Effects of taxation by economic functions on economic growth in the European Union

Szarowska, Irena

Silesian University in Opava

2013

EFFECTS OF TAXATION BY ECONOMIC FUNCTIONS ON ECONOMIC GROWTH IN THE EUROPEAN UNION

Irena Szarowská

SZAROWSKÁ, I. Effects of taxation by economic functions on economic growth in the European Union. In JIRCIKOVA, E., KNAPKOVA, A., PASTUSZKOVA, E. (eds.). *Proceedings of the 6th International Scientific Conference: Finance and the performance of Firms in Science, Education and Practice.* Zlin: Tomas Bata University, 2013, pp. 746-758. ISBN 978-80-7454-246-6. (WOS:000329435800063)

Abstract

The complexity of today's global economic environment increases importance of identifying and understanding the key factors affecting economic growth. This paper deals with effect of changes in tax burden on economic growth and provides direct empirical evidence in the European Union as financial and economic crisis has impacted also on tax systems. It is used the Eurostat´s definition to categorize tax burden by economic functions and implicit tax rates of consumption, labour and capital are investigated. The analysis is based on annual panel data of 24 EU member states in a period 1995-2010. Panel regression and Pairwise Granger Causality Tests are used as the main method of research. Results confirm, in line with the theory, statistically significant positive effect of consumption taxes and negative effect of labour taxes on GDP growth. In short-term, there is two-way causality between change of implicit tax rate of consumption and GDP growth and one-way causality between GDP growth and change of implicit tax rate of capital and implicit tax rate of labour.

Keywords: tax burden, implicit tax rates, economic functions, economic growth, competitiveness

JEL Classification: E62, H30, H21

1 INTRODUCTION

The complexity of today's global economic environment increases importance of identifying and understanding the key factors affecting economic growth. Policymakers are struggling to find ways to cooperate and manage the current economic challenges while preparing their economies to perform well in an increasingly difficult and unpredictable global landscape. Many determinants drive productivity and competitiveness. Understanding the factors behind this process has occupied the minds of economists for hundreds of years, engendering theories ranging from Adam Smith's focus on specialization and the division of labor to neoclassical economists' emphasis on investment in physical capital and infrastructure (see Nordhaus and Boyer, 2000, Acemoglu, 2009 or Acemoglu et al., 2012) and to interest in other mechanisms such as education and training, technological progress, macroeconomic stability, good governance, market efficiency, among others. While all of these factors are likely to be important for competitiveness and growth, they are not mutually exclusive—two or more of them can be significant at the same time.

Moreover, as it is described in The Global Competitiveness Report 2012–2013 (2012), taxation is very important and problematic factor for doing business. Respondents - business

executives were asked to select from a list of 16 factors the five most problematic for doing business in their economy and rank them from 1 (most problematic) to 5.

Tab.1 summarizes for how many percentages of respondents tax rates and tax regulations belong to the most problematic factors (only in the EU member states). Bold values have expressed that the tax measures are the most problematic factor for doing business in the country at all.

Tab. 1 – Taxation as the most problematic factor for doing business. Source: The Global Competitiveness Report 2012–2013 (2012)

country	tax regulation	tax rates	country	tax regulation	tax rates	country	tax regulation	tax rates
BE	15	21.1	FR	13	14.5	AT	9.5	12.3
BG	5.2	3.5	IT	8.8	**17.1**	PL	**20.4**	11.5
CZ	9.2	8.4	CY	1.2	5.7	PT	9.1	13.1
DK	11.1	18.6	LV	9	**16.9**	RO	7.6	13.9
DE	**18.1**	12	LT	13.5	13.6	SI	6.5	9.5
EE	2.1	9.6	LU	1.9	**3.9**	SK	5.5	5.6
IE	2	6.7	HU	11.7	12.2	FI	8.7	**22.8**
EL	11.9	7.4	MT	2.9	7.9	SE	11	**17.5**
ES	5	9.4	NL	3.3	5.1	UK	10.2	**15.3**

The aim of the paper is to examine effects of taxation by economic functions on economic growth and to provide direct empirical evidence in the European Union. It is used the Eurostat´s definition to categorize tax burden by economic functions and implicit rates of consumption, labour and capital are investigated. The analysis is based on annual panel data of 24 EU member states in a period 1995-2010. Panel regression and Pairwise Granger Causality Tests are used as the main method of research.

2 THEORETICAL BASES

The theoretical effect of taxation on economic performance is not an apparent matter. A higher level of tax burden can be seen as a serious obstacle to sustained improvement of the economic level of the country. Scully (1991) has stated that taxes levied by government may have both positive and negative effects on economic growth. The value of economic resources and the ability to transform resources into output are greater to the degree that property is protected, roads and harbors are provided, and domestic tranquility is insured. Taxation beyond this level may have a negative effect. In modern times, many private goods are provided at public expense and direct income redistribution takes place on a large scale. At some level of taxation, resources employed in the public sector are less than in the private sector and resources escape into informal or underground economy – which diminish economic growth.

