EFFECTIVE TAXATION IN THE CONTEXT OF MICROECONOMIC FACTORS AFFECTING COMPANIES OF THE EU MEMBER COUNTRIES

[a]ALENA ANDREJOVSKÁ, [b]JOZEF GLOVA

Faculty of Economics, Technical University of Košice, Boženy Němcovej 32, 040 01 Košice, Slovak Republic;
email: [a]alena.andrejovska@tuke.sk, [b]jozef.glova@tuke.sk

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Abstract: Currently progressing globalization has supported a simple transfer of capital among countries. Investment allocation can be a difficult task for investors. Investors have a tendency to seek a country in which they will pay the least tax. The presented article approaches the issue of the relationship between selected microeconomic determinants, namely the size of the company, capital intensity and company indebtedness, inventory, profitability of the company and the nominal tax rate and their impact on the effective tax rate, with the expectation that the deciding determinant will be the size of the company. The impact of the selected microeconomic determinants on the effective tax rate is followed via quantile and regression analysis. The analyses include data from the financial statements of 1 651 production companies based in the European Union. The information about the companies comes from the Orbis database and the studied time period are the years of 2009 through 2018. The result of the analysis points towards a positive relationship between effective tax rate and the size, indebtedness and inventory of the company and the nominal tax rate. There exists a negative relationship between the effective tax rate and the physical capital and profitability of the company. The performed analysis confirms a competing theory, i.e. the fact that larger companies have lower effective tax rates, because they possess more power and a higher amount of resources, thanks to which they can influence the amount of their taxes.

Keywords: effective taxation, tax rates, microeconomic indicators, size of the company

1 Introduction

In the 1960s, Jorgenson and Hall (1967, pp. 391-414) pointed out an effective tax rate which includes multiple factors rather than only statutory tax rate. Effective tax rate is simply the quotient of the tax burden and the tax base. Effective corporate tax rates consider the statutory tax rate but also aspects of the tax systems which determine the full sum of the effectively paid taxes. The differences between statutory and effective tax rate can, in some cases, be significant. A situation might occur when countries with a high statutory tax rate reduce the amount of the tax base or the tax enforceability.

Effective tax rates are useful not only to investors but also politicians, economists and other subjects which are trying to create positive conditions for an inflow of foreign capital into the economy. If a high effective tax rate dissuades investors from choosing a given country as their target destination, it is up to politicians to make their country more attractive through effective measures.

The objective of this article is to express the currently applicable relationships between selected microeconomic determinants (size, indebtedness, capital intensity, inventory and nominal tax rate) and the effective tax rate. The regression and quantile analysis uses data from financial statements of 1 651 companies active in the industrial sector in member countries of the European Union. The input data come from the Orbis database for the period of 2009 through 2018. We expect that the size of the company is the deciding determinant of the amount of the effective tax rate.
To include the possible nonlinear impacts of explanatory variables in relation to the effective tax rate faced by the companies, the article uses quantile regression in order to follow heterogeneous behavior on the different levels of dependent variables. Quantile regression minimizes the deviations in the absolute value with asymmetrical weights rather than minimizing the squares of the errors. The results of quantile regression are compared with the results of the method of the smallest squares, which is used in the classic linear regression model.

The article consists of the following parts. The literature review points out existing empirical evidence of the existence of various relationships between selected microeconomic determinants and the effective tax rate. The methodology part describes the selected quantile and linear regression, as well as the used data. The following part, results, describes the achieved results of the analysis, and the discussion part contains a summation of the results and their comparison with previous empirical studies.

2 Literature review

Microeconomic determinants significantly impact the height of the effective tax rate of individual companies. The important determinants include the size of the company, capital intensity, company indebtedness, inventory, profitability and also the nominal tax rate determined by the state where the given company is based. Existing studies do not show a clear relationship between selected determinants and the effective tax rate.

One of the most significant determinants which affect the effective tax rate is the size of the company. This factor is often studied in the literature and studies almost always point it out as a determinant which has a predictive power over the effective tax rate. The relationship is, however, not clear. Zimmerman (1983, pp. 119-149) finds that larger companies are associated with higher effective tax rates than smaller companies. This is explained using the theory of political expenses. According to this, paid taxes are a tool of transferring assets from companies to other social groups, which means that tax rates are a certain form of repaying political expenses. The existence of this theory in practice is condirmed by Kim & Limpaphayom (1998, pp. 47-68).
A competing theory suggests that larger companies have lower effective tax rates because they have more power and more resources, which enable them to control their taxes. This negative relationship between the size of the company and the effective tax rate is confirmed by multiple studies (see Dyreng et al., 2008, pp. 61-82; Richardson & Lanis, 2007, pp.689-704). This negative relationship is also pointed out by Richardson & Lanis (2007, pp.689-704), Delgado et al. (2012, pp. 160-165), Derashid & Zhang (2003, pp. 45-62). Developing economies can, however, show a different relationship between the size of the company and the ETR. This finding is sensitive to the choice of the effective tax rates and the time of the study. Large companies in developing countries have lower tax rates than small companies.

The way in which companies manage their financial resources is important for the financing of potential investments. Companies have two possible ways to fund their activities, namely debt financing and equity financing (Ribeiro, 2015).

A negative relationship between indebtedness and tax burden was evidenced by Stickney & McGee (1982, pp. 125-152). This opinion is not shared by Kraft (2014, pp. 1-19), who failed to confirm the existence of a negative impact of indebtedness on taxation. Existing empirical studies also show a positive relationship between indebtedness and the effective tax rate. A positive relationship only exists to the degree to which companies are motivated to increase their indebtedness in order to decrease their taxation (see Chen et al., 2010, pp. 41-61; Feeny, 2006, pp. 1167-1175; Harris & Feeny, 2003, pp. 951-958; Janssen, 2005, pp. 47- 66). this nonlinear relationship is confirmed by Fernández-Rodríguez & Martínez-Arias (2011, pp. 381). Kim & Limpaphayom (1998, pp. 47-68) a Wilkinson et al. (2001, pp. 157-175) failed to find a significant relationship between indebtedness and the effective tax rate of a company.

