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The long-run impact of personal income taxation on economic development: Evidence from Croatia

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Abstract

Since the endogenous growth model appeared in the economic theory, taxation has been considered as one of the key determinants of the economic growth. In the public finance theory, taxation is considered to have a negative impact on economic growth, which is explained by implications of tax revenues distortions on the economic activity. This assumption has been investigated by many empirical studies. The aim of this paper is to analyse the impact of personal income taxation on economic conditions in Croatia in the long-run. After providing a brief insight into the economic and the public finance theory regarding taxation and economic growth, previous relevant research is presented. The empirical analysis of the impact of personal income taxation on economic conditions in Croatia is conducted using the Johansen cointegration approach. The existence of cointegration is examined and the error correction model is estimated using monthly data from January 2000 to March 2016. The results of the research show that personal income taxation in Croatia has a significant negative impact on the economic growth in the long-run, which is in line with the economic theory and relevant empirical research.

Keywords: Johansen cointegration approach, economic development, vector error correction model, personal income taxation

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Introduction

Economic growth is one of the most important concepts in economic theory. Achieving the steady GDP growth is one of the most important goals of every country. Before 1980s, technological progress and increase of population were considered to have most significant impact on economic growth. The development of endogenous growth theory has opened new possibilities of exploring the effects of endogenous determinants, such as taxation, on economic growth. The impact of taxation on economic growth significantly depends on the structure of tax system in the country (Alinaghi, 2015).

In public finance theory, it is considered that taxes have negative impact on economic growth. It is the consequence of distortions which taxes impose on individuals' behaviour, such as their decisions about savings, spending and leisure (Kesner-Škreb, 1999). Taxes are considered to bring inefficiency into the economy in form of deadweight loss (Rosen, 1998). In macroeconomic theory, there are two models which are often used to explain the impact of taxation on economic growth: neoclassical growth model and endogenous growth model. Neoclassical growth model implies that the long-run growth rate is defined as the rate of technical progress and population growth. Furthermore, according to neoclassical model, taxation has an impact on economic growth in short-run, but not in the long-run (Belaney et al., 2001). This model has been used until 1980s, when the endogenous growth model appeared in macroeconomic theory. The most famous endogenous growth model introduced by Barro (1990) and King and Rebelo (1990) assumes that taxes and public expenditures can determine both the output level and the steady state growth rate (Alinaghi, 2015). Endogenous growth model implies that the impact of fiscal policy on growth depends on the structure and level of taxation (Belaney et al., 2001). It also points out that growth is stimulated by the decisions of economic agents concerning accumulation of physical and human capital (Kesner-Škreb, 1999). Most researchers assume that the endogenous growth model explains growth better due to the fact that in the neoclassical model taxes do not have permanent effects on GDP growth per capita (Alinaghi, 2015). Karras (1999) researched the impact of tax rate on economic growth for a panel of 11 OECD countries in order to test theoretical framework of endogenous and neoclassical growth models. The main difference between endogenous and neoclassical model is related to the fact that increase in tax rate will permanently diminish economic growth in endogenous model, while in neoclassical model change in tax rate affects economic growth only temporarily and it has permanent impact only on steady-state GDP per capita. Karas (1999) empirically confirmed the neoclassical growth model is more suitable for observed countries.

This research is primarily focused on the impact of personal income tax on economic development in Croatia. Income tax is accepted not only as a possible instrument of raising the required public revenue, but also as an essential fiscal instrument for managing the economy (Burgess, 1993). The aim of this research is to assess whether the income taxation has significant impact on economic conditions in Croatia and to assess the direction of the estimated impact. The research hypothesis is that the personal income taxation significantly impacts economic development in Croatia in long-run.

The outline of the paper is following: firstly, the brief literature review is provided; and after that the empirical analysis of the impact of personal income taxation on economic conditions in Croatia is conducted. Finally, main conclusions and limitations of the research are stated.

The existing research on the impact of personal income taxation on economic conditions

Most of the existing empirical research provides different results concerning the impact of taxation on economic growth. There are few problems which disable comparability of results of different studies: different coverage of taxes in different countries, problems concerning measuring specific tax variables, complex interactions of fiscal variables, difficulties concerning segregation of the impact of other variables which effect growth from the impact of fiscal variables, sensitivity of quantitative results on elasticity parameter estimations (Kesner-Škreb, 1999). Alinaghi (2015) analyses taxes and economic growth in OECD countries and also points out that important characteristics which can explain difference of results across studies are the different measures and types of taxes, various data structures available in cross country studies, different control variables included in the model, different econometric methodologies used and groups of countries included in the research.