Both neoclassical and Keynesian theoretical models predict that higher taxes reduce economic activity, even though there is less agreement on the exact mechanisms that generate this result. On the other hand, taxes may be a benefit for the economy because the taxes are the basic source for financing public goods and services, and in this way can increase the living standards and wealth of the whole society. If collected taxes are used efficiently, provided public services can increase productivity of human and fixed capital in the private sector and promote long-term economic growth.

Economic theory mostly links taxation to growth through its influence on the decisions of economic agents. Stiglitz (1999) distinguishes non-distortionary taxation, where individuals cannot alter their tax liabilities, from distortionary taxation, where individuals take action in order to reduce tax liabilities. Hence, taxation – at least theoretically - changes economic decisions and can thereby affect economic growth. Considering a simple production function, it is obvious that taxation can affect GDP and economic growth through its impact on physical capital, human capital and through its effect on the total factor productivity (TFP).

$$Y = f(K, L, A) \qquad (1)$$

where K denotes physical capital, L denotes labour and A represents the state of technology, i.e. the total factor productivity. As explained in more detail further on, tax on labour might impact on labour market and educational decisions (L) as it makes work less profitable. Taxation of capital reduces incentives to save and invest, i.e. the accumulation of physical capital (K), and taxation of research and development might curb technological developments, by making these activities less profitable (A). While in exogenous growth models taxation can affect the steady state level of income per capita and its short-term growth rate on the transitional path, in endogenous growth models taxation can actually alter the long-run growth rate.

There is voluminous literature on the effects of taxes on the economy and its rate of growth (Barro, 1991, Mendoza et al., 1994, Slemrod, 1995, Leibfritz, Thornton and Bibbee, 1997, Nordhaus and Boyer, 2000, Acemoglu, 2009 or Acemoglu et al., 2012). Myles (2009) reviews different production functions – which are also referred to as growth accounting models - and effects of taxation on GDP and economic growth. However, using statistical data for comparing levels of taxation and economic performance also does not provide unequivocal conclusions. We can find countries with high economic performance, which have a low tax burden, e.g. United States, but also countries that have high economic performance with high tax burden, e.g. Scandinavian countries (Zipfel, and Heinrichs, 2012).

But there are many studies which present negative relationships between taxes and economic growth, and recommend lowering tax rates. Plosser (1992) has found a significant negative correlation between the level of taxes on income and profits (as a share of GDP) and growth of real per capita GDP. King and Rebelo (1990) have simulated changes in the income tax by applying an endogenous growth model and find that an increase from 20 per cent to 30 per cent reduces the rate of growth by 2 percentage points. Scully (2000) claims that countries in which government takes more than 43% of national income in the form of taxes could collect more revenue by lowering their tax rates. Further, tax rates anywhere close to 43% have devastating effects on economic growth. Hill (2008) has estimated the growth–maximizing size of states for the United States in 1960–1990 was between 9% and 29% of GDP. Also Romero-Ávila and Strauch (2008) have stated that government consumption and direct taxation negatively affect growth rates of GDP per capita in the EU-15 in the last 40 years. Johansson et al. (2008) have investigated the design of tax structures to promote economic growth. Corporate taxes were found to be most harmful for growth, followed by personal income taxes, and then consumption taxes. Recurrent taxes on immovable property appear to have the least impact.

Lee and Gordon (2005) have explored how tax policies in fact affect a country's growth rate, using cross-country data during 1970–1997. They have found that statutory corporate tax rates are significantly negatively correlated with cross-sectional differences in average economic growth rates, controlling for various other determinants of economic growth, and other standard tax variables. In fixed-effect regressions, they have again found that increases in corporate tax rates lead to lower future growth rates within countries. The coefficient

estimates suggest that a cut in the corporate tax rate by 10 percentage points will raise the annual growth rate by one to two percentage points.

Karras and Furceri (2009) have examined the effects of changes in taxes on economic growth. Using annual data from 1965 to 2003 for a panel of 19 European economies, the results show that the effect of an increase in taxes on real GDP per capita is negative and persistent. An increase in the total tax rate by 1% of GDP has an effect on real GDP per capita of minus 0.5% to minus 1% in the long run. The findings also imply that increases in social security contributions or taxes on goods and services have larger negative effects on per capita output than increases in income tax.

Prammer (2011) has summarized indications on how taxation might influence growth relevant decisions. The focus of the analysis is on tax categories namely on the categories labour, capital, consumption, property and environment.

Taxes on labour (i.e. personal income taxes, payroll taxes and social security contributions) can affect decisions in three major ways by altering: i) the allocation of time between labour and leisure ii) human capital accumulation iii) occupational and entrepreneurial behavior and choices. Labour taxes can also affect labour supply decisions, both concerning the decision to participate in the labour market and the amount of hours worked (García et al, 2011, Szarowská, 2010, Johansson et al., 2008). However, the exact effect of taxation on labour supply can theoretically not be determined as the substitution effect and the income effect work in opposite directions. The exact impact of labour taxes on the labour market depends on the labour demand elasticity, the degree of centralization of the wage bargaining and the distribution of incomes among different income levels (Loretz, 2008, Nerudová, 2012).

