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Article

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An Empirical Analysis of the Relationship between Tax Structures and Economic Growth in CEE Countries[1]

*Maja GRDINIĆ – Saša DREZGIĆ – Helena BLAŽIĆ**

Abstract

This paper investigates the relationship between tax structures and economic growth in selected CEE countries in the period from 1990 to 2010. The research basis on the data for 20 selected countries (EU-13 and selected former Soviet Union countries and Albania). We obtain empirical results by using the Pooled Mean Group estimator (PMG). The analysis focuses on the impact of structure of taxes on economic growth. All regressions contain the overall tax burden represented as a share of total tax revenues in GDP. The results show that all tax forms have a negative impact on economic growth. Personal income taxes proved to have the highest negative impact on economic growth, followed by corporate income taxes and property taxes, which had the least negative impact. Consumption taxes showed to be statistically insignificant. Furthermore, the results indicate a significantly different impact observed countries' tax structures had on economic growth to that of previous research on the dataset of OECD developed industrial countries.

Keywords: *tax structure, economic growth, Central and Eastern Europe, Pooled Mean Group Estimator*

JEL Classification: H10, H21, O47, O52

Introduction

During the last two decades, economic theory and practice have shown an increased interest in the analyses of the impact of various fiscal variables on economic growth. More and more attention directs to designing tax systems,

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which would foster economic growth and employment at a certain level of tax revenues. As economic growth presents a prerequisite for general improvement of living conditions, there are many discussions in the economic literature about how and to what extent changes in tax structures affect gross domestic product and long-term growth.

Unfortunately, the main goals of the tax policy very often address tax reforms that do not consider comprehensive economic effects of tax changes. These policies usually target tax revenue growth and do not forecast effects on economic growth. Such state denotes clear need for researching the effects of tax structures and particular tax forms on both short and long-term effects on economic growth.

However, due to lack of availability of data most of the empirical research refers to developed countries, usually OECD economies. Therefore, this empirical research attempts to fill this gap. In addition, we can assume that tax structure affects economic growth differently depending on the level of development of particular country. Comparative studies show sharp contrast between tax policies observed in developing countries and those seen in developed countries (Gordon and Li, 2009).

These tax policies diverge as well from the prescriptions of the optimal tax literature. In line with the above mentioned, it is very important for the tax policy holders in different countries to identify the potential impacts which changes in individual tax forms will have on overall economic performance prior to implementing tax system reforms.

Therefore, the main objective of this research is to determine which tax forms are preferable for rising the tax revenues having in mind their negative effects on economic growth. The empirical methodology basis on Arnold's (2008) seminal paper, which uses dataset of OECD economies. This research basis on the data for 20 selected countries (EU-13 and selected former Soviet Union countries and Albania) in the period from 1990 to 2010. The results of the paper shed light on significant differences of effects of tax structure on economic growth between developed and emerging economies. The results of this research are valuable inputs for policy recommendations regarding the future tax reforms in European emerging economies.

The paper consists of five sections. After introduction, which elaborates motivation and objective of the research, first section presents brief literature overview. Second section deals with the empirical methodology used in the paper. Third section describes basic features of the dataset and provides exposition of results and related discussion. Finally, conclusion drafts policy recommendations and guidelines for future research.

1. Literature Overview

Since the 80ies of the last century, there are increasing demands for changes regarding the conceptual considerations of the role of taxes and their role and relevance within the socio-economic and political context. These directions came under umbrella of growing influence of neoliberal economic theory and were focused not only towards decrease of overall tax burden but also tax structure changes which were indirect taxation forms were more favourable source of tax revenues. In this regards, the efforts to meet higher tax neutrality were more favourable than redistributive potential of progressive direct tax forms.

Therefore, in the centre of empirical research of the relations of overall tax burden and tax structures and economic growth is to reveal which tax forms are most harmful to the economic development. The first empirical studies that included fiscal variables in regressions of growth were those conducted by Barro (1989; 1991), Koester and Kormendi (1989), Plosser (1992), Easterly and Rebelo (1993) and Levine and Renelt (1992).

Kneller, Bleaney and Gemmell (1999) divided taxes into those that distort (income tax and property tax) and those that do not distort the decisions of economic entities (consumption taxes) and they divided expenditures into productive and non-productive ones. Their conclusion is that income taxes and property taxes reduce growth, while consumption taxes do not reduce growth. The main conclusion of the research conducted by Bleaney, Gemmell and Kneller (2001) is that distortionary taxes have a significantly negative impact on growth. These taxes include all taxes except consumption taxes, denoted as non-distortionary taxes, as they do not violate intertemporal decisions.

More recently, Fölster and Henrekson (2000) observed the relationship between growth and country size and found that there is a negative correlation between total public expenditure, as a share of GDP, and growth, while Agell, Ohlsson and Thoursie (2006) found only an unstable and insignificant relationship between expenditure and growth. Widmalm (2001) investigated the impact of tax structures on growth using the data for 23 OECD countries from 1965 to 1990. Her methodology follows that of Levine and Renelt (1992), but she used four basic variables (initial income, the share of investment in GDP, population growth and the average tax rate (the share of tax revenues in GDP)). She looked at the proportion of different tax instruments in revenue (corporate income tax, personal income tax, property tax, taxes on goods and services, and taxes on wages), and concluded that the share of tax revenues from income tax has a negative impact on economic growth and found evidence of tax system progressivity. Similarly, Padovano and Galli (2002) found a negative impact of effective marginal tax rates and tax progressivity on economic growth on a panel of 25 industrialized

countries from 1970 to 1998. The negative impact of progressivity on entrepreneurial activity is one of the conclusions in the work of Gentry and Hubbard (2000).