The asset composition can have a significant impact on the ETR faced by the companies. In all tax regimes, companies are usually entitled to have deductions of long-term tangible assets.

This means that companies with high tangible investment assets should have lower tax burden than companies with a low amount of tangible assets usable for deductions. In some countries, tax stimuli are used to gain tangible investment assets. A negative impact on the effective tax rate was confirmed in capital intensity by Hanlon & Heitzman (2010, pp. 127-178). An increase in the amount of physical capital brings about a reduction in the effective tax rate of the company. The claimed reduction in the effective tax rate will be even higher than the increase in physical capital of the company. A negative relationship between the effective tax rate and physical capital is also mentioned by Richardson & Lanis (2007, pp.689-704), who evaluated companies and their capital intensity in the context of deductions. They discovered that a company with a higher amount of physical capital in its possession can more easily manage taxes, for example by postponing expenses on deductions.

A higher amount of tangible investment assets leads to a lower ETR. This is proven by Chen et al. (2010, pp. 41-61), Derashid & Zhang (2003, pp. 45-62), Fonseca Díaz et al. (2011, pp. 491-516), Gupta & Newberry (1997, pp. 1-34), Janssen (2005, pp. 47- 66), Noor & Fadzillah (2010, pp. 189) and Stickney & McGee (1982, pp. 125-152). Conversely, Feeny (2006, pp. 1167-1175), Plesko (2003, pp. 201-226) and Wilkinson et al. (2001, pp. 157-175) discovered a direct relationship between physical capital and tax burden. Other studies, however, did not discover any connection between this determinant and ETR (Liu &

Cao, 2007, pp. 49-67). Fernández-Rodríguez & Martínez-Arias (2011, pp. 381) discovered a nonlinear relationship.
The asset composition is determined by the field in which a company operates. The opportunity to reach a lower ETR can also depend on the volume of current assets, which companies need for their operation. These is inventory created for a smooth operation of production. Investments in inventory are considered an alternative to investments in long-term tangible assets. The volume of inventory held by the company can be considered a reason which might lead to a larger tax burden. The volume of inventory as an explanatory variable of ETR is not represented in existing empirical research to the same degree as other determinants. Several authors, such as Gupta & Newberry (1997, pp. 1-34) and Richardson & Lanis (2007, pp.689-704) have dealt with it and the results of their studies speak to a statistically significant relationship. Other authors, such as Derashid & Zhang (2003, pp. 45-62) or Adhikari et al. (2006, pp. 574-595) have no identified any statistically significant relationship.

Profitability is the deciding factor for the tax burden of companies. The most profitable companies have the highest profit every year, which is subject to tax. Less profitable companies have lower profits. Some years, they even suffer a loss, which means they pay lower or even no taxes. Empirical evidence points to a positive relationship between profitability and ETR (Chen et al., 2010, pp. 41-61; Fernández-Rodríguez & Martínez-Arias, 2011, pp. 381; Gupta & Newberry, 1997, pp. 1-34; Plesko, 2003, pp. 201-226; Richardson & Lanis, 2007, pp. 689-704; Stickney & McGee, 1982, pp. 125-152; Wilkie & Limberg, 1993, pp. 46). Profitable companies are subject to a higher tax burden than the less profitable ones. However, there is a converse situation in Malaysia. This is proven by Derashid & Zhang (2003, pp. 45-62), Noor (2008, pp. 1602-1604) and Noor & Fadzillah (2010, pp. 189). In Malaysia, the most profitable companies have a lower tax burden due to a tax compensation provided by the government to the most effective companies. In the Spanish bank sector, Fonseca Díaz et al. (2011, pp. 491-516) did not discover any significant relationship between profitability and ETR.

Manzon & Plesko (2001, pp. 175) and Kraft (2014, pp. 1-19) are of the opinion that profitable companies are able to more effectively use tax deductions as well as tax reliefs, and consequently show higher tax differences. Companies which are more profitable have lower costs in connection to tax administration and therefore have more resources to invest in tax planning, which contributes to lowering the effective tax rates.

Nominal tax rate as a determinant of effective tax rate is statistically significant in empirical studies and positively impacts effective tax rate. (see Dias & Reis, 2018, pp. 7). Effective tax rate is, on average, increased more slowly than nominal tax rate, as claimed by Graham & Tunbridge (2016), Rego & Wilson (2012, pp. 775-810) and Rego & Wilson (2009). Companies have the ability to decrease their total payable tax through tax management. Giannini & Maggiulli (2002) and Dyreng et al. (2008, pp. 61-82) claim that if there is a gap between effective and nominal rates, the tax system is not effective. Some companies reach significant differences between a high nominal and low effective rate, which leads to undesirable impacts on the unbalanced tax system.

3 Materials and Methodology

The analysis is focused on the impact of selected independent variables (size, capital intensity, inventory, profitability and nominal tax rate) on a dependent variable (effective tax rate). The relationship between selected microeconomic determinants is analyzed through quantile regression, which divides individual companies into quantiles. The selected analyzed countries are all the member states of the EU, 28 as of 2018. The followed time period are the years 2009-2018. The data are sourced from financial statements of companies from the Orbis database. An exception is the statutory corporate tax rate, whose values were sourced from ZEW (2018). After removing companies which do not show values in certain indicators and removing extreme values which might distort the analysis, the dataset is composed of 1 651 companies based in one of the EU member states. These are production companies which are classified in group C – Manufacturing under the NACE classification of economic activities. Variables which enter into the model are selected based on the works of international authors who deal with the issue of effective corporate tax and its determinants. The selected determinants are analyzed in many works (Fernández-Rodríguez & Martínez-Arias, 2014, pp. 214-228; Fattouh et al., 2008, pp. 417-438; Hsieh, 2012, pp. 1177-1180; Gupta & Newberry, 1997, pp. 1-34; Janssen & Buijink, 2000; Richardson & Lanis, 2007, pp.689-704; Stamatopoulos et al. 2019, pp. 236-254; Feeny, 2006, pp. 1167-1175; Vintila et al., 2017; Kim & Limpaphayom, 1998, pp. 47-68; Delgado et al. (2012, pp. 160-165; 2014, pp. 487-496), which consider them to be the most significant determinants which impact the height of effective corporate rate. The selected variables entered into the analysis are:

