in Malta can be explained by the stability of their corporate tax system and the minimum changes in the nominal corporate tax rate and EATR. The statistical dependency between nominal corporate tax rate and EATR was identified in the EU Member States with the exception of Ireland and Malta. Similar results were reached also by Elschner and Vanborren (2009). The authors expected to identify the correlation between NCITR and EATR due to the narrow link between NCITR and EATR.

Development of the changes in the depreciation rules, the loss compensation methods and the investment incentives as a factor for determination of EATR

With respect to the fact that depreciations decrease the amount of the present tax liability, it is necessary to take into account the time of depreciation, the minimum value of assets which can be depreciated or the speed of the depreciation as mentions Nerudová (2014) or Široký, Střílková and Krajňák (2016).

The analysis identified that only minimum changes in depreciation period took place in researched period. The significant change in the depreciation policy was identified especially in the Czech Republic, Germany, Lithuania and Slovenia.

According to the European Commission (2006), recording of losses and loss offsetting represents one

of the important factor for the investors. As mentions Nerudová (2014), there can be found two methods of loss recording in the EU – loss carry forward and loss carry backward. During the research we have identified only minimum changes in rules for loss recording the EU Member States. The changes were identified only in the Czech Republic, Latvia, The Netherlands, Austria and Slovenia.

Furthermore, as Morisset and Pirnia (2000) stated, providing of investment incentives represents one of the significant factor in decision making of potential investors. As mentions Nerudová (2014), system of investment incentives is applied by the most of the EU Members States. The performed analysis revealed that EU Member States apply a wide range of the investment incentives which were changing during the researched period relatively intensively. This changes were caused by the implementation of the EU Taxation Directives in the EU Member States and by the introduction of state aid rules, as indicated by European Commission (2011) and as mentioned by Elschner and Vanborren (2009).

With respect to the diversity and non-uniformity of investment incentives systems in the EU Member States, two basic incentives applied in the majority of the EU Member States were researched – deductibility of the costs on R&D and tax holidays. The research revealed that the tax holidays were applied only in the EU Member States facing economic transformation – that is Bulgaria, Czech Republic, Hungary or Romania. R&D incentives were introduced by 12 EU Member States only.

Testing the dependency of EATR on NCITR, depreciation, losses and tax incentives with the application of the panel analysis

The panel analysis was performed for 5 different models – panel analysis (A, B, C, D and E). The presented models differ in the individual factors affecting EATR. Due to the data availability, variables in the respective models were combined, corresponding to the number of countries included in the test. In the first model (A), 26 EU Member States were tested; in the last model (E), only 7 EU Member States were tested. Results of the panel analysis are presented in Tab. 2.

The aim of the model (A) is to research the dependence of a change in the AETR due to a change in the nominal corporate tax rate and is defined by the following formula (for description of the variables see chapter 3):

$$\Delta EATR = \alpha + \beta_1 \Delta NCITR_{it} + \delta_i + \varepsilon_{it} \quad (11)$$

The model (A) includes only 26 EU Member States excluding Malta. The panel data set for Malta could not be tested due to the statistical errors (this fact can be seen from Tab. 1 where the correlation between EATR and NCITR was not performed due to the fact that no change in NCITR occurred during the research period). Both of the time series had to be differentiated due to non-stationarity of the I(0). The results of the panel analysis show that the change in the effective tax rate is influenced by the changes in nominal corporate income tax rate. It can be stated that if the nominal tax rate changes by one percent, EATR will change by 0.78 percentage points in the same direction. Due to this fact it was tested even at a level of 1 percent of statistical significance. This dependence can be also deduced from the fact that the EATR calculation is based on the nominal corporate tax rate.

On the contrary, the aim of the model (B) is to research the change in the average effective tax rate due to changes in the nominal corporate tax rate and changes in average linear depreciation rates both for movable *[DMP(STRL)]* and immovable property *[DRE(STRL)]*. The model is defined by the following formula (for description of the variables see chapter 3):

$$\Delta EATR = \alpha + \beta_1 \Delta CITR_{it} + \beta_2 \Delta DMP(STRL)_{it} + \\ + \beta_3 \Delta DRE(STRL)_{it} + \delta_i + \varepsilon_{it} \quad (12)$$

In the model (B), 24 EU Member States are tested. The panel data set for Austria and Malta were removed from the model for causing errors (the panel data set for Malta and Austria were in fact constant since some of the time series were constant – data were unchanged during the research period). Due to the elimination of the non-stationarity, first differentiations had to be performed for all tracked variables in this model as well.

Results presented in Tab. II show that the statistical dependence at a significance level of 1 percent was identified in the nominal corporate tax rate and at a significance level of 10 percent in depreciation rates for movable property. Although depreciation rates for immovable property would have been expected to affect EATR, the statistical dependence was not identified.