Schwellnus and Arnold (2008) and Vartia (2008) calculated the negative impact of corporate income tax on the productivity of companies and industries. Their calculation basis on a large set of data for companies and industries across OECD countries. Similarly, Lee and Gordon (2005) found a significant negative correlation between the statutory tax rates on corporate income and growth for 70 countries during 1970 to 1997.

Numerous studies have examined the relationship between the overall level of taxation or public expenditure and growth in different countries, but, so far, there has been no common decision about the existence of such links. This is not surprising as the overall size of the public sector renders two opposite effects: higher taxes do not only signify potentially greater distortions but also higher public expenditure whereas some of them also encourage economic growth.

However, the relationship between tax structures and growth, the main issue in Arnold (2008), is not the subject of this ambiguity. If some tax instruments are more damaging for economic growth than other ones, then this should be possible to detect in the data. Arnold investigates whether such patterns exist on a panel of 21 OECD countries over the last 35 years. The research results show that higher shares of income and corporate income taxes are associated with significantly lower economic growth than consumption and property taxes.

Moreover, comparison of corporate and personal income taxes provides evidence that corporate income tax is associated with lower economic growth than personal income tax. Furthermore, in the comparison of consumption taxes and property taxes, the author shows that property taxes are associated with higher economic growth than those on consumption. According to research results, it follows that property taxes have the least negative impact on economic growth, which are followed by consumption taxes, personal income taxes, and finally corporate income taxes, which have the highest negative impact on economic growth.

Johansson et al. (2008) and Arnold et al. (2011) obtain similar research results. Xing (2010) questions these results and argues that the assumptions in Arnold (2008) and Johansson et al. (2008) may not be valid for the given data set. The above method, the Pooled Mean Group Estimator, assumes that the long-run relationships between variables are homogeneous for the observed countries. In challenging the validity of this assumption on homogeneity, Xing (2010) first repeats the estimates conducted by Johansson et al. (2008) by using slightly different specifications.

Based on different set of PMG estimates, the author concludes that personal, corporate and consumption taxes have higher negative impact on GDP per capita

than property taxes. However, Xing (2010) cannot find solid evidence to identify precisely which of these taxes i.e. consumption tax, personal income tax and corporate income tax, has the most negative impact on GDP per capita. By applying the OLS (ordinary least square) method and the two-way Fixed Effects and leaving the assumption of homogeneity, the author could solely confirm similar results for the certain country groups with the PMG estimator.

In Arnold et al. (2011), the analysis basis on a panel of 21 OECD countries over a 34-year period, with the aim to estimate, in more detail, the impact of the tax structure on economic growth in relation to Arnold (2008). Unlike Arnold (2008), which considers only the macroeconomic level, in this paper, the analysis includes data at industry and individual company level. The objective of the analysis is to obtain results that would show by which channels tax systems stimulate economic recovery and increase economic growth. The results show that some of the tax changes may result in an increase in innovation and entrepreneurial activity and thus affect long-term economic growth.

Moreover, based on revenue neutral tax changes, they argue that an increase in corporate and personal income taxes with a simultaneous decrease in consumption and property taxes affects the reduction of GDP in the long-run period. In regards to this, they also concluded that an increase in corporate income taxes, financed by the increase in taxes on consumption and property, has a stronger negative effect on GDP per capita than a similar increase in personal income taxation. Moreover, increase in consumption and property taxes (with a reduction in personal and corporate income taxes) leads to higher economic growth in the long-term, where the positive effect of increased property taxes is significantly higher than in case of consumption taxes. Their results indicate that a revenue neutral change from personal and corporate income taxes to other forms results with the increase in GDP per capita between 0.25 – 1% in the long-run. Acosta-Ormaechea and Yoo (2012) applied the Pooled Mean Group estimator on the data from 1970 to 2009 on 69 high, medium and low-income countries to determine whether there is a difference in the impact of the tax structure on economic growth depending on the country's level of development. They find similar results for countries with high and with medium income as previous studies, while they do not find significant results for low-income countries.

2. Empirical Model Specification

Following the recent literature (Arnold, 2008; Arnold et al., 2011; Xing, 2010; Acosta-Ormaechea and Yoo, 2012), the empirical analysis basis on the use of several econometric methods that take into account the stationarity and

endogeneity of the relevant variables within the selected models. The paper utilises the most relevant and latest methods for dynamic panel-regression analysis based on a panel of 20 CEE countries.[2] The primary objective of assessing the model is to test how the tax structures affect the economic growth of the selected countries. The analysis focuses on economic effects of tax structure and overall tax burden represented in all regressions as a share of total tax revenues in GDP.

The econometric analysis covers the period from 1990 to 2010. Apart from Croatia and Slovenia, the analysis does not include other former Yugoslav countries due to the unavailability of data. Moreover, for the same reasons, the dataset does not include the former USSR countries. The question of the unavailability of data does not only relate to individual countries. Namely, in order to have longer time series, the data for the analysis covers the period from 1990. Unfortunately, some of the variables in the model had a significant number of missing data. Given that the econometric methods applied in this study use optimization algorithms, the missing data may hinder the convergence of short-run coefficients to long-run coefficients.