- ETR (effective tax rate) – dependent variable defined as the ratio of common expenses on business tax and net income before tax,
- SIZE – size of the company measured as a logarithm of total assets,
- LEV (leverage) - financial leverage defined as the ratio of total debt and total assets,
- CAPINT (capital intensity) - physical capital of the company defined as the ratio of tangible assets and total assets,
- INVINT (inventory intensity) – inventory measured as the ratio of investments in inventory and total assets,
- ROA (return of assets) – the ratio of gains before tax and total assets,
- RATE - statutory (nominal) tax rate from income of judicial persons in each country per each year.

To record possible nonlinear impacts of explanatory variables depending on effective tax rate faced by the companies, quantile regression is used. This semiparametric approach was suggested by Koenker and Basset in 1978 (pp. 33-50) with the objective to follow heterogeneous behavior on different levels of dependent variables. Quantile regression minimizes deviations in their absolute value with asymmetrical weight rather than minimizing the squares of the errors. In 2005, Koenker published a book which discusses the theory of quantile regression in detail and applies it to examples from economics, finance, biology and ecology.

Let (,), be a population sample, whereas is the regression vector. Assuming that the zero quantile of the conditioned division is linear in, the quantile regression model takes the form:

$$y_i = x'_i\beta_\theta + u_{\theta i} \quad (1)$$

and

$$\mathrm{Quant}_\theta(y_i|x_i) = \inf\{y: F_i(y|x) \geq \theta\} = x'_i\beta_\theta \quad (2)$$

where it is required that

$$\mathrm{Quant}_\theta(u_{\theta i}|x_i) = 0 \quad (3)$$

signify the zero quantile, represent the regression vector, is the unknown parameter vector, which should be estimated for different values in the interval (0,1), is the standard error. A change in the value of from 0 to 1 records the whole distribution of, which is a determined variable.

In the process of quantile regression, all observations are always entered for each quantile. Each is suitable for each quantile but in the end, the pairs of sampling points are decisive, where is the number of parameters which ought to be estimated. The selection of points depends on the full number of observations in the sample. (Koenker, 2004, pp. 74,89)

To estimate the covariant matrix of the vector of regression parameters, there are two general approaches. The first one is derived from the asymptotic standard estimation error, while the second one uses bootstrap methods to calculate the standard errors and to create reliability intervals.

Any quantiles of distribution of a dependent variable determined by independent variables can be achieved by changing from zero to one using linear programming methods to minimize the sum of the weighed absolute deviations. The functions of quantile regression fit our data better than traditional estimations of OLS linear regression. Classic properties of effectiveness and estimations of minimum OLS dilution are gained using restrictive assumptions of independent, identical and normally distributed errors. When the division of errors deviates from normal, a quantile regression estimation can be more effective than OLS. (Buchinsky, 1998, pp. 88-126)

Since estimations of quantile regression are derived using the minimization of the weighed sum of absolute deviations, estimations of parameters are less sensitive to deviations in data distribution. Thus, quantile regression estimation is relatively robust in comparison with heteroscedasticity of residuals.

Quantile estimations use all observations and coefficients are estimated using the iterative method through linear programming in different places of the distribution. This method is more effective than an OLS estimation, since the distribution of errors is still nonstandard. (Buchinsky, 1998, pp. 88-126). The results of quantile regression are compared with the results of the smallest squares method, which is used in the classic linear regression model.

Existing literature and studies do not agree in determining the relationship between ETR and selected determinants. Since our analysis focuses on companies operating in EU countries between the years 2009 and 2018, we expect to confirm the following hypotheses:

Hypothesis H1: The relationship between the size of the company, indebtedness, inventory and statutory tax rate and effective tax rate is positive, and the relationship between capital intensity and profitability of the company in the industrial field is negative.

Hypothesis H2: The size of the company is the deciding determinant for taxing companies in the industrial field.

The hypotheses will be confirmed or denied based on carrying out a quantile regression of companies from the member countries of the European Union in the period of 2009 to 2018 which perform business activities in the industrial field.

4 Results and Discussion

One of the important parts of analyses is data preparation. A similar issue is addressed by Delgado et al. (2014, pp. 487-496). Using quantile regression in analyzing effective corporate tax rate is also the subject of Fernández-Rodríguez & Martínez-Arias (2011, pp. 381) and Hsieh (2012, pp. 1177-1180). After the initial reformatting and homogenization of the data set, the first part of the statistical evaluation was carried out. This is a descriptive analysis to express the basic statistical properties consisting of calculating the average value, standard deviation and the variables (Table 1). The analysis was performed in the R-commander software, version 3.6.1. (R.C. Team, 2020).

Table 1. Descriptive statistics

	average	Standard deviation	Minim.	Maxim.
ETR	0.2586	0.121	0	0.998
SIZE	11.5539	1.299	6.005	19.158
LEV	0.4120	0.189	0	0.973
CAPINT	0.3004	0.160	0.002	0.968
INVINT	0.2228	0.171	0	0.996
ROA	12.4685	9.421	0.012	85.141
RATE	0.2439	0.057	0.090	0.350

Source: Own processing – R-commander output (2020)

The average effective tax rate, which was calculated as the ratio of paid taxes and the net income before tax, is approximately 26%. ETR is close in value to the average statutory tax rate, which is 24.39%. Since these are companies operating in the industrial field, the value of assets is in millions of EUR. The average size of company in assets is approximately 104 million EUR. The average indebtedness of companies which were entered into the analysis was at 41% of total assets. Tangible assets compose on average 30% of total assets of the analyzed companies in the EU. The amount of inventory held by the companies is on average 22% of total assets. The ratio of profit and total assets is on average 12.5%.

