

## The Impact of Taxation on Economic Growth: Case Study of OECD Countries<sup>1</sup>

Rudolf Macek<sup>2</sup>

**Abstract:** The aim of this paper is to evaluate the impact of individual types of taxes on the economic growth by utilizing regression analysis on the OECD countries for the period of 2000 – 2011. The impact of taxation is integrated into growth models by its impact on the individual growth variables, which are capital accumulation and investment, human capital and technology. The analysis in this paper is based on extended neoclassical growth model of Mankiw, Romer and Weil (1992), and for the verification of relation between taxation and economic growth the panel regression method is used. The taxation rate itself is not approximated only by traditional tax quota, which is characteristic by many insufficiencies, but also by the alternative World Tax Index which combines hard and soft data. It is evident from the results of both analyses that corporate taxation followed by personal income taxes and social security contribution are the most harmful for economic growth. Concurrently, in case of the value added tax approximated by tax quota, the negative impact on economic growth was not confirmed, from which it can be concluded that tax quota, in this case as the indicator of taxation, fails. When utilizing World Tax Index, a negative relation between these two variables was confirmed, however, it was the least quantifiable. The impact of property taxes was statistically insignificant. Based on the analysis results it is evident that in effort to stimulate economic growth in OECD countries, economic-politic authorities should lower the corporate taxation and personal income taxes, and the loss of income tax revenues should be compensated by the growth of indirect tax revenues.

**Key words:** Taxation, Economic Growth, World Tax Index, Tax Quota, Panel Data

**JEL Classification:** E22, F21 H20, C50

### Introduction

The current globalized society is characteristic by the necessity of existence of redistribution processes due to the fulfilment of elementary state's functions. At the same time, the government spending as the basic tool of economic policy is conditioned by the necessity of their financing, where the tax revenues usually represent the most significant part of state budget income. However, the tax system structure itself, tax mix, tax

---

<sup>1</sup> This paper was financially supported by the VŠB - Technical University SGS grant project No. SP2014/145 "The Influence of Structure of Government Spending and Taxes in Selected Sectors and Economic Growth in the Czech Republic".

<sup>2</sup> VSB – Technical University of Ostrava, Faculty of Economics, Sokolská třída 33, 701 21 Ostrava; rudolf.macek@gmail.com.

reliefs and tax surcharges and other characteristics of tax system are the subject of vast discussions and polemics not only among economists but also among other professionals and the public. This is the reason why individual tax systems are considerably heterogeneous and usually include various national specifications.

Concurrently, many developed countries integrated in OECD<sup>3</sup> are currently affected by the significant budget crisis within which they have problems to repay their short-term and long-term liabilities. Due to this, governments themselves are exposed to increased supervision from the financial markets and therefore they are forced to consolidate public budgets. The public finance crisis is usually solved by two concrete channels – channel of reducing the public spending, and the channel of increasing taxes, or tax revenues. On one hand, the basic aim of the consolidation is to keep criteria of budget responsibility as determined, and on the other hand, to restore the economic growth as soon as possible.

Different approaches to the creation and characteristics of tax system with the connection to budget problems of developed economies emphasize the significance of the issue of mutual interaction between taxes (tax burden) and economic growth (as a basic aim of the economic policy makers). Therefore, the aim of this paper is to evaluate the impact of individual types of taxes on the economic growth by utilizing regression analysis on the OECD countries for period 2000 – 2011. The analysis is based on widened neo-classical growth model of Mankiw, Romer and Weil (1992). When evaluating impact of taxation on the economic dynamics it is impossible to work with statutory tax rates because they have a very low explanatory power when it comes to the representation of real tax burden. Due to this, traditional tax quota and alternative World Tax Index were used for approximation in this paper.

### **Integration of Taxation Into the Neoclassical Growth Theory and Selected Ways of Tax Burden Approximation**

When evaluating the impact of fiscal variables on economic growth, it is necessary to derive from the fact that taxation influences economic growth solely through its impact on individual growth variables (Kotlán, Machová and Janíčková, 2011). Growth theories can be considered as the key ones in this evaluation, and it is therefore necessary to introduce, at least in short, their substance and to describe the channels of taxation impact on the economic growth. The work of Solow (1956) and Swan (1956), or the neo-classical growth model can be considered to be the turning point within the researched resources of economic growth. However, from the long-term view and due to the decreasing marginal product of capital, every economy aims towards the steady state in which it is not possible to increase output per one worker (Duczynski, 2003). Only

---

<sup>3</sup> Organization for Economic Co-operation and Development (OECD) includes till 01. 01. 2014 34 world developed countries: Australia, Austria, Belgium, Canada, Czech Republic, Chile, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Korea, Luxembourg, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey, United Kingdom, United States.

technology advancement, which is exogenous in this model, secures the change of steady state and thus the product growth per worker, too. Exogenous technology advancement presents probably one of the biggest insufficiencies of this model. Consequently, within further development of growth theories, technology advancement is endogenous. Romer (1986) and Lucas (1988) made technology advancement endogenous by repeatedly defining the term capital. In this case, the capital consists of physical and human form. Especially investments into human capital represent the source of long-term economic growth, or they slow down the convergence of economies towards the steady state.

Judd (1985) was one of the first who dealt with the productivity of government spending and its impact on economic growth in connection to its financing by various types of taxes, whereas Barro (1990) widened researched model by national tax burden. The paper by King and Rebello (1990), who tried to determine the reasons for disparity existence among individual countries within long-term economic growth, can be considered as a very important contribution. Their paper researched the hypothesis in which they assumed that the answer to these disparities lies in different tax policies which influence incentives of individuals to accumulate capital in both its forms – physical and human. In their analysis they worked with the neoclassical growth model where they pointed out the significant effect of the impact of national taxation to the rate of long-term economic growth. Their first finding was that national tax policies can have a big influence on average rate of economic growth of isolated economies because they influence private incentives for accumulation of physical and human capital. These motivation effects of taxation are strengthened in open economies which have an access to international capital markets where even a small tax changes can result in stagnation of economy. The second conclusion was that the impacts of national taxation also depend on the aspects of technology production for new human capital. Last, their third conclusion was the fact that the tax policies have the potential to influence the growth rate in a long-term horizon so then there is a bigger quantitative impact of these policies on the welfare.

According to the aforementioned study it can be stated that tax burden can represent a significant factor which influences economic growth and ultimately also the social welfare which is the top objective of the economy policy makers.<sup>4</sup> When evaluating the impact of taxation on economic growth, it is necessary to realize that taxation can be integrated into growth theories only through its impact on individual growth variables (Kotlán, 2010; Kotlán, Machová and Janíčková, 2011). Due to this, in the case of widened neoclassical growth model of Mankiw, Romer and Weil (1992), it is the impact of taxation on the capital accumulation and investment or human capital and technology advancement. These channels are described below.