The decrease in personal income taxation have the prospective to increase economic growth by stimulating individuals to work, invest and save, what refers to substitution effect (Gale, Samwick, 2016). While substitution effect of tax cuts will increase saving and labour supply, the impact of tax cuts on supply side of the economy is ambiguous due to additional effects. Namely, this refers to the income effect (Gale, Samwick, 2016). Taxes decrease the disposable income for individuals and can possibly diminish their engagement in productive economic activity (Gale, Samwick, 2016). Furthermore, the decrease in income tax cuts which is not accompanied by decreased government spending is likely to increase the budget deficit. The higher deficit will lead to lower national saving and higher interest rates, what will impact investment negatively. The net effect of the tax cut on economic growth is therefore unresolved and depends on the structure of the tax cut and the timing and structure of its financing (Gale, Samwick, 2016). If tax cuts do not lead to the expected economic growth, tax revenues could decrease and put higher pressure on the budget deficit, lower national saving, and lead to decreased future economic activity (Engen, Skinner, 1996). According to Gale and Samwick (2016), long persistent tax cuts financed by higher deficits will probably to reduce national income in the long-run. On the contrary, according to their simulation, cuts in income tax rates that are financed by spending cuts can have positive impacts on economic growth. Furthermore, Jaimovich and Rebelo (2015) propose the non-linear model for the analysis of the impact of taxation on economic growth, which is based on the assumption that low or moderate tax rates have lower impact on economic growth. Furthermore, as tax rates rise, their marginal impact on growth increases. These effects on growth are the consequence of heterogeneity in entrepreneurial ability.

The majority of previous studies has shown negative relation between taxes and economic growth, what is in line with public finance theory. Taufik and Imbarine (2012) investigate the inconsistent effects of tax structures on economic development and show that taxes on income, profit and capital gain negatively affect both low and high income countries. Arnold (2008) has conducted panel data analysis using Pooled Mean Group estimator for 21 OECD countries in order to examine the effects of tax structures on economic growth. The mentioned research has shown that income taxes lead to lower economic growth than taxes on property and consumption, and corporate income taxes have the most negative effect on economic growth. Karras and Furceri (2009) examined the impact of tax changes on economic growth in 19 European countries. The results of the research imply that increase in taxes by 1% leads to decrease in real GDP per capita by 0.5% to 1.2% in the long-run. Furthermore, Jaimovich and Rebelo (2015) propose the non-linear model for the analysis of the impact of taxation on economic growth, which is based on the assumption that low or moderate tax rates have lower impact on economic growth. Furthermore, as tax rates rise, their marginal impact on growth increases. These effects on growth are the consequence of heterogeneity in entrepreneurial ability. Kotlan and Machova (2013) examined the impact of tax burden on the economic growth in OECD countries and found the significant negative impact. Maček (2014) has verified the negative relation between economic growth and personal income taxes, corporate taxation and social security contributions in OECD countries.

Bonu and Pedro Motau (2009) concluded that lower tax rates lead to economic development in Botswana. Keho (2013) conducted econometric analysis to investigate the impact of tax structure on economic growth in Cote d'Ivoire and concluded that increasing tax burden leads to reduced economic growth. However, the analysis has shown that increase in indirect taxes and decrease in direct taxes could have a positive impact on economic growth.

The part of previous empirical research points to the positive or negligible impact of taxation on economic growth. Ojong and Myles (2000) concluded that the effect of taxation on economic growth, if it exists, is relatively minor. Slemrod (2003) suggests that raising taxes and using the obtained revenues for education and infrastructure would increase economic growth. Tajumah (2014) analysed the impact of revenue on economic growth in Ghana using vector autoregression approach and Johansen cointegration procedure. The mentioned research pointed to the positive short run and long run impact of taxation on economic growth. Anthony and Akripo (2016) analyse the impact of tax revenue on economic growth in Nigeria and show that an increase in personal income tax leads to increased economic growth. Chang (2017) assessed the impact of tax structure on economic growth in China using liner regression analysis. The mentioned research points to the result that increase in local tax revenue will have a positive impact on economic growth in China.

The empirical analysis of the impact of personal income taxation on economic conditions in Croatia

This section of is divided into three subchapters. First subchapter explains data used in analysis and used approximations. Second subchapter gives a brief insight into vector error correction model and cointegration analysis. In third part of this chapter, the empirical analysis of the impact of personal income tax on economic development is conducted.

Data

Monthly data on volume indices of industrial production, 2010=100 are used to approximate the output. This approximation is used due to the fact that data on gross domestic product are published quarterly and volume indices of production are published monthly, with the aim of preserving degrees of freedom and reliability of econometric analysis. The same approximation of output is also used in Dumičić and Čibarić (2010) and Dumičić et al. (2010). Regarding the data on personal income tax revenues, data are derived from Croatian Ministry of Finance State Budget (Ministry of Finance, 2016). Monthly seasonally adjusted logarithmic data on these variables for the period from January 2000 to March 2016 were used in cointegration analysis. The seasonal adjustment is conducted using X-13 ARIMA SEATS adjustment method (see U. S. Census Bureau, 2016). Data for April 2004 and December 2012 were missing and therefore the interpolation of missing data is done using cubic spline interpolation method in software MATLAB R2014a. For cubic spline interpolation, every two consecutive points are connected by the part of the graph of the polynomial of the third degree. For more detailed description of the method of cubic spline see Sastry (2012).