From all the variables, a correlation matrix was created using a series of Pearson's correlation tests, out of which we are listing the correlation coefficient (r), which determines the direct or indirect proportionality in the relationship between variables and the corresponding p-value (p), which determines the potential significance of this relationship (if $p < 0.001$). Table 1. lists the descriptive characteristics and a matrix of correlations between the variables, whereas all correlative relationships, excepting two (Pearson's correlation test: SIZE vs. RATE, $r = 0.01$, $p > 0.05$; INVINT vs. ROA, $r = 0.002$, $p > 0.05$) are statistically significant, positively or negatively.

The linear dependence between selected indicators is weak. The highest absolute value is in the relationship between inventory and capital. This is a negative relationship, which is logical from a practical perspective, since companies have limited financial resources at their disposal, which they invest in purchasing tangible capital or purchasing inventory in the most beneficial ratio for them. The strongest positive relationship is between effective and statutory tax rate. The impact of STR on ETR has already been mentioned several times in the preceding chapters. STR is reflected in the height of ETR, since the statutory tax rate is used to tax assets of companies. A positive relationship between these two variables was also shown by Dias & Reis (2018). Their study focuses on only five EU countries, namely Denmark, Slovenia, Finland, Luxembourg and Great Britain.

There was no correlation proven between STR and the size of the company. This situation is explained by similar size of the companies, whose assets amount to millions of EUR, thus their assets are taxed the same. There exist no small companies in the sample which would have lower tax rates than large companies. Another relationship where no correlation was proven is the relationship between inventory and ROA (Table 2.).

Table 2. Correlation matrix

	ETR	SIZE	LEV	CAPINT	INVINT	ROA	RATE
ETR	1						
SIZE	0.03***	1					
LEV	0.18***	-0.08***	1				
CAPINT	-0.10***	-0.07***	0.08***	1			
INVINT	0,18***	-0.08***	0,31***	-0.51***	1		
ROA	-0.21***	-0,11***	-0.24***	-0.13***	0.002 NS	1	
RATE	0.37***	0.01 NS	0.16***	-0.18***	0.24***	-0.05***	1

Note.: ***, **, * a „NS "refers to the level of statistical (in)significance at the values of 5%, 1%, a 0,1 %
Source: Own processing; R-commander output (2020)

Consequently, we proceeded to do the partial modeling of relationships between a dependent variable – effective corporate tax rate (ETR) and six independent variables – size of the company (SIZE), financial leverage (LEV), physical capital (CAPINT), amount of inventory (INVINT), profitability of the company (ROA) and statutory tax rate (RATE), through creating six quantile regression models with nine quantile levels (from $\tau = 0.1$ to $\tau = 0.9$ with an interval of 0.1). As the algorithmic method used to calculate the position of individual quantile curves, we used a modified version of Barrodale's and Roberts' algorithm (described in detail in Koenker and d'Orey (1994, pp. 410-414). This method is relatively effective for datasets sized up to multiple thousand observations. It also implements a method for calculating the intervals of reliability for the estimated parameters (β0 and β1), which is based on an inversion of the values of the test described in Koenker (1994, pp. 349-359).

The values of the coefficients (β0 a β1) together with their standard deviations and p-values are listed for each value of τ in a table, as well as a graph. The values of the locating constant β0 are listed in Annex B. The individual pictures (Figure 1., Figure 2., Figure 3., Figure 4., Figure 5., Figure 6) show red constant lines which represent the estimated coefficients using the method of the smallest squares, and a 90% reliability interval. The gray portion represents 90% reliability intervals for individual regression coefficients depending on quantiles.

Tab. 3 Estimators of quantile regression – Intercept β1

	Quantiles								
	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
SIZE	-0.00026 NS (0.00166)	0.00052 NS (0.00091)	0.00368 *** (0.00054)	0.00604 *** (0.00081)	0.00523 *** (0.00078)	0.00398 *** (0.00072)	0.00342 *** (0.00074)	0.00371 *** (0.00083)	0.00408 ** (0.00155)
LEV	0.04831 *** (0.01062)	0.04559 *** (0.00535)	0.05119 *** (0.00366)	0.09456 *** (0.00495)	0.10933 *** (0.00559)	0.10597 *** (0.00526)	0.11638 *** (0.00541)	0.13612 *** (0.00578)	0.20579 *** (0.00920)
CAPINT	-0.10212 *** (0.00952)	-0.09146 *** (0.00805)	-0.06489 *** (0.00348)	-0.09737 *** (0.00454)	-0.11475 *** (0.00618)	-0.11004 *** (0.00644)	-0.08147 *** (0.00660)	-0.05677 *** (0.00758)	0.00212 NS (0.01316)
INVINT	0.11198 *** (0.01075)	0.07477 *** (0.00494)	0.09300 *** (0.00575)	0.13208 *** (0.00616)	0.13822 *** (0.00573)	0.13070 *** (0.00556)	0.12011 *** (0.00512)	0.13291 *** (0.00745)	0.19922 *** (0.01356)
ROA	-0.00081 *** (0.00007)	-0.00076 *** (0.00014)	-0.00082 *** (0.00002)	-0.00149 *** (0.00006)	-0.00200 *** (0.00002)	-0.00226 *** (0.00010)	-0.00247 *** (0.00004)	-0.00298 *** (0.00008)	-0.00373 *** (0.00008)
RATE	0.66971 *** (0.03629)	0.65496 *** (0.01691)	0.76587 *** (0.01296)	0.82426 *** (0.00799)	0.90951 *** (0.00626)	0.96108 *** (0.01137)	1.00151 *** (0.01809)	0.80733 *** (0.02265)	0.78522 *** (0.03561)

Source: Own process; R-commander output (2020)

The results of individual tests are shown in the summary tables and also in graphic visualizations, using both p-values determining the test result and standard codes of significance: *** if $p < 0.001$; ** if $p < 0.01$; * if $p < 0.05$; NS if $p > 0.05$. Data manipulation, as well as all statistical calculations and modeling were performed in the environment of the programming language "R" version 3.6.1 (R Core Team, 2019) using the libraries „readxl" (Wickham & Bryan, 2019), „Hmisc" (Harrell & Harrell, 2019, pp. 235-6) and "quantreg" (Koenker, 2019). Graph outputs were edited in the program Inkscape (Harrington & Engelen, 2004). It is important to note that the breadth of 95% of confidence intervals for the coefficients is very narrow, which suggests above-average precise estimations of these values – from this we can conclude that the sample was sufficiently large and the used methods adequate.