---

<sup>4</sup> The definition of social welfare is rather problematic (Kliková, Kotlán et al. 2012). For example, in the conception of utilitarian ethics it is the total amount of partial utility of individual members of society, see Kinkor (1996). Pareto (1971) states that it is “such an activity of society that can be increased only if there is a change, which will be advantageous for all its members or advantageous for some members without disadvantaging others.”

### *Impact of Taxation on Accumulation of Capital*

Daniel and Jefferey (2013), or Dwenger (2009) mention that corporate taxation lowers the return of invested capital and also the structure of capital or age of a company (Pfaffermayr, Stockl and Winner, 2008). Negative relation between corporate taxation and foreign direct investment (FDI) was confirmed by e.g. Schraztenstaller, Wagener and Kohler-Toglhofner (2005), or by Feld and Heckemeyer (2008), whereas Brebler (2012) claims that lower taxation rate represents the factor stimulating the inflow of FDI. In the context of globalization and significant mobility of factors, Adina (2009) evaluated the impact of tax policy on entrepreneurs and their localization decisions. The results of the analysis show that when it comes to the investment localization, taxation plays an important role in the investor's decision making, however, the investor must take into account other investment aspects, too, e.g. infrastructure, workforce availability, and legislation etc. This work is followed by e.g. Becker (2009) who works with the qualitative investment aspect and states that the growth of corporate taxation results in a decrease of tax revenues due to the lower inflow of FDI into the given economy. Potential investors ignore other advantages and characteristics of domestic economy (infrastructure, market availability, politic stability etc.) because the high corporate tax burden itself already discourages potential investor from the investment realization in the given state. The issue of corporate taxation rate importance in developing countries was dealt with for example by Vill and Barreix (2002), who state that most of these countries widely use tax policy as a tool for attracting foreign investors. It is necessary to realize that corporate taxation harms the entrepreneurial environment and discourages economic activity. Talops and Vancu (2009) came to similar conclusions but in the case of developed countries their results show that corporate taxation rate is not the determining factor of investment. The impact of tax progressivity onto decisions of companies related to localization depends on the existence of tax neutrality (Wong, 2011).

Entrepreneur's decision making about investment realization is also influenced by the labour taxation. Alesina et al. (1999) mention that the main reason for this fact is that the growth of labour tax rate leads to the employees' effort to get salary increase at a certain level before the taxation (it potentially also leads to the decrease of work supply). By this, pressure is created on companies to lower their profits, and consequently their investment, too. Feld and Kirchgässner (2001), or Overesch and Voeller (2010), state that high labour taxation discourages companies from localizing their investment, and at the same time it affects the structure of capital accumulation. The negative impact of the aforementioned channels of labour taxation on economic growth is verified in the paper of e.g. Dackehag and Hansson (2012).

Capital allocation or entrepreneur's investment decision can be influenced also by the consumption taxes. Salanié (2003) states that when a risk is absent, this type of taxation has the same impact on investment as labour taxes.

### *Impact of Taxation on Human Capital*

In the growth model, human capital is the next factor which is influenced by taxation. Because of growing marginal product, human capital has such an effect that investment into education is effective in economies which are in the steady state. A positive relation between investments into human capital and long-term economic growth was confirmed

in many studies, see e.g. Jones and Manuelli (2001), or Teixeira and Fortuna (2003). Lin (2001) confirms that a positive dependency can exist between economic growth and taxation if revenues from taxes are used only for human capital accumulation. Individual companies invest into their employees' training and development only once, usually in the first period of employment (Becker, 1993). However, when companies invest into human capital, they must differentiate between the general and specific capital. General capital can be utilized by employees also at other employer, but they do not bear any investment costs and the employer can therefore afford to pay the employee a higher salary (corresponding to higher labour productivity). Due to this, companies require that spending connected with investments into general human capital is taken up by the employees themselves (Kotlán, Machová and Janíčková, 2011). The situation is different in the case of specific capital since employee productivity is increasing only with the given employer who is then logically willing to take up a part of the investment costs and pay the employee a higher salary than is his/her productivity. However, this salary will be lower than increased productivity (connected with the investment into specific human capital) due to the fact that employer bears the risk of losing the employee (Kotlán, Machová and Janíčková, 2011). It is necessary to realize that human capital is typical for its illiquidity, it is highly risky, and presents insufficient level of certainty (Grochulski and Piskorski, 2007), and it is especially due to these reasons that financial institutions provide funds for investment into human capital only in a small rate. Tax reliefs are the most important motivation element for the employer to invest in human capital (Jacobs, 2007).

#### *Selected Ways of Tax Burden Approximation*

The issue of measurement and mutual comparison of tax burden can be ranked among the actual and very frequent topics. The reason for this can be found in the fact that appropriately expressed way of tax burden enables to compare two basic economic characteristics linked to the tax issues. Comparison of different tax systems, or their elements, is the first one, the second one then being the comparison of state participation rate on redistribution processes.

Comparing taxation rate by statutory, or nominal tax rate, represents the simplest way of comparison. These rates are used very often because of their simplicity and data availability. They are also characteristic by significant signal function, but in respect to variability of elements that create the tax system, they do not have much of explanatory power. It is necessary to realize that individual national tax systems usually contain also temporary, or permanent tax reliefs or tax exemptions. Due to this, their construction is not unified, and at the same time the possibility to objectively compare the taxation rate by nominal rates is highly limited due to the existence of different legislative rules. The statutory tax rates therefore cannot serve as an objective approximator of taxation rate (Blechová, 2008; Szarowska, 2011). This paper is devoted to the impact of individual types of taxes on economic growth. There are many particular types of taxes, and every one of them is characteristic by its own tax rate. Due to this, it is not possible to compare total taxation rate in OECD countries, and this comparison will therefore be executed only within the total tax quota and total World Tax Index, see below.