We tested this possibility by regresing the collected data and this assumption proved to be justified. In fact, in some specifications it was impossible to calculate the coefficients. In order to solve the problem of missing data, from a range of possible methods, the authors opted for interpolation. By using this this method, we interpolated the missing values based on the regression relationship of the dependent variable (in this case, GDP per capita) and certain independent variables characterized by a number of insufficient data. In this way, we were able to achieve a sufficient number of observations required for the performance of the model while preserving the accuracy and impartiality of assessing the relationship between dependent and independent variables.

The basic functional form of the model used in this study basis on the formulations set by Arnold (2008). The authors use the identical basic structure of the model, but it differs in certain specifications. The logarithmic equation of economic growth used in the research is as follows:

$$\Delta \ln y_{i,t} = a_{0,t} - \varphi_t \ln y_{i,t-1} + a_{1,i} \ln s_{i,t}^{K} + a_{2,i} \ln h_{i,t} - a_{3,i} n_{i,t} + \sum_{j=4}^{m} a_{i,t} \ln V_{i,t}^{j} +$$

$$+\tau,t + b_{1,t} \Delta \ln s_{i,t}^{K} + b_{2,t} \Delta \ln h_{i,t} + b_{3,t} \Delta n_{i,t} + \sum_{j=4}^{m} b_{i,t} \ln V_{i,t}^{j} + \varepsilon_{i,t}$$

[2] Slovenia, Croatia, Poland, Czech Republic, Slovak Republic, Romania, Bulgaria, Malta, Cyprus, Latvia, Lithuania, Estonia, Hungary, Ukraine, Belarus, Moldova, Georgia, Armenia, Russia, Albania.

where y denotes GDP per capita, s^K share of gross investment in GDP (opposed to the rate of investment in Arnold, 2008), h the gross enrolment rate in higher education institutions (the average number of years of schooling in Arnold, 2008), n the population growth rate, $a_{i,t}$ a set of fixed effects by country and t time. The second row of the equation refers to the differentiated variables related to short-term interdependence with the dependent variable, where $\varepsilon_{i,t}$ refers to the accidental deviation.

The error correction model (ECM) is one of the most popular econometric methods and its popularity, due to its features, increases exponentially in the research involving panel data.

In the analysis of the panel data on 20 countries over a 20 year period, the authors use the Pooled Mean Group estimator (PMG) first developed by Pesaran, Shin and Smith (1999) in which they demonstrated the considerable advantages of using this approach. The PMG estimator is an appropriate method in the analysis of panels in which the time and group dimensions, as well as similar dimensions, are relatively large i.e. 20X20 or larger. Namely, in the most commonly used approach to econometric modelling, two mutually distinctive procedures are used. In the first, the coefficients are determined for each group of variables (e.g. countries), and then, based on the distribution of the results, the average coefficient is calculated. This presents the Mean Group (MG) estimate. On the other hand, we have methods such as the random and fixed effects methods where group or time effects vary, whereas all other coefficients and variance errors are fixed. For example, we have the Dynamic Fixed Effects (DFE) method, which relies on the assumption that long-term and short-run coefficients and variance errors are the same across all countries in the sample.

The PMG estimator represents a compromise between both methods. It takes the advantages of both approaches, and is, as such, considerably more accurate. This method assumes that the long-term coefficients of the variables are equal, or in other words, that the short-term dynamics of the variables converge to long-term values of the relationship, which is a very reasonable assumption and quite common in the relationship between economic variables (Pesaran, Shin and Smith, 1999, p. 2).

As the aim of this study is to assess the impact of tax structures (and not the overall levels of taxes) on economic growth, all tax variables are expressed as a share of revenues from individual tax forms in total tax revenue. Given the fact that we use the share of total tax revenues in GDP as a control variable in the model, every change in tax revenues relating to one form of tax should reflect an equal change (in opposite direction) in other forms of tax in order for the total tax burden to remain unchanged. Due to this, when estimated models disregard

one or more tax forms, the explanations of the estimated coefficients should be interpreted as a shift from the omitted tax form towards the tax form estimated in the model. For example, changes in taxes on income and profits compensate the same changes in taxes on consumption and property, but in the opposite direction (the first increase while the second decrease) in order for the total tax burden to remain unchanged. This implies that the changes in taxes are revenue neutral.

As previously explained, the PMG estimator is a method representing a compromise between the MG estimate and the DFE method. The PMG estimator leads to efficient and consistent estimates when the assumption of homogeneity of long-term parameters is valid. However, these estimates are not consistent if the model is heterogeneous. To test the difference in the estimations of long-term parameters by PMG and MG estimators, the Hausman test is used. When comparing PMG and MG estimations in each regression equation, the Hausman test strongly suggests that we cannot discard the assumption of homogeneity of long-term coefficients (p-values are very high for all specifications), and therefore, we can conclude that the PMG estimator gives better results than the MG estimator. In order to determine the most appropriate econometric approach to this research, the article presents the results of the PMG, MG and DFE methods.

3. Data and Results

3.1. The Data

The main source of the data needed for the econometric analysis in this paper is the International Monetary Fund database i.e. the Government Finance Statistics (GFS) yearbooks from which we use all the data relating to the tax structure variable (data on total tax revenues and the revenues from individual forms of tax). When constructing the data sets for the tax variables, it is important to take into account the changes in methodology, resulting from the introduction of a new manual in 2001 (Government Finance Statistics Manual 2001 – GFSM2001). The methodology that was in effect prior to 2001 based on the 1986 manual (GFSM1986). The new manual (GFSM2001) records the economic transactions on accrual basis i.e. they are recorded at the time they are created, while the old manual (GFSM1986) recorded on cash basis i.e. when cash is received or paid.