Based on performing quantile regression, we will confirm the validity of the above-mentioned hypotheses formulated based on our expectations and existing empirical evidence.

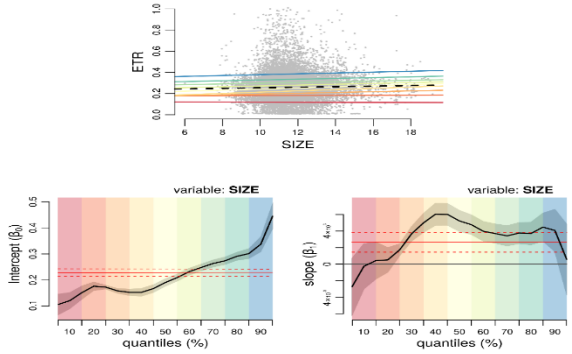
From the perspective of the dynamic of coefficient valuesβ0 (Annex 1) and β1 (Table 3.) across quantiles, we can conclude that all the created quantile regression models evidence the existence of strong positive (SIZE, LEV, INVINT, RATE) but also negative (CAPINT, ROA) relationships between ETR and the other six economic indicators, whereas the character of these relationships is, with a few exceptions, identical for all quantiles. The exemptions are only with the 10% and 20% quantile of the

size of the corporations (SIZE). With such small subjects, the additive effect of ETR on RATE is statistically indemonstrable.

Hypothesis H1: The relationship between the size of the company, indebtedness, inventory and statutory tax rate and effective tax rate is positive, and the relationship between capital intensity and profitability of the company in the industrial field is negative.

The relationship between ETR and SIZE is an often present subject of various studies, Kim & Limpaphayom (1998, pp. 47-68), Richardson & Lanis (2007, pp.689-704), Delgado et al. (2012, pp. 160-165), Derashid & Zhang (2003, pp. 45-62). The results of these studies vary, due to the time when they were performed but also due to tax jurisdictions they focus on. This fact is confirmed by Wilkie & Limberg (1990, pp. 76-91) and Kern & Morris (1992). Some of them point to a significant and positive relationship (Kim a Limpaphayom, 1998). This fact supports the the political cost hypothesis which claims that politicians have the power to redistribute wealth of the companies through corporate income taxes, regulations, subsidies, etc. This idea comes from (1971, pp. 3-21), Peltzman (1976, pp. 211-240) and Jensen & Meckling (1978, pp. 31-37). In Figure Error: Reference source not found 1 we can see that this hypothesis applies, if unevenly, across the whole sample of selected companies. Effective tax rate increases in a relative stable and monotonous way with the increasing size of the corporation. The impact of ETR and size of the company is most felt by corporations in the size quantile between 40% and 50%. For companies in the size quantile between 10% and 20%, the effect of ETR is nonexistent. It is important to note that reliability intervals estimated for the size variable are very narrow. All the companies in the examined sample showed a profit in the examined period. Settling a loss is different in different countries, which can distort results to a significant degree. In the case of Slovakia, we can see that different governments implemented different rules. For example tax license, which did not allow companies not to pay income tax, since even companies which had a loss in the tax period had to a pay certain legally set tax rate. Another example is accepting a tax loss through dividing into multiple tax periods, which lowers the tax base and thus the paid amount of corporate income tax.

Figure 1. Relationship between size of the company and effective tax rate

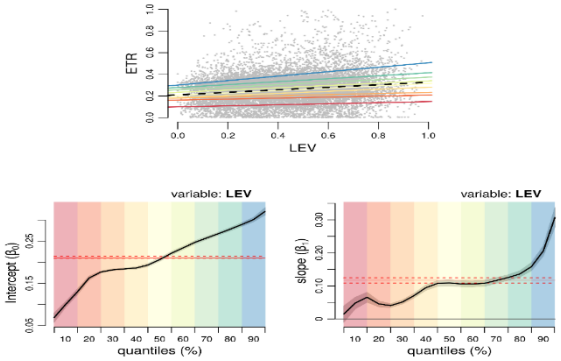


Larger companies reach a higher value of ETR, since they are oftentimes more legislatively burdened than smaller companies, who get various tax reliefs from policy-makers. Larger companies are subject to higher tax controls or different government controls. An exception are companies in the 90% quantile, which can use their size and economic power to influence the taxation of their net income, for example through tax holidays or very beneficial tax reliefs as a compensation for investments in a given area and employing a significant portion of the population in a region. This theory is known as competition theory and claims that larger companies have lower effective tax rates because they have more power and more resources through which they can influence the amount of paid taxes. This relationship is confirmed by multiple studies (Dyreng et al., 2008, pp. 61-82; Richardson & Lanis, 2007, pp.689-704).

Another reason might be the fact that large companies make large investments which are reflected in their financial statements as increased operating costs, which decreases the tax base for paying the taxes on net income.