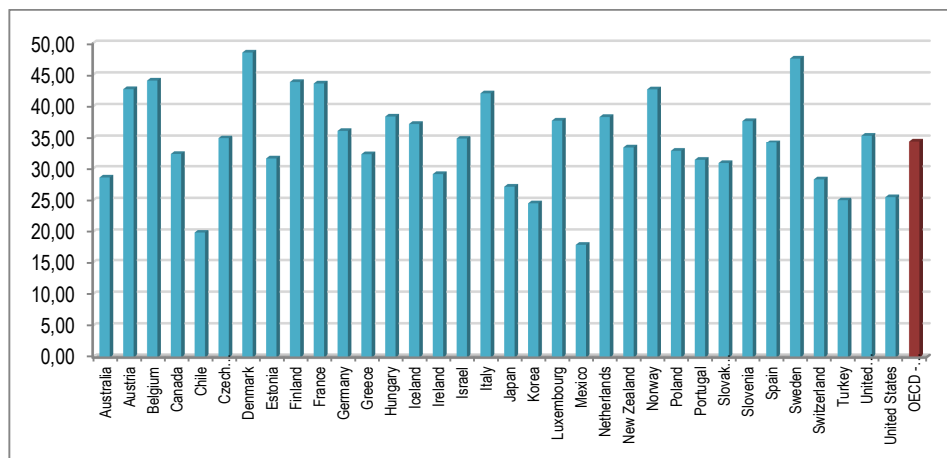
Tax quota represents the basic and probably the most often used indicator of measuring tax burden and it is also very often used in more sophisticated analysis. This approxima-

tor of taxation rate can be compared from both the time and space viewpoints. Tax quota presents the ratio of tax revenues to nominal gross domestic product (GDP) usually for the period of one calendar year in the easiest way.

Categorization and classification of total tax quota into individual partial quotas can be considered rather more empirical than technical issue; it is most often executed based on methodology and classification according to OECD. Based on this classification, it is possible to determine partial tax quotas for individual types of taxes as it is mentioned and shown in the empirical analysis.

It is necessary to realize that tax quota is, as the approximator of taxation, characteristic by its own advantages, and also by significant disadvantages which misrepresent the expressed rate of tax burden. Complexity and simplicity, and thus quite a simple comparability, can be mentioned as some of the basic benefits of tax quota. Individual disadvantages of tax quota derive from the way of its construction, since this approximator expresses what part of nominal GDP is redistributed through public budgets. Among the basic ones, the following can be mentioned: e.g. not incorporating shadow economy; in meaning of Laffer curve it does not really have to reflect the real tax burden; not incorporating time delay between the real tax liability and real tax payment or administrative costs of tax payments (Kotlán and Machová, 2012a; Arnold, 2008; Szarowska, 2010).

**Figure 1 Average Total Tax Burden Approximated by Tax Quota in OECD Countries (2000-2011)**



Source: OECD Tax Statistics, author's elaboration

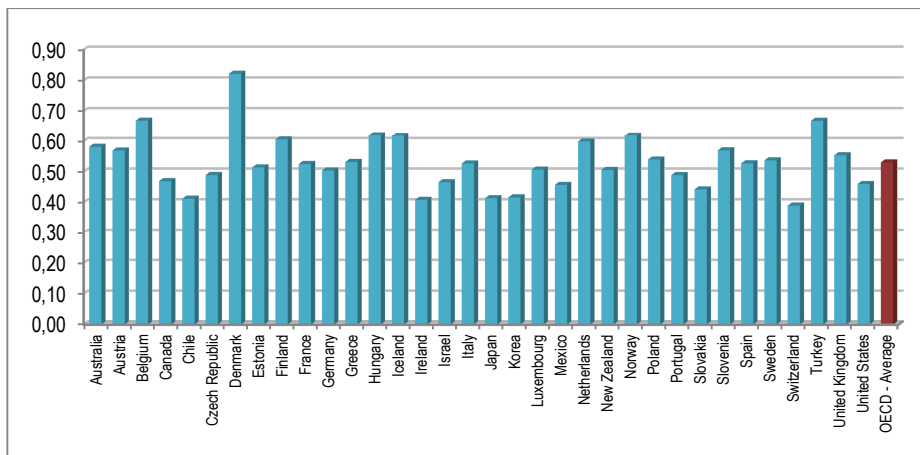
Figure 1 represents the level of the average total tax burden in individual OECD countries approximated by tax quota for the period of 2000-2011. It is evident from the figure that the total average tax burden for OECD as a whole is at 34.5%. The highest tax quota was measured in the case of Denmark, 48.5%; Sweden follows with 47.6%. There are six OECD countries above the 40% limit, in particular Austria, Belgium, Finland, France, Italy, and Norway. The majority of countries are within the interval from 30 to

39%, where seventeen states can be found. In particular it is Canada, Czech Republic, Estonia, Germany, Greece, Hungary, Iceland, Israel, Luxembourg, the Netherlands, New Zealand, Poland, Portugal, Slovak Republic, Slovenia, Spain and United Kingdom. Australia, Ireland, Japan, Korea, Switzerland, Turkey and United States can be ranked to the range from 20 to 29%. The lowest total average tax quota, located below the level of 20%, is computed for Chile – 19.9%, and Mexico – 17.9%. The difference between the highest and the lowest tax quota measured presents 30.6 p. p.

Consequently, the attention will be paid to the next approximator of taxation. World Tax Index represents an alternative indicator of taxation which expresses the real tax burden because it combines hard and soft data. Concurrently, it is an aggregate multicriteria indicator of tax burden which is based on the combination of information about tax conditions available at internationally respected sources (World Bank – Doing Business) with information expressing expert’s opinions (Qualified Expert Opinion – QEO). Tax burden is expressed by a relative way in relation to other researched countries, where the higher value of World Tax Index will represent higher tax burden. The concept of tax burden, in the case of World Tax Index, does not relate only to the value of tax revenues and its connection to GDP as it is in the case of tax quota. This index tries to implement into the tax burden evaluation also other important aspects connected e.g. with administrative demands of tax collection from the view of tax payers, range of tax exemptions, possibility of tax deductibles or taxation progressivity etc.

World Tax Index also represents multicriterial index which consists of multiple sub-indexes where its classification, similarly as in the case of tax quota, is executed in empirical analysis (Machová and Kotlán, 2013; Kotlán and Machová, 2013).

**Figure 2 Average Total Tax Burden Approximated by World Tax Index in OECD Countries (2000-2011)**



Source: Kotlán and Machová (2012b), author’s elaboration

Figure 2 shows the average total tax burden in individual OECD countries approximated by World Tax Index for the period of 2000 – 2011. The average total tax burden for OECD as a whole is at 0.53, where the highest average tax burden is definitely computed in Denmark, namely 0.82. This is followed by Belgium and Turkey with average World Tax Index 0.67. Another five countries can be found in the interval from 0.60 to 0.69, i.e. Hungary, Iceland, Norway, Finland and the Netherlands. The highest number of countries can be found within the interval from 0.50 to 0.59, where are fourteen countries. These are Australia, Austria, Estonia, France, Germany, Greece, Italy, Luxembourg, New Zealand, Poland, Slovenia, Spain, Sweden and United Kingdom. A minority of eleven countries are found in the average index range from 0.40 to 0.49; these countries are Canada, Chile, Czech Republic, Ireland, Israel, Japan, Korea, Mexico, Portugal, Slovakia and United States. The lowest value of the average World Tax Index was measured in Switzerland, i.e. 0.39. The difference between the highest and the lowest average taxation expressed by World Tax Index was 0.43 p. p.