In addition to changes in the way of recording the data, the difference between the old and new methodology reflects the fact that, the old GFSM1986 methodology did not record the data at general government level. As according to GFSM2001, the general government sector consists of sub-sectors: central government, state, provincial or regional government and local government.

Where there was no data at general government level we construct the data (tax revenues) by adding up the data for those sub-sectors. Moreover, due to the differences in the presentation of data between the old and new methodology (accrual basis and cash basis), whenever the available data were reported on an accrual basis they were taken into account as such, and in other cases, the collected data are reported on a cash basis. We supplement the set of data obtained from the GFS by other data sources (data of the analysed countries' Ministries of Finance). The macroeconomic variables included in the analysis come from the statistical database of the World Bank (World Development Indicators – WDI) and the UN database (UNdata). In addition, we also considered Penn World Table (2017) data, particularly in order to represent the human capital variable, however, due to lack of data (data on several countries are missing which would substantially decrease number of observations) we choose another source. However, we use data from the Penn World Table to derive a ratio of number of persons employed in total population as a proxy for the rate of employment in order to deal with the endogeneity issue.

The tax variables used in the regressions in this paper and defined according to the GFSM2001 tax classification are as follows:

- Total tax revenues: taxes (11) and social contributions (12). Total tax revenues are included in the regression as a percentage of GDP
- Personal income tax revenues: payable by individuals (1 111)
- Corporate income tax revenues: payable by corporations and other enterprises (1 112)
- Social security contributions (121): employee contributions (1 211), employer contributions (1 212), self-employed or non-employed contributions (1 213) and un-allocable contributions (1 214)
- Consumption taxes: taxes on goods and services (114) and taxes on international trade and transactions (115)
- Taxes on property (113)

Other variables used in the regressions are:

- Population growth: exponential rate of growth of midyear population from year $t - 1$ to t, expressed as a percentage (WDI, various issues).
- Investment: Investments in fixed assets (% of GDP) include investments in property, plant, machinery, equipment purchase, construction of roads, railways, and the like, including schools, offices, hospitals, private residential dwellings and commercial and industrial buildings (WDI, various issues).
- GDP per capita: USD 2005 constant prices PPP; gross domestic product converted to international dollars using purchasing power parity rates (PPP). An international dollar has the same purchasing power over GDP as the USD has in

the United States. GDP at purchaser's prices is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources (WDI, various issues).

• Human capital: the gross enrolment rate in tertiary education (%); the number of students enrolled in higher education, regardless of age and gender, expressed as a percentage of total students who according to official figures correspond to the level of education (UNESCO, Institute for Statistics).

Before proceeding to the estimation of empirical model, the usual procedure is to check the stationarity of the variables used in the model. For these purposes, we use a number of panel unit root tests (Harris and Tzavalis, 1999; Breitung, 2000; Hadri, 2000; Choi, 2001; Levin, Lin and Chu, 2002; Im, Pesaran and Shin, 2003; Breitung and Das, 2005). Table 1 presents the results for all variables in levels. We tested all variables in levels and various lags. Surprisingly, lagging of variables does not lead to changes in the results of panel unit-root tests in levels presented in the Table 1.

T a b l e 1

The Results of the Panel Unit-root Tests (levels)

Variables	**Levin--Liu-Chu**	**Harris--Tzavalis**	**Breitung**	**Im-Peseran--Shin**	**Fisher**	**Hadri LM**
GDP p.c.	–2.01** (0.02)[a]	0.96 (3.09)[b]	3.56 (0.99)[c]	6.29 (1.00)[d]	–2.46 (0.99)[e]	39.25*** (0.00)[f]
Investment	–4.89*** (0.00)	0.71*** (0.00)	–2.73*** (0.00)	–1.54*** (0.06)	0.22 (0.41)	20.03*** (0.00)
Human capital	–3.39*** (0.00)	0.85 (0.37)	5.08 (1.00)	1.37 (0.91)	–1.04 (0.85)	45.66*** (0.00)
Population growth	–2.05** (0.02)	0.27*** (0.00)	–2.17** (0.02)	–4.35*** (0.00)	15.36 (0.00)	8.65*** (0.00)
Overal tax burden	–0.32 (–8.21)	0.72*** (0.00)	–2.54*** (0.00)	–2.34*** (0.00)	5.31*** (0.00)	9.43*** (0.00)
Personal income tax	–18.0*** (0.00)	0.15*** (0.00)	–2.69*** (0.00)	–6.14*** (0.00)	18.70*** (0.00)	3.34*** (0.00)
Corporate income tax	–13.38*** (0.00)	0.3953*** (0.00)	–3.84*** (0.00)	–3.98*** (0.00)	6.71*** (0.00)	9.07*** (0.00)
Social Security Contributions	–27.08*** (0.00)	0.10*** (0.00)	–3.39*** (0.00)	–4.78*** (0.00)	8.51*** (0.00)	5.66*** (0.00)
Property Taxes	–8.69*** (0.00)	0.56*** (0.00)	–3.98*** (0.00)	–6.48*** (0.00)	18.22*** (0.00)	7.06*** (0.00)
Consumption Taxes	–73.27*** (0.00)	0.53*** (0.00)	–4.20*** (0.00)	–3.98*** (0.00)	7.36*** (0.00)	4.42*** (0.00)

Note: *, **, ***: significant at 10%, 5%, 1% levels.

a) adjusted *t* (p value); b) (rho)z-value; c) lambda (p-value); d) Z-t-tilde-bar (p-value); e) modified inv. chi-squared (p – value); f) z (p-value).