The relationship between effective tax rate and indebtedness of the company is also strong and positive. (Error: Reference source not found Figure 2.). The higher the indebtedness, the higher the ETR, whereas this relationship is most progressive (steepest curve) for corporations with indebtedness in the highest quantile (90%). in the manufacturing sector, it is necessary for companies to own various machinery, buildings, land and other tangible and intangible assets, the purchase of which requires significant financial resources. These resources are usually borrowed from banks and other financial institutions. Significant indebtedness is mostly seen with large companies (size of the company is measured through assets that it owns). Large companies have no problems with borrowing money, since they can use their assets as collateral. Financial leverage was measured as the total indebtedness versus total assets. In other words, the higher the indebtedness of the company, the higher the effective tax rate.

Figure 2. Relationship between indebtedness of the company and effective tax rate

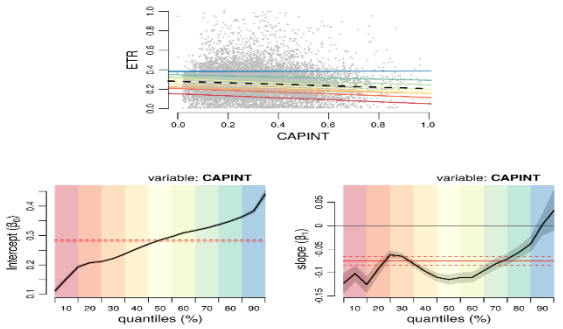


A positive relationship between ETR and indebtedness of the company was proven in Chen et al. (2010, pp. 41-61), Feeny (2006, pp. 1167-1175), Harris & Feeny (2003, pp. 951-958) and Janssen (2005, pp. 47- 66). Companies are willing to take on debt, but only to a certain degree. One important finding is the fact that interest from loans and other borrowed resources is a taxable expense In many European countries, and this decreases the tax base used to calculate the payable corporate income tax. The results of our analysis are in agreement with theoretical arguments which support a positive relationship between ETR and indebtedness of companies, which are under a lot of fiscal pressure in terms of provided stimuli to decrease indebtedness, thus decreasing their effective tax rate. The indebtedness of the companies has certain limits. One of them is the amount of financial resources that a company has at its disposal to pay back the debt. Thus, we can assume that under certain circumstances, the relationship between ETR and indebtedness is nonlinear, which is also suggested by Fernández-Rodríguez & Martínez-Arias (2011, pp. 381).

Capital intensity represents the ratio of tangible and total assets. Physical capital is connected with accounting and tax write-offs. The write-offs are a tax expense which decreases the tax base used for calculating corporate income tax. The methods and times for write-offs vary across EU countries. The total of the write-offs is also called a tax shield or tax relief which is provided to companies indirectly by the state. Tangible assets which are subject to write-offs are used to decrease the value of the effective tax rate. The analysis points to a strong negative relationship. This negative relationship is confirmed by Stickney & McGee (1982, pp. 125-152) and Gupta & Newberry (1997, pp. 1-34). Companies with a low amount of assets that can be written off are not able to decrease their tax burden. Conversely, companies which reach a certain level of capital show a decrease

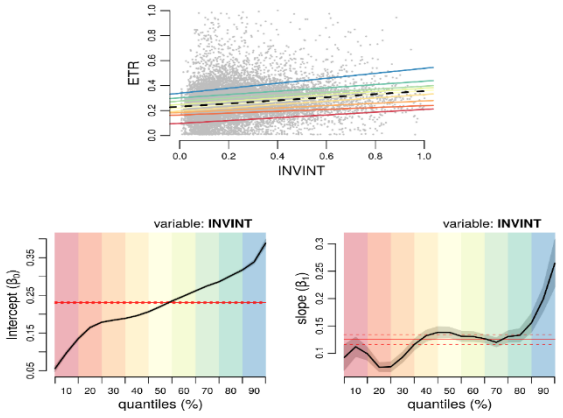
in ETR, resulting from the ability to have high write-offs. In our analysis, the relationship is the most significant for companies with physical capital in the 10%, 50% and 60% quantile. For companies in the 90% size quantile, the effect of ETR is nonexistent.

Figure 3. Relationship between capital intensity of the company and the effective tax rate



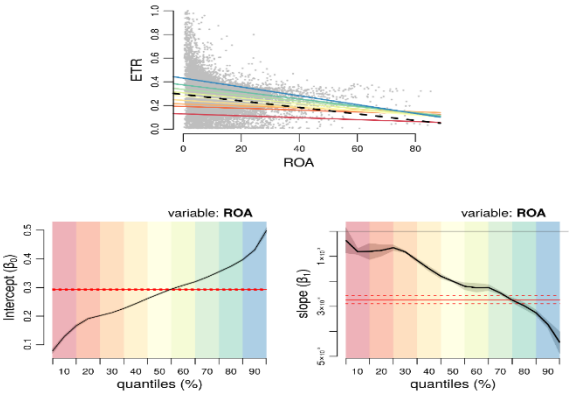
The relationship between the effective tax rate and inventory is strong, positive and the most significant for corporations with inventory in the 90% quantile. In the manufacturing sector, it is important to keep the necessary volume of inventory in stock, so that manufacturing is not stopped in case delivery is delayed by a couple days. These current assets are necessary for undisturbed operation of the companies. Investments in inventory are considered an alternative to investments in long-term tangible assets. The volume of inventory held by the company can lead to higher tax burden. A statistically significant relationship has also been confirmed by Gupta & Newberry (1997, pp. 1-34) and Richardson & Lanis (2007, pp.689-704). An important part of current assets is their discharge from storage at different prices. There are four ways to discharge inventory, namely FIFO (first in first out), LIFO (last in first out), weighed arithmetic average and set prices. Not all tax jurisdictions allow a choice from these four options. Tax burden varies. The highest tax burden happens with discharging with set prices, and the lowest with discharging while accounting for price increases – LIFO.