### **Empirical Analysis: Data Sources, Methodology and Results**

The aim of this paper is to evaluate the impact of individual types of taxes on economic growth by utilizing regression analysis in OECD countries for the period of 2000 – 2011. According to what has been mentioned so far, it can be stated that taxation influences economic growth through its impact on the realization of investment and capital accumulation or human capital and technology advancement.

In compliance with Barro and Sala-i-Martin (1995) approach, a homogenous group of countries will be analyzed. Homogenous group of countries can be understood as the group of economies with similar production functions, institutional parameters etc. This approach is also kept in the analysis executed in this paper, where membership of a country in OECD is the basic homogeneity criterion (same as Barro and Sala-i-Martin (1995) or Kotlán, Machová and Janíčková (2011)). It is obvious that OECD can be understood as a divergent group of countries. However, in the case of European Union (EU) countries, for example, the problem can be caused by a limited number of observations and also by the fact that the tax systems in EU are harmonized and coordinated to some extent. It is necessary to realize that a different, more homogenous grouping of countries is not available. Barro and Sala-i-Martin (2004) state that OECD countries can be considered a group of countries where the growth theory is valid, too (so called conditional convergence). Furthermore, the new tax studies of e.g. Kotlán and Machová (2012a) or Machová and Kotlán (2013) works with the OECD countries, too.

The data about the GDP amount per capita in purchasing power parity and government spending were acquired from OECD database National Accounts Statistics.<sup>5</sup> The information about the amount of ratio of investment on GDP is drawn from database Penn

---

<sup>5</sup> OECD National Accounts Statistics – available from: [https://www.oecd-ilibrary.org/economics/data/national-accounts-at-a-glance\\_naag-data-en](https://www.oecd-ilibrary.org/economics/data/national-accounts-at-a-glance_naag-data-en).



World Table (Penn World Table – database 1950 – 2011).<sup>6</sup> The information about human capital is acquired from OECD Education at Glance.<sup>7</sup> The data about tax quota are from OECD Tax Statistics<sup>8</sup>, and the data representing World Tax Index were acquired from World Tax Index database.<sup>9</sup> Generally, almost all necessary data were drawn from the OECD database, the only exceptions being the data from Penn World Table and World Tax Index databases. World Tax Index as an approximator of taxation is based on combination of hard and soft data, and hard data are drawn directly from OECD database. Penn World Table represents the system of national accounts. Since these data are very similar, or are drawn from similar or same source, it is possible to assume acceptable comparability.

The analysis is executed by panel regression in which time series for each entity used exists within sectional selection for the time period of 2000 – 2011. E-views, version (7), which enables its users to execute all common econometric tests such as it is mentioned by e.g. Wooldridge (2009) or Greene (2003) is the main econometric program.

Econometric analysis evaluating impact of individual types of taxes on economic growth in OECD countries is based on Mankiw, Romer and Weil model (1992); these authors were following the basic neoclassical growth model. Currently, this modified model is one of the most widely used models as it widens the basic neoclassical growth model by human capital. At the same time, it is important to realize that taxes represent the most important source of public budgets, and from the view of complexity evaluation of their influence it is necessary to incorporate government spending into the analysis since those consequently represent the basic expenditure part of public budgets.

In respect with the aforementioned Mankiw, Romer and Weil model (1992), individual variables of the analyzed model can be written down as:

- **GDP** - gross domestic product growth per resident expressed by the amount of real GDP per capita in purchasing power parity in USD (dependent variable);
- **RINV** - capital accumulation approximated by indicator of proportion of real investment to GDP, expressed in purchasing power parity per one resident;
- **HUM** - human capital which is approximated by proportion of people with a minimum of secondary education onto total manpower<sup>10</sup>;
- **GOV** - government spending as a % GDP;
- **TAX** - taxation rate approximated by tax quota (TQ) and World Tax Index (WTI).

Consequently, the classification of individual types of taxes according to the tax quota and World Tax Index as selected approximators used in the analysis is shown in table 1.

---

<sup>6</sup> Penn World Table – available from: [https://pwt.sas.upenn.edu/php\\_site/pwt\\_index.php](https://pwt.sas.upenn.edu/php_site/pwt_index.php).

<sup>7</sup> OECD Education at Glance – available from: [https://www.oecd-ilibrary.org/education/education-at-a-glance\\_19991487](https://www.oecd-ilibrary.org/education/education-at-a-glance_19991487).

<sup>8</sup> OECD Tax Statistics – available from: [https://www.oecd-ilibrary.org/taxation/data/revenue-statistics\\_ctpa-rev-data-en](https://www.oecd-ilibrary.org/taxation/data/revenue-statistics_ctpa-rev-data-en).

<sup>9</sup> World Tax Index database – available from: <https://www.worldtaxindex.com/wti-dataset/>.

<sup>10</sup> ISCED3, ISCED4 and ISCED5 in the international classification of education levels ISCED.

**Table 1 Tax Classification According to OECD and WTI**

Tax Classification According to OECD	
1100	personal income taxes
1200	corporate income taxes
2000	social security contributions
4000	property taxes
5110	value added tax
5120	other taxes on consumption
Tax classification according to WTI	
PIT	personal income taxes
CIT	corporate income taxes
VAT	value added tax
PRO	property taxes
OTC	other taxes on consumption

Source: OECD, Kotlán and Machová (2012b); author's elaboration

The aforementioned description of individual variables included in the model can be written into following mathematical formula.

$$HDP_{it} = \alpha + \beta_1 RINV_{it} + \beta_2 HUM_{it} + \beta_3 GOV_{it} - \beta_4 TAX_{it}^* + \hat{u}_{it}$$

*\* (TQ<sub>it</sub>; WTI<sub>it</sub>)*

*i* = 1 ... 34; *t* = 2000 ... 2011

In general, the regression analysis represents a statistic method examining relations of dependencies among dependent and independent variables with the aim to determine the impact of independent variable changes on dependent variable. In general, it can be in the form of time series, cross-sectional or panel data analysis. It occurs very often that the data necessary for modelling are not sufficient, as in the different time (time series) and also in the different space (cross-sectional data). In this case, appropriate solution seems to be the utilization of panel data which represent data set including time series for each space unit (Wooldridge, 2009). The resulting number of observations is therefore equal to the product of number of analyzed periods and the number of cross-sectional units. Therefore, the panel regression method is used in the analysis carried out in this paper, since it also enables to take into consideration the matrix relations throughout the selected sample of countries from time perspective (Kotlán, Machová and Janíčková, 2011). Baltagi (2005) ranks among the panel data advantages, such as acquiring a large number of observations which are not available in conventional time series; more precise conclusion deriving from model's parameters; evaluation of phenomena which cannot be studied by utilizing only the time series analysis, or cross-sectional data; it intercepts the structure of economic activity in a more complex way, observes individual heterogeneity or simplifies the computations.