Taxes on capital, such as business profits, capital gains, dividends and interests, can influence the rate of capital accumulation. By changing the return on capital, they might discourage saving and investment by economic agents (firms or individuals); hence capital taxes alter the intertemporal allocation of resources. Lower levels of investment eventually lower the capital stock which in turn impacts on growth. Thus, due to the intertemporal structure capital taxation accumulates the distortions over time (Vermeend et al., 2008).

Consumption taxes, mainly value added tax (VAT) and excise duties are often regarded as less distortionary than income taxes, as they do not distort intertemporal decisions the way income taxes do. Consumption taxes fall partly on accumulated assets, which are an inelastic tax base. Moreover, consumption taxes do not impact on the returns to saving and, usually, do not have a progressive tax structure (Stiglitz, 1999, Carey and Tchilinguirian, 2000).

3 AIM AND METHODOLOGY

As it is known, tax burden has very different structure and size in each country. The aim of the paper is to examine effects of taxation by economic functions on economic growth and to provide direct empirical evidence in the European Union. Hence, it is used the Eurostat´s definition to categorize tax burden by economic functions and implicit rates of consumption, labour and capital are investigated. The analysis is based on annual panel data of 24 EU member states in a period 1995-2010. Panel regression and Pairwise Granger Causality Tests are used as the main method of research.

It should be noted that the goal of this empirical analysis is not to find the ideal model describing the behavior illustrated by the variables, but a statistically significant linkage between explanatory (the tax burden which is expressed as the tax burden) and explaining variable (economic performance which is measured by GDP growth). We use the panel data and calculations which are made in the program Eviews.

Methodology of the analysis is based on studies of Karras and Furceri (2009) and Plojhar and Tomšík (2004), who have analyzed the influence of taxation on economic performance in OECD countries. We have used panel data as panel data have both cross-sectional and time series dimensions and the application of regression models to fit econometric models are more complex than those for simple cross-sectional data sets.

As Dougherty (2007) has stated, there are several reasons for the increasing interest in panel data sets. An important one is that their use may offer a solution to the problem of bias caused by unobserved heterogeneity; a common problem is the adaptability of models with cross-sectional data sets. A second reason is that it may be possible to exploit panel data sets to reveal dynamics that are difficult to detect with cross-sectional data. A third attraction of panel data sets is that they often have very large numbers of observations. Panel data modeling combines elements of time series analysis and elements of regression analysis.

We have performed both fixed effects and random effects regressions before analysis. A Durbin–Wu–Hausman test indicated significant differences in the coefficients so model with fixed effects is used in the analysis. A panel model with fixed effects can be formally written as:

$$y_{it} = \alpha_i + \beta' X_{it} + \varepsilon_{it} \qquad i = 1, 2, ..., N, t = 1, 2, ..., T, \qquad (2)$$

where y_{it} depends on a set of Z explanatory variables x_{it} and the constants are specific to the i–th unit (country) at time t, at the same time but are constant. β ' is the vector dimension $1xZ$ constants and α_i is a constant representing the effects of those variables, which are characteristic of the i–th observation. ε_{it} error component represents non-significant effects of variables inherent in the i-team observations and a given time interval. Furthermore, we assume it does not correlate with the vector x_{it}, for all the i and t, and it comes from independent identical distribution with zero mean and constant dispersion. This model is often referred to as a basic model representing the structure of panel data.

The panel consists of 24 EU members – Luxembourg, Romania and Malta were excluded due to lack of data. Basic panel model identifiers are country i and time t. The analysis has used adjusted annual data on tax burden by economic functions, namely implicit tax rates of consumption (ITR_C), labour (ITR_L) and capital (ITR_K) from Eurostat. Annual adjusted data on GDP at market prices has been also taken from Eurostat and they are based on accrual basis. Tab.2 presents basic variables and their descriptive statistics.

Tab. 2 – Descriptive statistics of variables. Source: author´s calculation based on data from Eurostat (2012)

	ITR_C	ITR_L	ITR_K	GDP_growth
Mean	21.30	35.66	24.80	2.92
Median	20.40	37.00	23.70	3.30
Maximum	34.20	49.30	49.90	11.70
Minimum	11.10	20.80	4.80	-17,70
Std. Dev.	4.45	6.40	9.24	3.60
Observations	379	379	339	376

Next we have adjusted the simplest dynamic approach that relates growth and implicit tax rate, a model similar to the empirical specification in Karras and Furceri (2009):

$$GDP\_growth_{it} = \alpha_i + \beta_1 dITR\_C_{it-j} + \beta_2 dITR\_L_{it-j} + \beta_3 dITR\_K_{it-j} + \varepsilon_{it}, \qquad (3)$$

where *GDP_growth* is the growth rate of real GDP, i is indexing over countries and t over time, α_i is a constant representing the effects of those variables, which are characteristic of the i–th observation, the β_1, β_2 and β_3 are parameters to be estimated, *dITR_C, dITR_L* and *dITR_K* are the changes in the implicit tax rates ($dITR\_C_{i,t} = dITR\_C_{it} - dITR\_C_{it-1}$), j is the number of lags, and ε is the error term. This means that the GDP growth is the result of the influence of individual components of tax burden.