Figure 4. Relationship between inventory of the company and effective tax rate



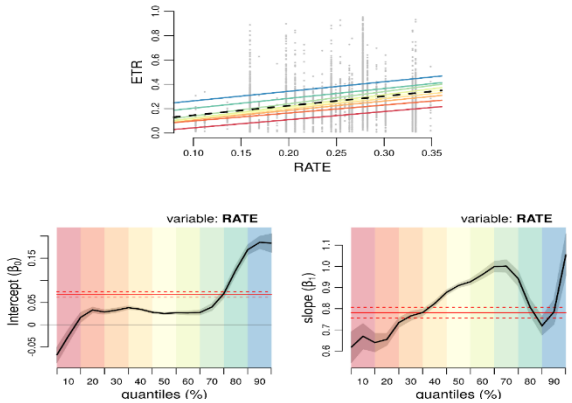
The relationship between effective tax rate and profitability of the company is the strongest negative relationship of all models and at the same strongly monotonous. The higher the corporation is, i.e. the higher the profitability quantile of the company, the lower the value of its effective tax rate. From a theoretical perspective, one might expect higher taxes along with higher profits. The results of our research claim the opposite. This opinion is shared by Manzon & Plesko (2001, pp. 175), Kraft (2014, pp. 1-19), Stickney & McGee (1982, pp. 125-152), Wilkie & Limberg (1993, pp. 46), Gupta & Newberry (1997, pp. 1-34), Plesko (2003, pp. 201-226) and Chen et al. (2010, pp. 41-61), who claim that profitable companies are able to more effectively utilize tax breaks, write-offs and reliefs, and thus lower their effective tax.

Figure 5. Relationship between profitability of the company and effective tax rate



It is important to note that the independent variable profitability was calculated using profit before tax and total assets of the company. It is important to include profit before tax in the calculation, because profit after tax and other reliefs could distort the results of the analysis. This is repeated because this is another case where a significant role is played by the size of the company. As mentioned above, large companies tend to plan their tax and also take advantage of various government stimuli, reliefs, tax holidays etc. Their profitability values, if calculated with profit after tax, would therefore be completely different. We observed a difference between the effective tax rate and statutory (nominal) tax rate at the level of approximately 1.5 percentage points, which is much lower than cited by Delgado et al. (2014, pp.487-496) – 5.5%. It is, however, important to note that the study followed the member countries of EU 15, not EU 28. The relationship between effective corporate tax rate and statutory tax rate can generally be described as positive especially for corporations with a statutory tax rate in the 70% and 90% quantile, however with a significant drop of the curve at the 80% quantile, where one might expect a higher value. Simultaneously, there is a strong correlation between these variables. The higher the value of STR, the higher the value of ETR. The statutory tax rate significantly impacts the value of the effective corporate tax rate. This relationship is visible during calculations and also during regression analysis.

Figure 6. Relationship between effective tax rate and statutory tax rate



As we were able to observe, the relationships between ETR and individual independent variables vary for the 10% to 90% quantiles. In some cases, there is a radical change within two variables. After evaluating the partial portions of the analyses, we can say that *Hypothesis H2: The size of the company is the deciding determinant for taxing companies in the industrial field has been confirmed by the analysis.*

The tax rate for corporate income tax is an important data point in the European tax system for makers of fiscal policy, companies, and investors. On the one hand, the tax rate can impact the unity of the market, on the other hand it can impact strategic decisions in the company. Using quantile regression, we pointed to an existing relationship between the effective tax rate and selected microeconomic determinants, namely: size of the company, volume of physical capital owned by the company, volume of inventory in stock, indebtedness of the company, and statutory tax rate in the country where companies are based. All the proposed hypotheses were confirmed using quantile regression. A positive relationship was shown between effective tax rate and size, indebtedness, inventory of the company and statutory tax rate. A negative relationship exists between the effective tax rate and profitability of the company and between the effective tax rate and capital intensity. These hypotheses apply to companies based in the member countries of the European Union. Assuming that large companies own a large volume of physical capital and inventory and are the most indebted. It is important to realize that companies with a size in the 90% quantile operate under specific rules. These companies have the ability to regulate their effective tax rate using their economic power. Banks and other financial institutions are willing to lend large companies a large volume of financial resources. If this assumption is true, we can say that large companies are more indebted, which means that the curve shows the most rapid growth in this quantile. Companies which entered into the analysis are from the industrial field. In the industrial field, the companies own physical capital of high value which they regularly write off. It is therefore odd that the analysis pointed out that companies with physical capital in the 90% quantile (assuming these are large companies), then the effect of the effective tax rate will be nonexistent. Since inventory increases the effective tax rate, this relationship is true for large companies with a high ratio of inventory in total assets. A negative relationship between the effective tax rate and profitability of the company is very progressive and rapidly drops in the 90% quantile. This confirms that large companies have the ability to use their good standing in the economy and their economic power to influence the amount of taxes that they must pay.

Table 4. Comparison of previous empirical studies with our analysis

Variable	Existing empirical studies			Our analysis		
	Author	Year	Relationship between ETR and variable	Expected relationship	Discovered relationship	Interpretation
Size	Delgado et al.	2012	negative	+	+	Increased size of the company means increased its effective tax rate (ETR).
	Wu et al.	2012	nonexistent			
	Dyreng et al.	2008	negative			
	Richardson & Lanis	2007	negative			
	Derashid & Zhang	2003	negative			
	Kim & Limpaphay	1998	positive			
Capital intensity	Kraft	2014	negative	-	-	The more physical inventory a company owns, the lower its ETR due to higher deductions of assets.
	Richardson & Lanis	2007	negative			
	B.- Semenescu & Semenescu	2010	nonexistent			
Indebtedness	Chen et al.	2010	positive	+	+	Indebtedness of the company increases its effective tax rate.
	Feeeny	2006	positive			
	Janssen	2005	positive			
	Harris & Feeny	2003	positive			
	Wilkinson et al.	2001	nonexistent			
	Kim & Limpaphay	1998	nonexistent			
Inventory	Richardson & Lanis	2007	positive	+	+	Increased amount of inventory in stock causes an increase in effective tax rate.
	Adhikari et al.	2006	nonexistent			
	Derashid & Zhang	2003	nonexistent			
	Gupta & Newberry	1997	positive			
Profitability	Armstrong et al.	2012	positive	-	-	The higher the profitability, the lower the effective tax rate of the company. Large companies with high profitability can use their economic power to influence the amount they pay in tax.
	Fonseca Díaz et al.	2011	negative			
	Chen et al.	2010	negative			
	Noor & Fadzillah	2010	negative			
	Minnick & Noga	2010	positive			
	Liu & Cao	2007	nonexistent			
	Feeny	2006	positive			
	Janssen	2005	negative			
	Plesko	2003	positive			
	Wilkinson et al.	2001	positive			
Nominal tax rate	Dias & Reis	2018	positive	+	+	Increased nominal tax rate means increased effective tax rate.
	Graham & Tunbridge	2016	positive			
	Rego & Wilson	2012	positive			
	Giannini & Maggiulli	2002	positive			