The pool data model was utilized in panel regression. In general, there are three basic models for estimating parameters in econometric regression models, where Wooldridge (2009) states that when creating econometric regression models, the method

of least squares (OLS) is used. This method was also used in the case of relevant analysis of Mankiw, Romer and Weil (1992).

Although statistical significance and the direction of impact between the dependent variable and independent variable are important with a similar analysis, the individual variables entering the analysis were first transformed into logarithms. Due to that, it is possible to interpret the resulting coefficients: If an independent variable changes by 1%, this fact will lead to growth or decrease of GDP growth rate by the amount of estimated coefficient.

Before the panel regression evaluating the impact of taxation on economic growth was executed, it was necessary to test the stationarity of time series, where hypothesis of existence of single root was tested.<sup>11</sup> Time series stationarity of individual variables was explored by the tests of Levin, Lin and Chua (2002); Im, Pesaran and Shin (2003) and ADF and PP tests according to Maddalu and Wu (1999). Stochastic instability was observed with GDP, GOV, TQ [2000] and VAT. Due to this, these individual variables were converted to first differences which have already shown stationarity.

Wooldridge (2009) states that in the case of utilizing macroeconomic data in a situation where the cross-sectional units are states, the model with fixed effects seems to be more appropriate. At the same time, when the group of OECD member states is fixed and concurrently the differences among individual member countries are relatively constant in time, then the individual models should also be estimated with fixed effects (Kubátová and Říhová, 2009). Appropriateness of utilizing fixed effects was tested by Hausman test. All models were also estimated by White Period method which eliminates possible occurrence of heteroskedasticity and autocorrelation, where it utilizes asymptotic covariance matrices without changing the estimation method. Due to this, it is possible to consider the estimates of regression coefficients, t-statistics and standard deviations as credible.

Table 2 represents the results of taxation impact analysis approximated by tax quota on economic growth. The model as a whole is statistically significant at 1% level of significance with the coefficient of determination at 22%, however, it is necessary to bear in mind that in the case of panel data, the level of determination coefficient is generally lower, and thus depends on analyzed area. A tax study of Kotlán, Machová and Janíčková (2011), for example, works with coefficient of determination at a similar level. Capital accumulation is statistically significant at 1% significance level, where the assumed positive relation with economic growth was verified. This fact can be connected with conclusions of basic neoclassical growth model, where growth of capital accumulation represented by increased savings or investment activity is the basic source of economic growth up to the achievement of steady state. Based on this, it is possible to assume that OECD countries have not reached the steady state yet.

---

<sup>11</sup> Time series can be considered as stationary if compound or simultaneously distributed set of T observations  $Y_1, Y_2, \dots, Y_T$  is the same as the simultaneous division of distribution of future observations  $Y_{1+h}, Y_{2+h}, \dots, Y_{T+h}$  for all T and h, i.e. independent on time (Hušek, 1998).

**Table 2 Results of Regression Analysis of Taxation Influence Approximated by Tax Quota Onto Economic Growth in OECD Countries (2000-2011)**

Number of observations	330	Economic verification	
		Theory	Empiric
Adjusted R <sup>2</sup>	0.22		
F-statistics	14.56***		
C <sub>0</sub>	-0.14(-2.51)**		
Ln_RINV	0.05(4,09)***	+	+
Ln_HUM	0.007(1,03)	+	+
D_In(GOV(-1))	-0.13(-2,81)*	+	-
Ln_1100(-1)	-0.04(-4,38)***	-	-
Ln_1200(-1)	-0.08(-2,36)**	-	-
D_In(2000)	-0.02(-3,21)***	-	-
Ln_5110+5120	0.04(3,16)***	-	+

Note: \*, \*\*, \*\*\* represent the significance level at 10 %, 5 % and 1 %.

Source: own computation

The results of human capital impact are in accordance with theoretical assumptions, but this variable is not statistically significant. Despite this fact, it was kept in the model as a basic growth “controlled” variable.

In case of government spending it is evident that this variable is lagging in the model by one period with statistical significance at 10 % significance level. First, it is important to mention that the change of government spending level or structure as one of basic economic-politic decisions carried out by economic-politic authorities is characteristic and is accompanied by a certain time-lag. Every such decision is a combination of several phases in which it usually comes to the time-lag. That is why it is possible to consider the empiric significance of government spending time-lag as justified. The result of government spending impact on economic growth itself implies that the increase of government spending decreases economic growth with a yearlong lag. This fact is in contradiction with the economic theory where this discrepancy of theory and empiricism can be most probably explained by the following: the first fact is the existence of crowding out effect, where according to the traditional view, the government spending crowds out private investment. Higher government spending increases the demand for goods and services, increases interest rates, makes disposable capital more expensive and therefore it decreases private investment. Ahmed and Miller (1999) confirm validity of this hypothesis in developed countries. The second reason most probably lies in the total government spending (productive and unproductive) structure itself. Kneller, Bleaney and Gemmell (1999) rank the following into unproductive spending: pension spending; social security contributions and expenditures for recreation; culture and religion. Productive spending consists of e.g. spending on education, healthcare, defence and infrastructure. From analysis of Hong (2012), or Kneller, Bleaney and Gemmell (1999), it is obvious that unproductive spending in particular has a significant negative impact on economic growth. Therefore, it can be stated that unproductive spending prevails in the total government spending, which ultimately lowers the growth rate. Mutual effect and combination of crowding out effect and unproductive govern-

ment spending has, according to the aforementioned, a negative impact on the economic growth rate. Furthermore it is also necessary to take into account their nature in the period after 2008. This period differed from others by noticeable growth of government spending as the reaction to the drop of economic activity. This fact could also sign on the negative impact of total government spending on the economic growth.