Source: Authors' calculations.

By the results of the table, we can conclude that the most of the variables are stationary, however for GDP p.c. and human capital variable only Levin--Liu-Chu test implies stationarity; all other tests for these variables imply non-stationarity in level and lags. In addition, Hadri LM test rejects the null hypothesis of stationarity, which alternatively, implies that some panels are non-stationary. However, when we differenced the variables, all results indicate stationarity.

Considering the fact that the results of unit root tests in most of the cases, indicate that variables are stationary and relatively short time-series dimension does not allow us to loose additional information from the dataset (observation) by lagging or differencing we proceed with the estimation of the empirical model.

3.2. The Results

This segment of the paper presents the results of the econometric analysis of the interdependence of tax structures and economic growth in selected CEE countries and the Republic of Croatia. We present the results in five tables. The first part of each table shows the convergence rate of short-run into long-run coefficients and the coefficients of the effect of independent variables on GDP per capita in the long-run period. The second part of each table shows the short--term dynamics of the impact of the independent variables on GDP per capita. The last part of the table shows the results obtained by the Hausman test comparing the effective estimators (PMG and DFE) with the consistent (MG) estimator. The results show that the PMG estimator is the preferred estimator. Moreover, a similarity between PMG and DFE estimated coefficients is observable in all tables.

As can be seen in Table 2, investments in fixed assets and human capital have a significant positive impact in the long-run period, whereas the value of the coefficient of the effect on population growth is negative, which is as expected given that the dependent variable is GDP per capita. Moreover, as expected, the overall tax burden has a negative long-term impact on economic growth. The coefficient of personal and corporate income taxes in the long-run is significant and carries a negative sign, which implies that if these taxes are increased, economic growth will be reduced proportionally, depending on the share of these taxes in overall tax revenues. In the short-run, personal and corporate income taxes have a positive effect, while the overall tax burden is not significant. Table 3 shows the results of model specifications in which we separately estimate the effects of personal income taxes and the effects of corporate income taxes on economic growth in order to see which of the two tax forms has a greater negative impact on growth.

T a b l e 2

The Joint Impact of Personal Income and Corporate Income Taxes on Economic Growth in Selected CEE Countries

Dependent variable: ΔGDP p.c.	Pooled mean group estimator (PMG)	Mean group estimator (MG)	Dynamic fixed effects (DFE)
Convergence rate	–0.102*** (–3.15)	–0.423*** (–3.24)	–0.185*** (–8.76)
Long-run coefficients			
Baseline model			
Investment	0.710*** (6.55)	–7.581 (–1.43)	0.489*** (5.62)
Human capital	0.843*** (15.67)	–1.169 (–0.31)	0.635*** (10.18)
Population growth	–0.093** (–2.16)	–3.683 (–1.01)	–0.019 (–0.44)
Control variable			
Overall tax burden (total revenues/GDP)	–0.114 (–1.94)*	2.999 (0.56)	–0.075 (–1.60)
Tax structures variables			
Personal and Corporate Income Tax	–0.786*** (–6.95)	–2.085 (–1.04)	–0.040 (–0.62)
Short-run coefficients			
Baseline model			
Investment	0.116*** (3.60)	–0.033 (–0.51)	0.073*** (3.63)
Human capital	–0.000 (–0.01)	–0.028 (–0.43)	–0.045 (–2.52)*
Population growth	0.064*** (3.04)	0.022 (0.66)	0.002 (0.42)
Control variable			
Overall tax burden (total revenues/GDP)	0.038 (1.44)	0.058 (1.06)	0.026 (2.05)***
Tax structures variables			
Personal and Corporate Income Tax	0.071** (2.30)	0.045 (1.06)	0.009 (1.55)
Characteristics of the econometric model			
Observations	397		
Log-likelihood	807.2802		
Hausman test	0.00 (0.9607)		0.00 (0.9992)

Note: *, **, ***: significant at 10%, 5%, 1% levels (z-values are under parenthesis).

Source: Authors' calculations.

Table 3 shows that the coefficients of the basic (macroeconomic) variables in the long-term are significant and have the expected signs as in the previous specification (Table 2). The overall tax burden in the long-run has a significant negative impact on economic growth. As the corporate income tax coefficient is not significant in the long-run, and the coefficient of personal income tax is negative and significant, it can be concluded that the taxation on personal income acts restrictively on economic growth in observed CEE countries. In the short--run, the coefficients of the macroeconomic variables have the same positive

sign as in the previous specification of the model (Table 2), but here, unlike in the Table 2 where the coefficient had negligible negative but significant value, the human capital coefficient is not significant. Moreover, we find that the coefficients on overall tax burden, personal income tax and corporate income tax are not significant in the short-run.

T a b l e 3

The Impacts of Personal Income Tax and Corporate Income Tax on Economic Growth in Selected CEE Countries