The aim of **the model (C)** is to research the dependence of the changes in the average effective tax rate on changes in identical factors as in model (B). In addition, it also researches the dependence of EATR change due to changes in the application of tax losses and can be defined by the following formula (for description of the variables see chapter 3):

$$\Delta EATR = \alpha + \beta_1 \Delta NCITR_{it} + \beta_2 \Delta DMP(STRL)_{it} + \\ + \beta_3 \Delta DRE(STRL)_{it} + \beta_4 \Delta L_{it} + \delta_i + \varepsilon_{it} \quad (13)$$

Results presented in Tab. 2 show that the statistical dependence at a significance level of 1 percent was identified in the nominal corporate tax rate and in application of tax losses. With respect to the fact that the loss carry-forward is possible only in some countries, only 16 countries were tested (Malta, the Netherlands, Austria, Belgium, Bulgaria,

Finland, Ireland, Latvia, Greece, Sweden and the United Kingdom were excluded from the model). In order to eliminate the non-stationarity of the time series, the method of first differentiations was applied in this model.

The aim of **the model (D)** is to research the dependence of EATR changes on the changes of factors identical as in model (B) and to research the dependence of EATR change due to changes in the application of R&D incentives. The model can be defined by the following formula (for description of the variables see chapter 3):

$$\Delta EATR = \alpha + \beta_1 \Delta NCITR_{it} + \beta_2 \Delta DMP(STRL)_{it} + \\ + \beta_3 \Delta DRE(STRL)_{it} + \beta_5 \Delta R\&D_{it} + \delta_i + \varepsilon_{it} \quad (14)$$

The model (D) includes Belgium, Czech Republic, Denmark, France, Ireland, Italy, Hungary, Portugal, Romania, Slovenia, Slovakia and the United Kingdom. In other countries these types of the tax incentives were not provided. The tested time series were again differentiated to eliminate the non-stationarity. As shows the results of the panel analysis, the statistical dependence at 1 percent significance level was demonstrated only in the nominal corporate income tax rate, which shows that a possible change in the nominal tax rate by one percent would induce a change in EATR by 0.76 percentage points in the same direction.

Furthermore, the influence of change in the average linear depreciation rate for movable property on EATR change at a significance level of 5 percent was identified. The negative dependence was revealed as we expected. If the depreciation rate changes by 1 percent, EATR will change by 0.12 percentage points in the opposite direction. The dependence of EATR on the linear depreciation rate for movable property is not remarkably strong, nevertheless, according to our results, it can be noted that the depreciation policy in 12 researched countries is not negligible for investors. The model has revealed no influence of EATR changes on other variables, namely average linear depreciation rate for immovable property and R&D incentives.

The aim of the last **model (E)** was to research the influence of EATR change on change of NCITR and depreciation rates. Nevertheless, the aim of the model was also to add a variable characterizing the tax holidays, which represent one of the significant tax factor for many investors, as was mentioned by Morisset and Pirnia (2000). Thus, the model can be defined by the following formula (for description of the variables see chapter 3):

$$\Delta EATR = \alpha + \beta_1 \Delta NCITR_{it} + \beta_2 \Delta DMP(STRL)_{it} + \\ + \beta_3 \Delta DRE(STRL)_{it} + \beta_6 TH_{it} + \delta_i + \varepsilon_{it} \quad (15)$$

Since the tax holidays were identified and researched only in seven member countries, this model was formulated only for Bulgaria, Czech Republic, France, Hungary, Romania, Greece and Slovakia. First differences were used only for the *NCITR, DMP(STRL)* and *DRE(STRL)* time series. The time series for tax holidays were stationary of the I(0). Although the influence of tax holidays on EATR was expected, the results of the panel analysis proof an opposite. The effect of the investment incentive (tax holidays) on EATR changes could

II: *Results of the panel analysis*

Variables	Model (A)	Model (B)	Model (C)	Model (D)	Model (E)
α	0.045 (0.057)	0.043 (0.062)	0.013 (0.055)	0.066 (0.077)	–0.164 (0.395)
β_1	0.787 (0.025)***	0.776 (0.028)***	0.771 (0.023)***	0.038 (0.038)***	0.949 (0.063)***
β_2		–0.053 (0.031)*	–0.031 (0.029)	–0.125 (0.055)**	–0.025 (0.079)
β_3		0.020 (0.062)	0.033 (0.048)	–0.049 (0.057)	–0.017 (0.094)
β_4			–0.007 (0.003)***		
β_5				–0.001 (0.003)	
β_6					0.049 (0.056)
Number of observations	390	360	240	180	105
Number of countries	26	24	16	12	7
Adj. R^2	0.718	0.707	0.848	0.718	0.730
Durbin-Watson statistic	1.768	1.773	2.021	1.589	2.044

Note: Asterisks denote significance at the 1 percent (***), 5 percent (**) and 10 percent (*) levels. In the brackets are the standard errors.
Source: Own calculation.

not be detected in the tested group of countries. The reason can be caused by the short time series as well as by the fact that conditions for the application of tax holidays, namely the number of years, did not changed in time. At 1 percent significance level only the effect of *NCITR* change on EATR changes could be demonstrated.