It is obvious in the [1100] and [1200] category that personal income taxes, or corporate income taxes are lagged by one period and they are statistically significant at 1%, resp. 5% significance level. Since taxes represent one of the basic tools of economic policy makers, a possible economic justification of time-lag can be explained similarly as in the case of government spending. Analysis results indicate that the increase of both personal and corporate income taxes decreases the economic growth with a one year period lag. This result can be considered as logical since personal and corporate taxes can be categorized as distortion taxes which are characteristic by the existence of income and substitution effect (Kotlán, 2010). If these distortion taxes are changed then individual economic subjects adapt to the changed conditions, within the existence of income and substitution effect. The adaptation to the new economic environment usually happens in a smooth way, and is characteristic by a certain time interval during which the adaptation takes place. Due to this, it is evident that the influence, or the impact of income taxes can be lagging. Due to this, the impact of these two types of taxes is most probably time lagged and also empirically quantifiable. These variables were statistically insignificant without the time lag. In the case of the social security contribution and value added tax, their lagged values were statistically insignificant and only the values without the time lag were therefore kept in this model. In this case the given result can be explained in similar way as the aforementioned, however, from an opposite point of view. The contributions to social security themselves can be considered as taxes only in the framework of wider definition of the term tax, and indirect taxes incorporated into one category cannot be categorized into the distortion taxes. Most probably the nature of individual taxes itself, i.e. distortion vs. non-distortion taxes, will determine if the individual taxes types impact with lag or without it.

In the case of corporate taxation it is possible to connect negative relation with economic growth with the fact that the increase of this type of taxation expressed by tax quota lowers the capital return, inflow of FDI or investment into human capital. We can consequently conclude from the fact that labour taxation has a negative impact on the economic growth that labour taxation unfavourably affects the welfare and the standard of living of working individuals (Decoster and Haan, 2010). From a different point of view, the labour taxation can also logically influence non-working individuals and their behaviour, where in this case to research the optimal amount of labour taxation seems appropriate. Taxes and social systems are optimal if governments have a much higher welfare value for income received by the non-workers than the working poor (Blundell et al., 2009).

Furthermore, it is necessary to realize that as far as the impact of these taxes on individual growth is concerned, variables impact the creation of savings as the basic source of investment in the neoclassical growth model. The decrease of savings results in a decrease of disposable sources which fund investments, and by this the number of realized investments decreases, too. Concurrently, the increase of labour taxation leads to effort

of employees to receive a salary increase before taxation, which leads to an increase of labour costs and to creation of pressure to lower profits of enterprises. Due to this, enterprises abandon investment localization, and the structure of capital accumulation changes, too. The increase in labour cost also causes the substitution of labour by capital, and decreases marginal product of capital. Therefore, growth of unemployment occurs in the long-term perspective, which is also connected to a low rate of product growth. The unemployment growth is accompanied by increased pressure on the passive unemployment policy and sources which fund it. The aforementioned is confirmed by empiric results of Daveri and Tabellini (2001), for example, too.

The mutual comparison of absolute impact of income taxes on economic growth and the analysis results indicate that corporate taxation harms economic growth to a great extent. Following the corporate taxes are personal income taxes and contributions to social security.

Consequently, the attention will be diverted to the remaining types of taxation represented by tax quota. For completeness it is necessary to state that property taxes were statistically insignificant, and these taxes were therefore removed from the analysed model. As of the model creation, it was not possible to estimate individual impact of categories [5110] and [5120] because these they were mutually correlated. Due to this, in accordance with econometric practices, these categories were united to one category. From the analysis results it is evident that negative relationship with the economic growth was not confirmed. This can be caused by bringing these categories together and also by the tax quota which is characteristic by its shortages which can distort the impact of this tax type. For completeness the results are same as in the case of Szarowska (2010) model, who states that indirect taxes influence demand and their impact on economic growth is therefore positive.

**Table 3 Results of Regression Analysis of Taxation Influence Approximated by World Tax Index Onto Economic Growth in OECD Countries (2000-2011)**

Number of observations	374	Economic verification	
		Theory	Empiric
Adjusted R <sup>2</sup>	0,66		
F-statistics	16.2***		
C <sub>0</sub>	-0.41(-8.6)		
Ln_RINV	0.10(8.23)***	+	+
Ln_HUM	0.001(0.44)	+	+
D_In(LAGGOV)	-0.24(-3.3)***	+	-
Ln_CIT	-0.04(0.96)**	-	-
Ln_PIT	-0.005(-1.71)*	-	-
D_In(VAT)	-0.001(-1.45)*	-	-

Note: \*, \*\*, \*\*\* represent the significance level at 10%, 5% and 1%.

Source: own computation

Table 3 shows the results of regression analysis of taxation impact expressed by World Tax Index on economic growth. The model as a whole is again statistically significant at

1% significance level with coefficient of determination at 66%. The difference between coefficients of determination of individual models most probably lies in the construction of individual indicators of taxation and in the amount of factors which are reflected in the evaluation of tax burden.

Similarly to the first model, capital accumulation is statistically significant at 1% significance level, where the theoretical assumptions were confirmed again.

Human capital also positively affects economic growth, however, this variable is characteristic by being statistically insignificant. It was also kept in the model as a basic growth "controlled" variable, see the first analysed model.

Government spending are, also as in the aforementioned model case, lagging by one period and are also statistically significant at 1% significance level. At the same time, it is obvious that growth of government spending lowers economic growth with a one year time-lag. This fact can be explained in the same way as in the first model analysed.

Corporate taxation expressed by CIT sub-index is statistically significant at 5% significance level. The theoretical assumption was confirmed and the increase of this taxation type therefore lowers the return of capital, inflow of FDI, employment or investment into the human capital, and through these channels it also affects the economic growth. Economic growth is also negatively affected by labour taxation (sub-index PIT) which is statistically significant at 1% significance level. This negative relation can be explained through the labour taxation impact on labour market, price of labour or realization of investment projects. In the case of value added tax and VAT sub-index assumed negative relation with economic growth was also confirmed, this variable is statistically significant at 1% significance level. In this case the analysis results are not in accordance with the results of the first model. This fact can be probably clarified by the characteristic of individual tax indicators, where WTI in itself includes a wider spectrum of factors affecting the tax level. Since it expresses real tax burden by this, there is a higher possibility that the taxation effect will be negative. When comparing absolute impact of taxation, corporate taxes, followed by personal income taxes and value added taxes seem to harm the most. Other tax variables were not statistically significant and they were therefore removed from the model.

Consequently, all of these results will be compared to analysis similar to Arnold (2008), who is also concentrating on OECD countries. Both analyses agree that corporate taxes followed by personal income taxes are those that harm economic growth to the greatest extent. At the same time, consumption taxes (see model with World Tax Index, table 3) seem to be on the opposite extreme, i.e. they harm economic growth the least. The results of both analyses are almost the same, however, the difference lies in the property taxes which are in our analysis statistically insignificant. Nonetheless, they have a similar impact on economic growth as consumption taxes in the analysis of Arnold (2009).