Dependent variable: ΔGDP p.c.	**Pooled mean group estimator (PMG)**	**Mean group estimator (MG)**	**Dynamic fixed effects (DFE)**
Convergence rate	–0.121*** (–3.35)	–0.383* (–3.31)	–0.184*** (–8.56)
Long-run coefficients			
Baseline model			
Investment	0.959** (12.10)	0.608 (1.86)	0.496 (5.64)
Human capital	0.694*** (15.80)	0.157 (0.82)	0.632** (9.98)
Population growth	–0.159*** (–4.01)	0.094 (0.95)	–0.024 (–0.56)
Control variable			
Overall tax burden (total revenues/GDP)	–0.156** (–2.91)	–0.814 (–3.44)	–0.043 (–0.67)
Tax structures variables			
Personal Income Tax	–0.462** (–7.82)	0.080 (0.82)	0.041 (0.93)
Corporate Income Tax	–0.050 (–2.16)	–0.117 (–1.27)	–0.056 (–1.49)
Short-run coefficients			
Baseline model			
Investment	0.098*** (3.40)	–0.017 (–0.28)	0.069*** (3.46)
Human capital	0.028 (0.69)	–0.124 (–2.29)	–0.044 (–2.45)
Population growth	0.070*** (3.04)	–0.014 (–0.36)	0.003 (0.47)
Control variable			
Overall tax burden (total revenues/GDP)	0.057 (1.61)	0.191 (2.35)	0.026 (2.11)
Tax structures variables			
Personal Income Tax	0.012 (0.40)	0.016 (0.34)	–0.004 (–0.62)
Corporate Income Tax	0.023 (2.14)	0.041 (2.37)	0.009 (1.58)
Characteristics of the econometric model			
Observations	397		
Log-likelihood	853.528		
Hausman test	5.42 (0.4912)		0.00 (1.0000)

Note: *, **, ***: significant at 10%, 5%, 1% levels (z-values are under parenthesis).

Source: Authors' calculations.

Table 4 shows the impact of personal income tax on economic growth when social security contributions are included in the analysis.

T a b l e 4

The Impacts of Personal Income Tax and Social Security Contributions on Economic Growth in Selected CEE Countries

Dependent variable: ΔGDP p.c.	**Pooled mean group estimator (PMG)**	**Mean group estimator (MG)**	**Dynamic fixed effects (DFE)**
Convergence rate	–0.097*** (–2.96)	–0.348*** (–3.99)	–0.190*** (–8.93)
Long-run coefficients			
Baseline model			
Investment	0.358*** (3.63)	0.572*** (2.00)	0.499*** (5.80)
Human capital	1.044 (11.88)***	–0.142 (–0.44)	0.631*** (10.13)
Population growth	–0.010 (–0.28)	0.059 (0.37)	–0.022 (–0.51)
Control variable			
Overall tax burden (total revenues/GDP)	0.352*** (2.86)	–1.261 (0.204)	–0.048 (–0.76)
Tax structures variables			
Personal Income Tax	0.052 (2.74)***	–0.371 (–1.44)	0.020 (0.47)
Social Security Contributions	–0.156*** (–2.76)	–0.904* (–1.72)	–0.014 (–0.29)
Short-run coefficients			
Baseline model			
Investment	0.144*** (3.97)	–0.014 (–0.21)	0.067*** (3.32)
Human capital	0.013 (0.19)	–0.090 (–1.75)	–0.045*** (–2.51)
Population growth	0.083*** (2.85)	–0.050 (–1.15)	0.003 (0.48)
Control variable			
Overall tax burden (total revenues/GDP)	–0.026 (–0.60)	0.197*** (2.00)	0.028 (2.16)
Tax structures variables			
Personal Income Tax	–0.001 (–0.02)	0.003 (0.06)	0.004 (0.74)
Social Security Contributions	–0.069*** (–3.02)	0.000 (0.01)	–0.003 (–0.53)
Characteristics of the econometric model			
Observations	396		
Log-likelihood	845.5355		
Hausman test	4.13 (0.6597)		0.00 (1.0000)

Note: *, **, ***: significant at 10%, 5%, 1% levels (z-values are under parenthesis).

Source: Authors' calculations.

As can be observed in Table 4, the impact of the share of social security contributions in total tax revenues on economic growth has an expected high and negative impact, in both the short and long-run.

However, with the introduction of the social security contributions variable, personal income tax becomes insignificant, while the overall tax burden has an uncommon positive coefficient in the long-run. Table 5 analyses the joint impact of consumption taxes and property taxes on economic growth.

T a b l e 5

The Joint Impact of Consumption and Property Taxes on Economic Growth in Selected CEE Countries

Dependent variable: ΔGDP p.c.	**Pooled mean group estimator (PMG)**	**Mean group estimator (MG)**	**Dynamic fixed effects (DFE)**
Convergence rate	–0.105 (–2.52)	–0.254*** (–3.92)	–0.190*** (–9.06)
Long-run coefficients			
Baseline model			
Investment	0.183** (3.14)	0.035 (0.11)	0.491** (5.76)
Human capital	0.749** (13.84)	0.440 (3.20)	0.629** (10.37)
Population growth	–0.027 (–1.54)	0.263 (0.85)	–0.018 (–0.44)
Control variable			
Overall tax burden (total revenues/GDP)	0.141 (1.89)	0.048 (0.13)	–0.042 (–0.67)
Tax structures variables			
Property and Consumption Taxes	–0.157 (–1.97)	0.454 (1.60)	–0.001 (–0.06)
Short-run coefficients			
Baseline model			
Investment	0.150*** (5.14)	0.069 (1.74)	0.070*** (3.54)
Human capital	0.043 (0.60)	–0.073 (–1.52)	–0.045 (–2.47)
Population growth	0.057 (2.09)	0.010 (0.19)	0.002 (0.38)
Control variable			
Overall tax burden (total revenues/GDP)	–0.013 (–0.31)	–0.012 (–0.21)	0.026 (2.06)
Tax structures variables			
Property and Consumption Taxes	–0.017 (–0.55)	–0.077 (–1.78)	0.000 (0.06)
Characteristics of the econometric model			
Observations	397		
Log-likelihood	789.9516		
Hausman test	3.31 (0.6525)		0.00 (1.0000)

Note: *, **, ***: significant at 10%, 5%, 1% levels (z-values are under parenthesis).