Source: Own processing

5 Conclusion

Corporate taxes represent one of the important income sources to the state budget. The statutory and effective tax rate is an important factor for investors when deciding where to place their investment. Companies try to find a country where they will pay the least in corporate tax. The solution, however, is not to find the country with the lower statutory tax rate, but the lowest effective tax rate. For the company, this will mean not only the lowest percentage of the tax base from the net income that will have to be paid to the government, but also a lower inflation rate, interest rates for foreign capital, more beneficial conditions for writing off long-term assets and other factors which the company encounters on a daily basis. All of this constitutes the calculation of the effective tax rate.

The results of the quantile regression, which used data from financial statements of 1 651 companies from the industrial field based in the countries of the European Union from the years 2009 to 2018, showed significant relationships between the effective tax rate and selected microeconomic determinants, namely size of the company, capital intensity and indebtedness, inventory, profitability and nominal tax rate. Quantile regression confirmed our proposed hypotheses about the relationship between the effective tax rate and determinants. A positive relationship was proven for the size of the company, capital intensity, indebtedness, inventory and nominal tax rate. A negative relationship exists between the effective tax rate and profitability of the company. An important output of the quantile regression was pointing out large companies, which can use their economic power to regulate their effective tax rate but also other determinants. The results of quantile regression need to be observed from a broader perspective, since it is important to see hidden connections. The observed phenomenon applies to the above mentioned large companies with an amount of total assets owned in the 90% quantile. Based on the results, we can conclude that these companies pay much lower taxes than other

companies, which placed in different quantiles. Large companies also have high indebtedness, since financial institutions are willing to lend them money before small and medium enterprises. A similar situation arises with capital intensity and inventory of these large companies. Since the analysis included industrial companies, the capital intensity required for their operation and the volume of inventory held in stock are key for undisturbed manufacturing. The curves showing the relationship between determinants and the effective tax rate have a more significant downward slope in the 90% quantile. An important relationship is between the effective tax rate and profitability of the company. Quantile regression showed that the higher effective tax rate, the lower the profitability of the company.

We cannot forget that the European Union consists of countries with varying levels of economic development, and thus different rules in the domestic tax systems. To collect corporate income taxes, one must understand the deciding factors which affect them. One of these factors is the effective tax rate, which reflects the operation of the whole tax system in a country. A lack of unity in fiscal policies, specifically in the tax area, in the member countries of the European Union, creates a competitive environment. To create the same tax conditions in all member countries, the European Union has attempted to implement a tax harmonization multiple times. It has never been successful, however. Countries worry about losing competitiveness and are not open to such a change. It is disputable whether it will ever be possible to implement a tax harmonization.

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Primary Paper Section: A

Secondary Paper Section: AH

Appendix 1. Quantile regression estimators (Intercept β0)

	Quantiles								
	0.1	**0.2**	**0.3**	**0.4**	**0.5**	**0.6**	**0.7**	**0.8**	**0.9**
SIZE	0.12086 ***	0.17605 ***	0.15838 ***	0.15279 ***	0.19041 ***	0.23200 ***	0.26336 ***	0.29102 ***	0.33733 ***
	(0.01914)	(0.01031)	(0.00590)	(0.00604)	(0.00523)	(0.00846)	(0.00861)	(0.00965)	(0.01784)
LEV	0.10003 ***	0.16271 ***	0.18204 ***	0.18643 ***	0.20628 ***	0.23408 ***	0.25747 ***	0.27827 ***	0.30121 ***
	(0.00400)	(0.00284)	(0.00123)	(0.00176)	(0.00257)	(0.00236)	(0.00219)	(0.00227)	(0.00309)
CAPINT	0.15310 ***	0.20742 ***	0.22177 ***	0.25478 ***	0.28477 ***	0.30911 ***	0.32588 ***	0.34898 ***	0.38307 ***
	(0.00382)	(0.00201)	(0.00147)	(0.00194)	(0.00212)	(0.00199)	(0.00193)	(0.00224)	(0.00411)
INVINT	0.09759 ***	0.16450 ***	0.18420 ***	0.19608 ***	0.22027 ***	0.24826 ***	0.27522 ***	0.30192 ***	0.33882 ***
	(0.00254)	(0.00192)	(0.00104)	(0.00138)	(0.00174)	(0.00160)	(0.00134)	(0.00187)	(0.00318)
ROA	0.12886 ***	0.19136 ***	0.21221 ***	0.24355 ***	0.27822 ***	0.30765 ***	0.33615 ***	0.37385 ***	0.43097 ***
	(0.00261)	(0.00180)	(0.00094)	(0.00156)	(0.00139)	(0.00158)	(0.00140)	(0.00160)	(0.00246)
RATE	-0.02458 **	0.03331 ***	0.03289 ***	0.03496 ***	0.02530 ***	0.02652 ***	0.03992 ***	0.12318 ***	0.18568 ***
	(0.00926)	(0.00388)	(0.00306)	(0.00158)	(0.00138)	(0.00257)	(0.00479)	(0.00648)	(0.00837)

Source: R-commander output (2020)