## **Conclusion**

The aim of this paper was to evaluate the impact of individual types of taxes on economic growth by carrying out a regression analysis in the OECD countries for the period of 2000 - 2011. The individual tax systems represent significant heterogeneous ele-

## REVIEW OF ECONOMIC PERSPECTIVES

ments including national specifications, and there is therefore a need of appropriate way of comparing tax burden. Because of that, the analysis is not based on a traditional tax quota only, which is characteristic by multiple insufficiencies, but also on the World Tax Index alternative.

Both analyzed models confirmed the theoretical assumption that capital accumulation increases the product growth rate until it reaches the steady state. Since this result was statistically significant, it is possible to state that the OECD countries have not reached the steady state yet.

Similarly, the results of human capital impact on economic growth were in accordance with the theory. According to this, it is evident that human capital approximated by the ratio of at least secondary educated people on whole manpower is indeed the source of long-term economic growth.

The theoretical assumptions were not valid in the case of government spending. The analysis results indicated that government spending decreases economic growth. These results can be most probably linked to the existence of crowding out effect and with the structure of total government spending where the unproductive spending predominates. Unproductive spending is connected to funding of the so-called welfare state, or with spending on social security, which in the final consequence lowers the rate of economic growth.

As far as the tax burden approximated by tax quota is concerned, the negative relation between economic growth and personal income taxes, corporate taxation and social security contributions was verified. Therefore, it can be stated that these basic types of taxes lower product growth rate through their impact on capital accumulation, inflow of FDI, creation of savings or labour market. With the property tax, the negative relation with economic growth was not confirmed. This fact can be explained by the increasing share of property tax within total tax burden in OECD countries, which has a positive impact on economic growth. When it comes to value added tax, the result is also in contradiction to the economic theory, which can be most probably explained by insufficiencies of tax quota.

A negative relation to economic growth was confirmed in the case of corporate taxation and personal income taxes approximated by World Tax Index. Similar results were also achieved in the case of value added tax, which is in contradiction to the results of the first model. This fact can be most probably explained by individual approximators of taxation, where World Tax Index includes in itself a larger number of factors connected to the tax payment than the tax quota. Therefore, it shows the real tax burden within the value added tax, due to which it ultimately lowers economic growth.

As far as mutual absolute comparison of taxation impact on economic growth is concerned, it is obvious that corporate taxation harms the most, and is followed by personal income taxes and social security contributions. In the case of World Tax Index, it is followed by value added tax.

Since economic growth is one of the fundamental economic objectives of the economic policy makers and it is the basic assumption of fulfilling other social objectives, the following can be stated resulting from our analysis:



- In their effort to stimulate economic growth, OECD countries should try to lower taxation rate in the case of corporate taxation, personal income taxes and social security contributions;
- The outage of tax revenues caused by the decrease of income taxes should be compensated by an increase of indirect taxes.

## References

ADINA, M. (2009). The Impact of Taxation on the Investment Localization Decision in the Context of Globalization. *Analele Stiintifice ale Universitatii Alexandru Ioan Cuza din Iasi*. 56 (1), pp. 133-142.

AHMED, H., MILLER, S. (1999). Crowding-Out and Crowding-In Effects of the Components of Government Expenditure. University of Connecticut Department of Economics. Working Paper No. 02.

ALESINA, A. et al. (1999). Fiscal Policy, Profits and Investment. National Bureau of Economic Research. Working Paper No. 7207.

ARNOLD, J. (2008). Do Tax Structures Affect Aggregate Economic Growth? Empirical Evidence from a Panel of OECD Countries. OECD Economic Department. Working Papers No. 643

BALTAGI, H. B. (2005). *Econometric Analysis of Panel Data*. 3rd ed. Chichester: Wiley.

BARRO, R., SALA-I-MARTIN, X. (2004). *Economic Growth*. 2nd ed. London: The MIT Press.

BARRO, R., SALA-I-MARTIN, X. (1995). *Economic Growth*. New York: McGraw Hill.

BARRO, R. (1990). Government Spending in a Simple Model of Endogenous Growth. *The Journal of Political Economy*. 98 (5), pp. 103-125.

BECKER, J. (2009). Taxation of Foreign Profits with Heterogeneous Multinational Firms. Center for Economic Studies. Working Paper No. 2889.

BECKER, G. (1993). *Human Capital: A Theoretical and Empirical Analysis, with Special Reference to Education*. Chicago: University of Chicago Press.

BLECHOVÁ, B. (2008). Charakteristika přístupů používaných v EU pro hodnocení efektivního daňového zatížení příjmu korporací. In: CD od Participants Reviewed Papers from XIII. International Conference Teoretické a praktické aspekty veřejných financí. Praha: VŠE, (ISBN 978-80-245-1378-2, s. 1-11).

BLUNDELL, R. (2009). Optimal Income Taxation: An Empirical Comparison of the UK and Germany. *The Economic Journal*. 119 (535), pp. F101-F121.

BREBLER, D. (2012). The Impact of Corporate Taxes on Investment: An Explanatory Empirical Analysis for Interested Practitioners. ZEW. Working Paper No. 12040.

- DACKEHAG, M., HANSSON, A. (2012). Taxation of Income and Economic Growth: An Empirical Analysis of 25 Rich OECD Countries. Lund University Department of Economics. Working Paper No. 2012:6.
- DANIEL, B., JEFFREY, P. (2013). Investment Taxation and Portfolio Performance. *Journal of Public Economics*. 97 (1), pp. 245-257.
- DAVERI, F., TABELLINI, G. (2001). Unemployment, Growth and Taxation in Industrial Countries. *Economic Policy*. 30 (4), pp. 47-104.
- DECOSTER, A., HAAN, P. (2010). Empirical Welfare Analysis in Random Utility Models of Labour Supply. German Institute for Economic Research, Working Paper No. 1074.
- DUCZYNSKI, P. (2003). On Extended Versions of the Solow-Swan Model. *Bulletin of Czech Econometric Society*. 10 (19), pp. 39-58.
- DWENGER, N. (2009). Corporate Taxation and Investment: Explaining Investment Dynamics with Firm-Level Panel Data. Discussion Papers of DIW Berlin. Discussion Paper No. 924.
- FELD, L., HECKEMEYER, J. (2008). FDI and Taxation: A Meta-Study. ZEW. Working Paper No. 08-128.
- FELD, L., KIRCHGÄSSNER, G. (2001). The Impact of Corporate and Personal Income Taxes on the Location of Firms and on Employment: Some Panel Evidence for Swiss Cantons. Center for Economic Studies. Working Paper No. 455.
- GREENE, W. (2003). *Econometrics Analysis*. New Jersey: Prentice-Hall.
- GROCHULSKI, B., PISKORSKI, T. (2007). Risky Human Capital and Deferred Capital Income Taxation. Federal Reserve Bank of Richmond. Working Paper No. 06-13.
- HONG, D. (2012). Economic Growth and Welfare State: A Debate of Econometrics. Munich Personal RePEc Archive. Working Paper No. 39685.
- HUŠEK, R. (1998). *Základy ekonometrické analýzy II*. Praha: Vysoká škola ekonomická.
- IM, K., PESARAN, H., SHIN, Y. (2003). Testing for Unit Roots in Heterogeneous Panels. *Journal of Econometrics*. 115 (1), pp. 53-74.
- JACOBS, B. (2007). Optimal Tax and Education Policies and Investments in Human Capital. In Hartog (ed.), *Human Capital: Theory and Evidence*. Cambridge: Cambridge University Press.
- JONES, L., MANUELLI, R. (1999). On the Taxation of Human Capital. University of Minnesota – Department of Economics. Working Paper.
- JUDD, K. (1985). Redistributive Taxation in a Simple Perfect Foresight Model. *Journal of Public Economics*. 28 (1), pp. 59-83.
- KING, R., REBELO, S. (1990). Public Policy and Economic Growth: Developing Neoclassical Implications. *Journal of Political Economy*. 98 (5), pp. 126-150.