Source: Authors' calculations.

In contrast to the results obtained in Arnold (2008), where property tax and consumption tax had a positive and significant impact on economic growth, in our analysis on selected CEE countries, their impact is not significant. In Table 6

we present the results of model specifications in which we can observe effects of property taxes and the effects of consumption taxes on economic growth.

T a b l e 6

The Impacts of Consumption and Property Taxes on Economic Growth in Selected CEE Countries

Dependent variable: ΔGDP p.c.	**Pooled mean group estimator (PMG)**	**Mean group estimator (MG)**	**Dynamic fixed effects (DFE)**
Convergence rate	–0.107*** (–2.74)	–0.405* (–3.98)	–0.192*** (–9.06)
Long-run coefficients			
Baseline model			
Investment	0.135*** (2.26)	0.386 (1.67)	0.490** (5.80)
Human capital	0.816*** (13.87)	0.258 (1.14)	0.624** (10.36)
Population growth	–0.031 (–1.30)	–0.0141 (–0.10)	–0.021 (–0.50)
Control variable			
Overall tax burden (total revenues/GDP)	0.184 (2.36)	0.551 (0.89)	–0.039 (–0.62)
Tax structures variables			
Property Taxes	–0.007* (–1.66)	0.032 (0.49)	–0.002 (–0.16)
Consumption Taxes	–0.118 (–1.55)	1.323 (1.29)	0.039 (0.68)
Short-run coefficients			
Baseline model			
Investment	0.154*** (4.44)	0.009 (0.23)	0.069*** (3.44)
Human capital	0.011 (0.25)	–0.075 (–1.75)	–0.045 (–2.49)
Population growth	0.075*** (2.75)	–0.036 (–0.48)	0.002 (0.41)
Control variable			
Overall tax burden (total revenues/GDP)	0.010 (0.20)	0.064 (0.96)	0.025 (1.99)
Tax structures variables			
Property Taxes	–0.006 (–0.49)	0.003 (0.22)	0.000 (0.17)
Consumption Taxes	–0.003 (–0.06)	–0.174 (–2.05)	–0.003 (–0.34)
Characteristics of the econometric model			
Observations	397		
Log-likelihood	833.4518		
Hausman test	1.48 (0.9611)		0.00 (1.0000)

Note: *, **, ***: significant at 10%, 5%, 1% levels (z-values are under parenthesis).

Source: Authors' calculations.

As can be seen from Table 6, if we look at the effects for these two group of taxes separately, we find that previous conclusions remain the same i.e. both tax

forms have a negative coefficient. However, we find that only property taxes are significant at a relatively unreliable level of significance (10%) and have a very low coefficient. We can observe a relatively low value of convergence rate coefficients in all econometric results presented in the previous tables, which indicates that a significant period (about 10 years) is required to equalize the long-term relations between observed variables. This is not surprising as there are significant differences in the tax structures across the selected countries, as well as differences in other macroeconomic features and thus it is not realistic to expect rapid convergence.

One of the usual problems related with research on effects of tax structure is the issue of endogeneity, which comes from the fact that tax revenues increase in expansions and decrease in times of recession. Even though the favourable feature of PMG is accounting of short-term dynamics, which deals precisely with the effects of the business cycle, there are still issues about the extent of control of such volatility. In order to provide more robustness of the results we include ratio of number of persons employed in total population as a proxy for the rate of employment. Due to lack of data, which would enable estimation of the output gap or unemployment rate, the increase or decrease of employment rate should address the effects of the business cycle. Of course, this variable addresses more direct taxes, particularly personal income tax and social security contributions. However, both consumption taxes and property taxes are less susceptible to business cycle fluctuations and, therefore, we would expect that endogeneity issue is less relevant for these tax forms. The regressions with the employment rate for all specifications confirm the results already presented in the paper. We can explain such results either by possibility that there is no endogeneity issue, or the PMG estimation pick-ups business cycle volatility. Another option is that it is possible that emerging (transition) economy does not follow classic business factor cycle particularly within the employment rate. Since the dataset stems from 1990s when the employment rate in the most of the countries is at its historical low value, it is possible that this variable does note denote business cycle indicator. In addition to that, productivity of labour in these countries most likely is the dominant source of economic growth.

According to the results presented in the Table 2, personal and corporate income taxes have a surprisingly positive impact in the short-run. However, we can explain such a positive impact in the following ways. First, the positive impact of personal income tax on economic growth can be the consequence of the income effect. The increase in personal income tax reduces the amount of disposable income which may result in an individual's desire to work more to make up for lost amount of net income due to tax increases. In the long-run, it is very

likely that the substitution effect will prevail as the individuals will eventually get used to lower disposable incomes, and will replace work with leisure. This will have a negative impact on economic growth. Moreover, it is possible that the increase in personal income tax in the long-run will be covered by the employers, which will, due to costs, reduce their demand for labour leading to a rise in unemployment. This, together with the unchanged amounts of capital, may lead to lower growth.

The short-run positive impact of the increase in the share of corporate taxes in revenues on economic growth may be the result of intensified economic activity and not necessarily the result of an increase in tax rates. A similar logic could be applied to personal income taxes paid by sole-traders and self-employed individuals. Moreover, as companies pay corporate income taxes in the current year based on previous year's business activity, in the short-run, an increase in corporate income tax rates should not have an impact on tax revenues.