It is necessary to test the stationary time series before starting econometric analysis due to the assumes of panel regression. For this purpose panel unit root tests are often used. A stationary time series is required because any variable which stochastically permanently departs from its mean value cannot be affected by long period variable, which returns to its mean value (effect may be only in a short term). Recent literature suggests that panel-based unit root tests have higher power than unit root tests based on individual time series. Panel unit root tests are similar, but not identical, to unit root tests carried out on a single series (Verbeek, 2000).

We have used panel unit root tests (Levin, Lin and Chu; Breitung; Im, Pesaran and Shin; Fisher-type tests using ADF and Fisher PP tests) and they have identified non-stationary of all level data. Therefore, it has not been possible to analyse the effect of taxation on economic performance based on level data. Next we have calculated and tested the first difference of time series with the aim to comply assumptions of panel regression. Panel unit root tests have confirmed that time series are stationary at the first difference I(1).

Finally, we have investigated causal relationship between economic growth and tax burden by economic functions using Granger causality methodology (Verbeek, 2000). Pairwise Granger Causality Tests can determine dynamic relations between two variables in short-term.

4 RESULTS AND DISCUSSION

4.1 Changes in taxation by economic functions

The structure of tax burden by economic functions reveals that the eastern EU member states generate a relatively high share of total revenues through consumption taxes. In the northern and central European states, revenues come predominantly from labour taxes. This is the result of a relatively high burden on the factor labour (for details look at Eurostat, 2012) − compared with the EU average. Especially in central EU member states such as Czech Republic, Germany, France and the Netherlands this is due to the large share of social security contributions. Denmark is a special case as social security revenues there only amount to 1% of GDP (in 2010).

However, governments have to find the way how to face with the difficult of consolidating their budgets while at the same time promoting economic growth. Raising consumption taxes while at the same time lowering taxes on labour and capital can stimulate an economic growth. Taxation of labour and capital should be kept low as it distorts decisions by economic agents, which in turn negatively impacts the use of the growth factors labour, capital and technological progress. Taxation on consumption has less adverse effects in this respect. As Zipfel and Heinrichs (2012) point out, since the turn of the millennium Europe has witnessed a slight trend towards more growth-conducive tax systems. Tax systems have been redesigned mainly in the countries of northern and eastern Europe, whereas central Europe has seen little change.

The financial and economic crisis also has an impact on tax systems in the EU. Tax burden and its structure in the EU Member States are regularly analyzed by Eurostat. Fig.1 presents

the changes of taxation by economic functions between 1995 and 2010 – the latest year for which detailed data are available. This figure shows difference in percentage points for following groups of taxes: taxes on labour (including social security contributions), capital (taxes on stocks of capital/wealth and taxes on capital and business income) and consumption (VAT and excise duties).

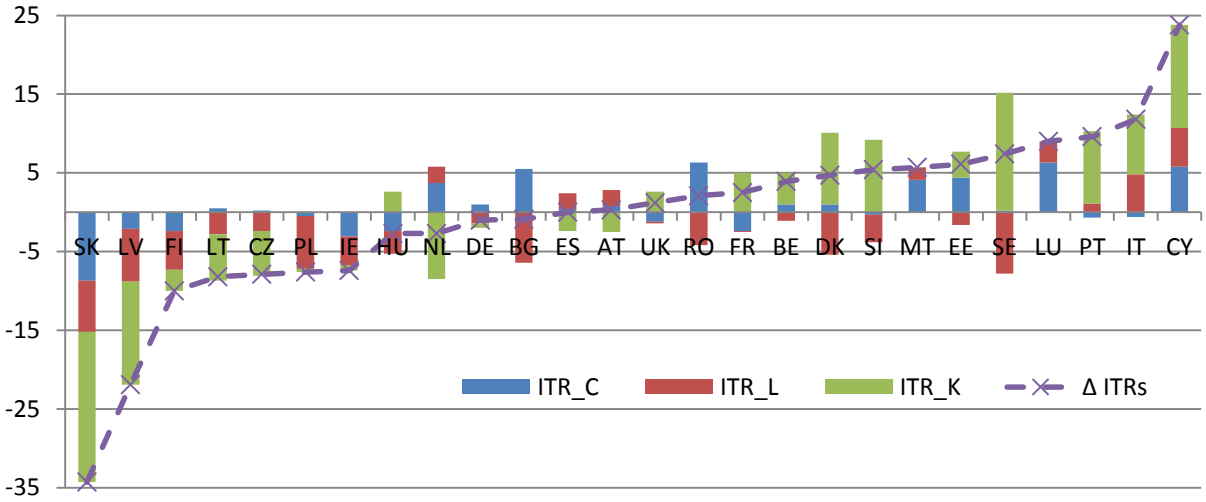

Fig. 1 - Changes of taxation by economic functions- difference in percentage points (1995 – 2010). Source: author´s calculation based on data from Eurostat (2012).