- KINKOR, J. (1996). Je ekonomie blahobytu racionální?. *Politická ekonomie*. 44 (1), pp. 197-212.
- KLIKOVÁ, Ch., KOTLÁN, I. a kol. (2012). *Hospodářská politika*. 3. vyd. Ostrava: Sokrates.
- KNELLER, R., BLEANEY, M., GEMMELL, N. (1999). Fiscal Policy and Growth: Evidence from OECD Countries. *Journal of Public Economics*. 74 (2), pp. 171-190.
- KOTLÁN, I. (2010). Daňové zatížení a struktura daní v ČR ve srovnání s vybranými zeměmi OECD a EU a legislativní změny ve smyslu de lege ferenda. Praha: Národohospodářský ústav Josefa Hlávky.
- KOTLÁN, I., MACHOVÁ Z. (2013). Konstrukce alternativního ukazatele daňového zatížení na základě Saatyho metody a jeho využití v růstových modelech. Praha: Národohospodářský ústav Josefa Hlávky.
- KOTLÁN, I., MACHOVÁ, Z. (2012a). Vliv zdanění korporací na ekonomický růst: selhání daňové kvóty? *Politická ekonomie*. 60 (6), pp. 743-763.
- KOTLÁN, I., MACHOVÁ, Z. (2012b). World Tax Index: Methodology and Data. *DANUBE: Law and Economics Review*. 3 (2), pp. 18-33.
- KOTLÁN, I., MACHOVÁ, Z., JANÍČKOVÁ, L. (2011). Vliv zdanění na dlouhodobý ekonomický růst. *Politická ekonomie*. 59 (5), pp. 638-658.
- KUBÁTOVÁ, K., ŘÍHOVÁ, L. (2009). Regresní analýza faktorů ovlivňujících výnosy korporativní daně v zemích OECD. *Politická ekonomie*. 57 (4), pp. 451-470.
- LEVIN, A., LIN, Ch., CHU, Ch. (2002). Unit Root Tests in Panel Data: Asymptotic and Finite-Sample Properties. *Journal of Econometrics*. 108 (1), pp. 1-24.
- LIN, S. (2001). Taxation, Human Capital Accumulation and Economic Growth. *Japanese Economic Review*. 52 (2), pp. 185-197.
- LUCAS, R. (1988). On the Mechanics of Economic Development. *Journal of Monetary Economics*. 22 (1), pp. 3-42.
- MADDALA, G., WU, S. (1999). A Comparative Study of Unit Root Tests with Panel Data and a New Simple Test. *Oxford Bulletin of Economics And Statistics*. 61 (0), pp. 631-652.
- MACHOVÁ, Z., KOTLÁN, I. (2013). World Tax Index: New Methodology for OECD Countries 2000-2010. *DANUBE: Law and Economics Review*. 2013 (2), pp. 165-179.
- MANKIW, G., ROMER, D., WEIL, D. (1992). A Contribution to the Empirics of Economic Growth. *The Quarterly Journal of Economics*. 107 (2), pp. 407-437.
- OVERESCH, M., VOELLER, D. (2010). The Impact of Personal and Corporate Taxation on Capital Structure Choices. *Financz Archiv*. 66 (3), pp. 263-294.
- PARETO. V. (1971). *Manual of Political Economy*. New York: A. M. Kelley.
- PFAFFERMAYER, M., STOCKL, M., WINNER, H. (2008). Capital Structure, Corporate Taxation and Firm Age. University of Innsbruck. Working Paper No. 2008-09

## REVIEW OF ECONOMIC PERSPECTIVES

ROMER, P. (1986). Increasing Returns and Long-Run Growth. *The Journal of Political Economy*. 94 (5), pp. 1002-1037.

SALANIÉ, B. (2003). *The Economics of Taxation*. Cambridge: MIT Press.

SCHRATZENSTALEER, M., WAGENER, A., KOHLER-TOGLHOFFER, W. (2005). Company Taxation in an Enlarged European Union. *Monetary Policy and the Economy*. 5 (1), pp. 96-102.

SOLOW, R. (1956). A Contribution to the Theory of Economic Growth. *The Quarterly Journal of Economics*. 70 (1), pp. 65-94.

SWAN, T. (1956). Economic Growth and Capital Accumulation. *The Economic Record*. 32 (2), pp. 334-361.

SZAROWSKA, I. (2011). Jak vysoké je korporátní daňové zatížení? *Acta Academia Karvinsia*. 13 (2), pp. 196-207.

SZAROWSKA, I. (2010). Changes in Taxation and Their Impact on Economic Growth in the European Union. Munich Personal PePEc Archive. Working Paper No. 32354.

TAPLOS, I., VANCU, I. (2009). Corporate Income Taxation Effect on Investment Decisions in the European Union. *Annales Universitatis Apulensis Series Oeconomica*. 11 (1), pp. 513-518.

TEIXEIRA, A., FORTUNA, N. (2003). Human Capital, Innovation Capablility and Economic Growth. Faculdade de Economia. Working Paper No. 131.

VILLELA, L., BARREIX, A. (2002). Taxation and Investment Promotion. Banco Inter-americanode Desarrollo. Working Paper.

WONG, K. (2011). Progressive Taxation and the Intensity and Timing of Investment. *Economic Modelling*. 28 (1), pp. 100-108.

WOOLDRIDGE, J. (2009). *Introductory Econometrics: A Modern Approach*. Mason: South-Western CENGAGE Learning.