In the long-run, an increase in corporate income tax rates reduces total factor productivity through the reallocation of resources to less productive sectors; it reduces the incentives for investment in innovation activities and foreign direct investments, and hinders the technology transfer and knowledge spillovers to domestic companies, resulting in a negative impact on economic growth.

When we estimate the effects of personal income taxes and the effects of corporate income taxes on economic growth as separate tax forms (Table 3), we obtain significant and negative impact of the personal income tax. This negative effect is the result of the negative impact (substitution effect) of personal income tax for sole-traders and the self-employed. In addition, this negative impact is a result of the taxation of employment income (salary). Namely, the most of the countries analysed collect personal income taxes, as a rule, mainly by taxing the labour and in less extent capital. However, one should not ignore the negative substitution effect of individual forms of capital taxation in some of the observed countries.

When personal income taxes and social security contributions are included in the analysis (Table 4), the overall tax burden has a positive impact on economic growth in the long-run. Although such impact is highly unusual, it may be the result of the multicollinearity due to the observed negative effect of personal income tax and social security contributions, which within the framework of overall tax burden have a significant negative effect of economic growth. We can explain the positive coefficient of the overall tax burden by the fact that social security contributions, in comparison to personal income tax, have less impact on labour supply, because the potential social benefits workers receive correlates with the amounts of contributions paid. This means that by paying

social security contributions the workers receive in return some benefits from the government, which ultimately may not have a negative impact on economic growth and can even result in a positive impact. Moreover, free lancers also pay social security contributions (on individual service contracts) as a rule, at higher rates than in the case of full employment, which has a positive fiscal impact for the government as it increases revenues from contributions.

As can be seen from Table 4, when personal income tax and social security contributions are included in the analysis, we find the first one to be insignificant while the coefficient of the latter is significant and carries a negative sign in both the long and short-run. We can partly explain the negative impact of social security contributions in the analysed countries by the existence of a significant share of the unofficial economy, i.e. informal sector. In countries where there is no adequate system of combating the grey economy, tax evasion and non-payment of other public contributions, there is a large number of individuals who work illegally and employers who tend to, legally, by paying minimum wages, reduce the tax base for calculating personal income tax and social security contributions. In these circumstances, the tax burden and social security contributions is borne only by the formal sector, which is unfair as those who work in the informal sector cannot be taxed (their incomes are unrecorded) and they may even receive social benefits paid by the government to socially vulnerable groups of the population. Due to this, policy makers can rely only on the social security contributions collected from the formal sector to fund different programs related to health insurance, pension insurance and unemployment benefits. This results in relatively high rates of social security contributions. Such high contribution rates do not stimulate new employment, which has a negative effect on economic growth.

The labour market in CEE countries is relatively inflexible with high costs of hiring and firing workers, which fosters growth in the informal sector. Therefore, in order to finance the growing public expenditures, social security contributions need to be increased, which raises the cost of labour and reduces investment or leads to the substitution of labour with capital. This decreases the number of those employed in the formal sector thus reducing revenues from personal income tax and social security contributions while at the same time increases the required amount of public expenditure on unemployment benefits. Moreover, social security contributions distort savings decisions of both business entities and individuals and have a negative impact on investment, due to higher cost of capital, and on the demand for labour. Apart from the informal sector, another problem, which further burdens the economy and increases public expenditure, is the aging population. In this situation, the policy makers have to either reduce the benefits from social, health and pension programs or increase the rate of

social security contributions. Increasing labour costs distort the competitiveness of the economy and reduce the amount of domestic and foreign investment in manufacturing and service activities.

The results of the econometric analysis of the impact of consumption taxes and property taxes on economic growth show that these forms of taxes are insignificant i.e. property taxes are significant, but at a relatively unreliable level (10%) and the estimated coefficient are very small.

The results presented in the preceding tables show that all forms of taxes have a negative impact on economic growth. Personal income taxes have the largest negative impact followed by social security contributions and corporate income taxes, while property taxes have the least negative impact. Unlike these taxes, we do not find coefficients on consumption taxes to be statistically significant.

The empirical results of the interdependence of the tax structure and economic growth presented in this paper are somewhat expected since the countries included in our sample have different economic performance in comparison to developed OECD countries.

Conclusion

The research conducted in this study is one of the first systematic analysis of the interdependence of tax structure and economic growth in Central and Eastern European countries (EU-13 and selected former USSR countries) and, as such, contributes to the existing scientific and professional literature. The empirical results confirm that the existing tax structure of the countries included in the analysis needs modifications i.e. that the taxation policy should be altered in order to encourage economic growth. Furthermore, the results presented in this paper indicate that the tax structure of the observed countries has a significantly different impact on economic growth than the tax structure of the developed OECD industrial countries, which had been analysed in previous studies. Therefore, we can conclude that the tax structures of these two groups differ in regards to the importance of the individual tax forms for the budget i.e. their share in government revenues. Moreover, we can conclude that different forms of taxes show similarities regarding their impact on economic growth (direct taxes have a negative impact on economic growth). However, there are also significant differences (in the context of other tax forms). Based on our results, we can assume that the impact of the relevant macroeconomic variables is more important for the observed countries than for developed OECD industrial countries.

The conclusions and the results provide a basis for further research of the interdependence of tax structure and economic growth. One of the possibilities

is to group countries according to macroeconomic indicators to see whether the tax structures in such formed groups have a different impact on economic growth. Another approach could be to take either the growth rate of GDP or the gross national income (GNI) as a dependent variable and, for example, the number of the employed/unemployed, government deficit, foreign debt and various categories of public expenditure as independent variables.

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