The violet line shows the total change of implicit tax burden in EU member states. The figure highlights that some member states only shifted taxation from one type of taxes to another in the period under consideration. The Spain is an example of zero total changes in implicit tax burden as it has shifted the burden of taxation from capital taxes (-2.4 p.p.) to labour (+2 p.p.) and consumption taxes (+0.4 p.p.). Similar development can be seen in Austria or Bulgaria. The highest difference in tax burden can be found in Slovakia (decrease more than 34 p.p.) and Cyprus (increase nearly 24 p.p.) during the period 1995 - 2010. Significant structural changes in fiscal policy are probably the main reasons for the development and they have different context in the short term and over a medium to longer-term horizon. For the short run, countries have attempted to stimulate demand via tax relief, reducing the effects on the real economy. In the medium to long term, fiscal consolidation is given priority, which may lead to tax hikes.

On average, labour taxes have decreased by 1.9 percentage points, capital taxes have also decreased – by 2.1 p.p., but consumption taxes have mildly increased by 0.4 p.p. This development is in line with tax and economic theory as most authors point out that the increase of capital mobility has raised concerns that excessive levels of taxation could influence capital and especially move profits to low tax jurisdictions. At the same time, there are hopes to attract foreign capital investments by offering an attractive tax treatment. Taxes on capital and corporate income may have distorted effects on the market, particularly in highly integrated areas like the EU internal market. These distortions may also impact personal income taxes because taxes on capital reduce capital accumulation and therefore negatively impact productivity levels, which in turn depress wages. Next, the fact that capital is generally more mobile than labour has generated the apprehension that the burden of taxation would be shifted from the former to the latter. Equity considerations also feature prominently in the debate on the taxation of capital held by individuals, given that capital is more lightly taxed than labour income, and is often taxed at flat rates, which calls for an

effective taxation of capital income to avoid elimination the progressivity of the income tax of its meaning. The relative mobility of capital has stimulated the apprehension about tax competition and a subsequent race-to-the-bottom in capital tax rates (Hill, 2008; Johansson et al., 2008; Acemoglu, 2009; Karras and Furceri, 2009; García et al., 2011; Prammer, 2011).

4.2 Effects of taxation by economic functions on economic growth

Next, we have focused on estimation the effect of taxation on economic growth. Panel regression and Pairwise Granger Causality Tests are the main methods of examining. Time series of GDP growth and implicit tax rates and the differences of all variables are stationary and therefore they can be used for panel regression. The panel regression is based on equation (3) and examination is modified in 3 models. Tab. 3 summarizes results of analysis.

Tab. 3 – Estimated effects of tax burden on economic growth. Source: author´s calculation

Variable	model 1	model 2	model 3
Constant	-15.33* (4.30)	2.65* (0.19)	-0.11 (0.22)
ITR_C	0.26 (0.14)		
ITR_L	0.39* (0.11)		
ITR_K	-0.08		
dITR_C		0.47** (0.23)	0.89* (0.25)
dITR_L		-0.01 (0.20)	-0.51** (0.21)
dITR_K		0.19 (0.07)	-0.10 (0.08)
Adjusted R–squared	0.09	0.14	0.08
Durbin–Watson stat	1.307	1.44	2.01
Observations	334	316	311

Symbols * and ** denote statistical significance at the 1%, 5% and 10% level. Model 1 is very simplistic as GDP growth is influenced only by values of implicit tax rates and there is no lag. Although we have found statistically significant parameters, other test have identified that residues are autocorrelated, so the results are not suitable. Model 2 reflects changes of implicit tax rates ($dITR\_C_{i,t} = dITR\_C_{it} - dITR\_C_{it-1}$) and can be expressed in (4).

$$GDP\_growth_{it} = \alpha_i + \beta_1\, dITR\_C_{it} + \beta_2\, dITR\_L_{it} + \beta_3\, dITR\_K_{it} + \varepsilon_{it}, \qquad (4)$$

The results shows the positive effect between variables: change of implicit tax rate on consumption increased by one percentage point increases the GDP growth by 0.47 percentage point. The estimate is significant at the 5% level. The Durbin–Watson statistic (1951) is a test statistic used to detect the presence of autocorrelation in the residuals; value equal 2 indicates no autocorrelation. The value of the Durbin–Watson test is 1.44 so residues are autocorrelated and conclusions are again not adequate for presenting.