DISCUSSION

The panel analysis is based on the evaluation of the dependence of EATR on selected variables. Due to the data availability in individual EU Member States, it was not possible to test all variables in one model (there were the unavailability data of R&D incentives and tax holidays in some EU Member States). The Economic Policy needed further analysis.

It should be noted that EATR data were taken according to the formula developed by Devereux *et al.* (1998). It can be concluded, that with respect to this formula and with respect to increasing profitability of corporations, the EATR will come closer to the nominal corporate income tax rate. This fact is also supported by the results of our paper. The panel analysis results indicate that EATR is dependent on *NCITR* in all tested EU Member States, on depreciation rate of movable property in 24 EU Member States and on loss compensation in 16 EU Member States. Nevertheless, the EATR is not dependant on straight-line depreciation rate for real estate (immovable property). It can be concluded that, the EATR is based on corporation model with an investment mix of assets. Hence there is no impact of immovable property on the EATR in 16 EU Member States. In these countries, the depreciation policy is significant for the determination of the effective tax burden. On the other hand, the preferential depreciation for tax purpose might already lead to modest EATR, as mentioned Finkenzeller *et al.* (2004).

Other variables such as R&D incentives and tax holidays have no effect on the change of EATR. Although Finkenzeller *et al.* (2004) declared that the tax incentives have a considerable impact on the level of effective tax burden, namely EATR, this fact was not confirmed by the empirical results in this paper. As expressed by European Commission (2011), the EATR depends on the characteristic of the specific investment project concerned and the methodology applied. Therefore, these results can be explained by dissimilarity and quantity of the tax incentives in the EU Member States. For the purpose of this paper two tax incentives were used only. In general, there is evident that R&D incentives and tax holidays are not significant for the determination of effective tax burden and the investors.

Baker and McKenzie (1999) noted that the composition of the tax base (that is using of tax incentives and depreciation) does not have a great impact on the EATR and that the level of nominal corporate tax rate is the truly important factor for the determination of the tax burden. This conclusion is in accordance with our performed analysis and results in the paper.

CONCLUSION

The aim of the paper is to quantify the relation between the effective average corporate tax rate and nominal corporate tax rates, depreciations, loss compensation and selected investment incentives and to identify the significance of these factors based on the panel analysis. The data for empirical analysis were collected for the period of 1998–2013 for the 27 EU Member States, that is for the EU-15 and states with transition economies which joined the EU in 2004 and 2007.

According to the analysis and collected data in the EU Member States, there were identified some changes in the effective average tax rates (EATR) and nominal corporate income tax rates (NCITR). There were identified minor changes in depreciation policy, tax compensation policy and almost no change in R&D and tax holidays. These findings were reflected in the statistical analysis.

The correlation analysis between NCITR and EATR revealed that the value of the correlation coefficient indicates very significant dependence of EATR on NCITR in the Bulgaria, Denmark, Spain, Luxembourg, The Netherlands, Poland and Slovakia. On the other hand, the correlation analysis proved the insignificant dependence in case of Malta. In case of Ireland the correlation coefficient is even negative. This indicates the negative dependency of EATR on NCITR.

The panel analysis was performed in order to quantify the significance of EATR variables. The constructed and researched econometric model explains the dependence of EATR on the nominal income corporate tax rate, average straight-line depreciation rate for movable property and real estate, number of years of loss carry forward, amount of deduction of the cost of research and development and number of years for which the taxpayers can use the tax holidays. This econometric model was divided into 5 models which were differentiated according to the combinations of factors influencing EATR. Generally, the aim of the specification of panel models was to explore the dependence between the explanatory and explained variables in the selected groups of countries.

Based on the panel dataset it was found that EATR is only statistically dependant on the nominal corporate tax rate, on tax loss compensation and on the depreciation tax rate of movable property,

while in case of other factors such as the depreciation of immovable property, tax holidays and R&D incentives, the dependence is not statistically significant. Even though the new EU Member States (in contrast to the old EU Member States) have introduced a large number of tax incentives (especially R&D incentives and tax holidays) the dependence on EATR is not possible to prove. It can be concluded that the depreciation policy in case of movable property does not have any influence on the change in EATR, the dependency of the depreciation on EATR is not possible to prove.

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