In model 3, we calculated estimation with time lag. We used information criteria (Akaike info criterion, Schwarz criterion and Hannan–Quinn criterion) and it seems that the model with one year lag is the most appropriate. Equation with 1 year lag has following form:

$$GDP\_growth_{it} = \alpha_i + \beta_1 dITR\_C_{it-1} + \beta_2 dITR\_L_{it-1} + \beta_3 dITR\_K_{it-1} + \varepsilon_{it}, \quad (5)$$

The estimation with 1 year lag reflects statistically significant negative effects of labour taxes on GDP growth at 5% level and positive effect of consumption taxes on GDP growth at 1% level. Regression coefficients are higher than in the previous equation: 0.89 and –0.51 percentage point. Consumption taxes have impact on demand and its increase can positively effect on economic growth. As Stiglitz (1999) or Carey and Tchilinguirian (2000) have written, consumption taxes, are regarded as less distortionary than income taxes (labour taxes), as they do not distort intertemporal decisions the way income taxes do. Consumption taxes fall partly on accumulated assets, which are an inelastic tax base and they do not impact on the returns to saving and, usually, do not have a progressive tax structure.

Labour taxes can have an impact on GDP by affecting labour utilization and labour productivity or both. However, it is generally difficult to assess the overall effect of the tax changes on GDP. For example, changes in any single tax may simultaneously affect several determinants of GDP. The effects of changes in taxation often depend also on the design of other policies and institutions. Thus, the negative effect of labour taxes on employment is often dependent on wage setting institutions which determine e.g. minimum wages, which negatively affect labour cost and then GDP growth. Our results are in line with conclusions of Johansson et al. (2008), Loretz (2008) or recommendations of Prammer (2011) about labour taxes.

Finally, we have used Pairwise Granger Causality Tests for examining relations between economic growth (GDP_growth) and tax burden by economic functions (ITR_C, ITR_L, ITR_K) in short-term. It is necessary to note that two-way causation is frequently the case: GDP growth Granger causes implicit tax rate and implicit tax rate Granger causes GDP growth. The null hypothesis should be rejecting if probability is less than 0.05 (usual level of statistical significance).

The example of null hypothesis is that economic growth does not Granger-cause the implicit tax rate of consumption (labour, capital) and that the implicit tax rate of consumption (labour, capital) does not Granger-cause economic growth. Tab.4 summarizes results of level data (ITRs), Tab.5 differences of implicit tax rates (dITRs), number of lags is two. Bold values indicate hypothesis which should be rejected.

Tab. 4 – Pairwise Granger Causality Tests for GDP growth and ITRs (lags: 2). Source: author´s calculation

Null Hypothesis:	Observations	F-Statistic	Prob.
ITR_L does not Granger Cause ITR_C	331	1.53631	0.2167
ITR_C does not Granger Cause ITR_L		1.05480	0.3494
ITR_K does not Granger Cause ITR_C	293	1.98943	0.1386
ITR_C does not Granger Cause ITR_K		0.88585	0.4135
GDP_growth does not Granger Cause ITR_C	**324**	**6.10932**	**0.0025**
ITR_C does not Granger Cause GDP_ growth		**3.23333**	**0.0407**
ITR_K does not Granger Cause ITR_L	293	0.10412	0.9011
ITR_L does not Granger Cause ITR_K		0.37436	0.6881
GDP_ growth does not Granger Cause ITR_L	**324**	**10.5264**	**4.E-05**
ITR_L does not Granger Cause GDP_ growth		0.64410	0.5258

GDP_ growth does not Granger Cause ITR_K	**288**	**9.70888**	**8.E-05**
ITR_K does not Granger Cause GDP_ growth		**11.3507**	**2.E-05**

Tab. 5 – Pairwise Granger Causality Tests for GDP growth and dITRs (lags: 2). Source: author´s calculation

Null Hypothesis:	Observations	F-Statistic	Prob.
dITR_C does not Granger Cause GDP_growth	**307**	**4.31991**	**0.0141**
GDP_growth does not Granger Cause dITR_C		**4.50509**	**0.0118**
dITR_L does not Granger Cause GDP_growth	307	1.81689	0.1643
GDP_growth does not Granger Cause dITR_L		**8.89758**	**0.0002**
dITR_K does not Granger Cause GDP_growth	270	1.66551	0.1911
GDP_growth does not Granger Cause dITR_K		**8.88235**	**0.0002**
dITR_L does not Granger Cause dITR_C	307	2.69666	0.0691
dITR_C does not Granger Cause dITR_L		0.05029	0.9510
dITR_K does not Granger Cause dITR_C	270	0.16038	0.8519
DITR_C does not Granger Cause DITR_K		2.22521	0.1101
dITR_K does not Granger Cause dITR_L	270	0.56772	0.5675
dITR_L does not Granger Cause dITR_K		0.31647	0.729

Due to results in Tab.4, we cannot reject the hypothesis that implicit tax rate of labour does not Granger-cause GDP but we do reject the hypothesis that GDP growth does not Granger-cause implicit tax rate of labour. Therefore it appears that Granger causality runs one-way from GDP growth to implicit tax rate of labour and not the other way. We can find two-way causality between implicit tax rate of consumption and GDP growth and between implicit tax rate of capital and GDP growth.

Tab.5 shows that there is two-way causality between change of implicit tax rate of consumption and GDP growth and one-way causality between change of implicit tax rate of capital and implicit tax rate of labour and GDP growth. It is interesting that Pairwise Granger Causality Tests have not confirmed inverse causality, as the theory presents negative impact of labour taxes on economic growth (Johansson et al., 2008; Prammer, 2011). The reason can be found in using different type of data – we have used cumulated implicit tax rates whereas other researchers have used individual tax rates.

It is important to mention that the statement for example ‘implicit tax rate of consumption Granger causes GDP growth‘ does not imply that GDP growth is the effect or the result of implicit tax rate of consumption. Granger causality measures precedence and information content but does not by itself indicate causality in the more common use of the term.

5 CONCLUSION

The goal of the paper was to examine effects of taxation by economic functions on economic growth and to provide direct empirical evidence in the European Union. It has been used the Eurostat´s definition to categorize tax burden by economic functions and implicit rates of consumption, labour and capital have been investigated. The analysis is based on annual data

in a period 1995-2010. Panel regression and Pairwise Granger Causality Tests have been used as the main method of research.

The first part of paper has dealt with theoretical effect of taxes and tax burden on economic growth. Next, we have examined development of tax burden in the European Union in a monitored period as financial and economic crisis has impacted also on tax systems. The structure of tax burden by economic functions reveals that the eastern EU member states generate a relatively high share of total revenues through consumption taxes. In the northern and central European states, revenues come predominantly from labour taxes. This is the result of a relatively high burden on the factor labour compared with the EU average. Between 1995 and 2010, labour taxes have decreased on average by 1.9 percentage points, capital taxes have also decreased – by 2.1 p.p., but consumption taxes have mildly increased by 0.4 p.p. This development is in line with tax and economic theory as most authors recommend raising consumption taxes while at the same time lowering taxes on labour and capital can stimulate economic growth. Taxation of labour and capital should be kept low as it distorts decisions by economic agents; taxation on consumption has less adverse effects in this respect.

Then, we have focused on estimation the effect of taxation on economic growth. The panel consists of 24 EU member states – Luxembourg, Romania and Malta were excluded due to lack of data. Results of panel regression with fixed effects have confirmed statistically significant positive effect of consumption taxes and negative effect of labour taxes on GDP growth. Change of implicit tax rate on consumption increased by plus one percentage point increases the GDP growth by 0.89 p.p. and 1 p.p. increasing of implicit tax rate on labour decreases the GDP growth by –0.51 p.p. with 1 year lag.

Finally, we have investigated relationship between economic growth and tax burden by economic functions using Granger causality methodology. In short-term, there is two-way causality between change of implicit tax rate of consumption and GDP growth and also GDP growth Granger-cause change of implicit tax rate of capital and implicit tax rate of labour through one-way causality.

References:

1. Acemoglu, D. (2009). *Introduction to Modern Economic Growth*. New York: Princeton University Press.
2. Acemoglu, D., Aghion, P., Bursztyn, L., & Hemous D. (2012). The Environment and Directed Technical Change. American Economic Review 102 (1), 131–66. http://dx.doi.org/10.1257/aer.102.1.131
3. Barro, R. J. (1991). Economic growth in a cross-section of countries. *Quarterly Journal of Economics,* 106 (2), 407-43. http://ideas.repec.org/a/tpr/qjecon/v106y1991i2p407-43.html
4. Carey, D., & Tchilinguirian, H. (2000). Average Effective Tax Rates on Capital, Labour and Consumption. OECD Economics Department Working Papers, No. 258, Paris: OECD Publishing. http://dx.doi.org/10.1787/247874530426
5. Durbin, J., & Watson, G. S. (1951). Testing for Serial Correlation in Least Squares Regression. *Biometrika*, 38, 159–179.
6. Dougherty, Ch. (2007). *Introduction to Econometrics*. Oxford: Oxford University Press.

7. Eurostat. (2012). *Taxation trends in the European Union*. Luxembourg: Publications Office of the European Union. DOI:10.2785/23293

8. García, S., Rodriguéz, E., & Arias, A. (2011). Corporate Tax Burden in the European Union. *EC Tax Review*, 1, 41-55.

9. Hill, R. (2008). Optimal taxation and economic growth. *Public Choice*, 134 (3-4), 419–427. DOI: 10.1007/s11127-007-9235-0

10. Johansson, A., Heady, Ch., Arnold, J., Brys, B., & Vartia, L. (2008). Taxation and Economic Growth. OECD Economics Department Working Papers, No. 620, Paris: OECD Publishing. http://dx.doi.org/10.1787/241216205486

11. Karras, G., & Furceri, D. (2009). Taxes and growth in Europe. *South-Eastern Europe Journal of Economics*, 2, 181–204. http://www.asecu.gr/Seeje/issue13/KARRAS.pdf

12. King, G., & Rebelo, S. (1990). Public policy and economic growth: developing neoclassical implications. *Journal of Political Economy*, 98 (5) 126–150. http://dx.doi.org/10.1086/261727

13. Lee, Y., & Gordon, R. H. (2005). Tax Structure and Economic Growth. *Journal of Public Economics*, 89 (5-6), 1027–1043. http://dx.doi.org/10.1016/j.jpubeco.2004.07.002

14. Leibfritz, W., Thornton, J., & Bibbee, A. (1997) Taxation and Economic Performance. OECD Economics Department Working Papers, No. 176, Paris: OECD Publishing. http://www.oecd.org/eco/publicfinanceandfiscalpolicy/1863834.pdf

15. Loretz, S. (2008). Corporate taxation in the OECD in a wider context. *Oxford Review of Economic Policy*, 24(4), 639-660. DOI: 10.1093/oxrep/grn035

16. Mendoza, E. G., Razin, A., & Tesar, L. L. (1994). Effective tax rates in macroeconomics: Cross-country estimates of tax rates on factor incomes and consumption. *Journal of Monetary Economics*, 34(3), 297-323. http://dx.doi.org/10.1016/0304-3932(94)90021-3

17. Myles, G. D. (2009). Economic Growth and the Role of Taxation – Theory. OECD Economics Department Working Papers, No. 713, OECD publishing. http://dx.doi.org/10.1787/222775817802

18. Nerudová, D. (2012). Common Consolidated Corporate Tax Base: Sharing the Tax Base under Formulary Apportionment. In Stavárek, D., & Vodová, P. (Eds.) Proceedings of the 13th International Conference on Finance and Banking (pp. 279 – 288). Karviná: Silesian university in Opava.

19. Nordhaus, W. D., & Boyer, J. (2000). *Warming the World: Economic Modeling of Global Warming*. Cambridge: MIT Press.

20. Plojhar, M., & Tomšík, V. (2004). Daně a ekonomická výkonnost. *Ekonomické zprávy*, 4, 10-22. http://www.finance.cz/zpravy-soubory/04_Duben.pdf

21. Plosser, C. I. (1992). The search for growth. In Proceedings, Federal Reserve Bank of Kansas City, 57–92. http://www.kansascityfed.org/publicat/sympos/1992/s92ploss.pdf

22. Prammer, D. (2011). Quality of taxation and the crisis: tax shifts from a growth perspective. Taxation Papers, No. 29, Luxembourg: Office for Official Publications of the European Communities. DOI: 10.2778/29300.

23. Romero-Ávila, D., & Strauch, R. (2008). Public finances and long-term growth in Europe: Evidence from a panel data analysis. *European Journal of Political Economy*, 24, 172–191. http://dx.doi.org/10.1016/j.ejpoleco.2007.06.008

24. Scully, G. W. (1991). *Tax rates, tax revenues and economic growth*. Dallas: National Center for Policy Analysis.

25. Scully, G. W. (2000). The growth-maximizing tax rate. *Pacific Economic Review*, 5, 93–96. DOI: 10.1111/1468-0106.00091

26. Slemrod, J. (1995). What do cross-country studies teach about government involvement, prosperity, and economic growth? *Brookings Papers on Economic Activity*, 26 (2), 373–431. http://homepage.ntu.edu.tw/~kslin/macro2009/Slemrod%20et%20al%201995.pdf

27. Stiglitz, J. E. (1999). *Economics of the public sector*. 3rd edition. W.W Norton & Company, Inc.

28. Szarowská, I. (2010). Theory and practice of tax burden in the European Union. In Stavárek, D., & Vodová, P. (Eds.) Proceedings of the 12th International Conference on Finance and Banking (pp. 224 – 234). Karviná: Silesian university in Opava.

29. *The Global Competitiveness Report 2012–2013: Full Data Edition*. (2012). Klaus Schwab, K. (Ed.). Geneva: World Economic Forum.

30. Verbeek, M. (2000). *A guide to modern econometrics*. New York: John Wiley & Sons Inc.

31. Vermeend, W., Ploeg, R., & Timmer, J. W. (2008). *Taxes and the economy: A Survey on the Impact of Taxes on Growth, Employment, Investment, Consumption and the Environment*. Cheltenham (UK): Edward Elgar Publishing.

32. Zipfel, F., & Heinrichs, C. (2012). *The impact of tax systems on economic growth in Europe*. Frankfurt am Main: Deutsche Bank Research.

Contact information
Ing. Irena Szarowská, Ph.D.
Silesian University in Opava, OPF SU
Univerzitni nam. 1934, 73340 Karvina
Email: szarowska@opf.slu.cz