Moreover, since both analysed time series exhibit trend component, Hodrick and Prescott (1980, 1997) filter is used for trend component removal. Hodrick-Prescott filter is a commonly used method for the removal of trend component of economic time series. Hodrick and Prescott (1997) suggest that the observed time series consists of cyclical and trend components. Furthermore, it is assumed that there is no seasonal component of time series, and that the seasonal component is removed in the process of preparing the data for empirical analysis. Hodrick and Prescott filter is often used in macroeconomics to obtain smoothed estimates of the long-run trend component of a series (Palić, 2015). In this research, the value of the smoothing parameter is set to λ = 14400 in line with the original values of Hodrick and Prescott (1980, 1997) for monthly data. In order to conduct empirical analysis, seasonally adjusted detrended (HP filtered) logarithmic values of tax revenues (denoted by *T)* and industrial production (denoted by Y) are used.

The Johansen cointegration method is used to examine the existence of cointegration among income tax revenues and industrial production in Croatia. The error correction model and long-run cointegrating equation are explained in next chapter.

Vector error correction model and cointegration analysis

The Johansen approach to cointegration is described in brief in this subchapter. If the set of economic variables is observed, the long-run equilibrium can be written as:

$$\Pi Z_t + e_t = 0\,, \tag{1}$$

where Π is matrix of parameters, Z_t is vector consisted of *n* economic variables, e_t is vector of innovations or vector of stationary random variables (Bahovec, Erjavec, 2009). The equilibrium is reached if $\Pi Z_t = 0$. In that case, the deviation from the long-run equilibrium is given by:

$$e_t = -\Pi Z_t\,, \tag{2}$$

If the long-run equilibrium is reached, the deviation e_t is described to be a stationary process. It has to be emphasized that there are some differences between long-run equilibrium definition of economic theorists and of econometricians. Economic theorists use this term in the sense of equality between actual and desired state of economic variables. In econometric sense, the term refers to the long-run relationship between non-stationary variables. Cointegration does not require the long-run equilibrium to be the result of a market mechanism or behavior of individuals (see, for example, Palić et al., 2016).

The vector error correction model is given by:

$$\Delta Z_t = \Gamma_1 \Delta Z_{t-1} + \Gamma_2 \Delta Z_{t-2} + \ldots + \Gamma_k \Delta Z_{t-k+1} + \Pi Z_{t-k} + e_t\,, \tag{3}$$

where $\Gamma_i = A_i + A_{i-1} + \ldots + A_1 - I$, $\Gamma_k = \Pi = A_k + A_{k-1} + \ldots + A_1 - I$, $A_1, A_2, \ldots, A_k$ are square matrices of the order *n*, *k* is the lag length, and $i = 1,2,\ldots,k-1$. In the equation (3) the term ΠZ_{t-k} is observed as the long-run part of the model, whereas the short-run is presented by $\sum_{i=1}^{k-1}\Gamma_i \Delta Z_{t-i}$ (Bahovec, Erjavec, 2009). In order to determine the number of cointegration relations, the rank of matrix Π must be observed. There are three possible situations. If matrix Π is a zero-matrix, the cointegration is not present. If matrix Π is of full rank or the rank is equal to the number of variables in the model (rank is equal to *n*), it is said that the process is stationary. If the rank of matrix Π is not full or the rank is lower than the number of variables in the model (rank is lower than *n*), the matrix Π can be written as:

$$\Pi = \alpha\beta' , \tag{4}$$

where α is the matrix of error correction speed (speed of variables needed to return in equilibrium), β is the cointegration matrix (contains the parameters of long-run equations). Both matrices, α and β, are of rank $n \cdot r$. Consequently, there are r cointegration relations between variables. In order to determine the number of cointegration relations, the maximum eigenvalue test and trace test are conducted. For the detailed explanation of maximum eigenvalue test and trace test see Bahovec, Erjavec (2009) and Enders (2015).

The estimation the long-run equation for the impact of personal income taxation on economic conditions in Croatia

In order to test whether personal income taxes and output are cointegrated, Johansen cointegration test is conducted using EViews 8. Prior to model estimation, the existence of deterministic components (trend and constant) is selected. Due to the fact that trend is removed from both variables, the model in which constant is present only in cointegrating equation, and trend does not exist neither in vector error correction model nor in cointegrating equation, is selected for the analysis. This model is very often used in the analysis of financial variables (Bahovec, Erjavec, 2009).

The number of cointegrating relations is examined using the maximum eigenvalue test and trace test. Tests are conducted until the first time the null hypothesis cannot be rejected. The results of both tests are presented in Table 1.

Table 1 Determining the number of cointegrating relations (trace test and maximum eigenvalue test)

Hypothesized number of cointegrating equations	Eigenvalue	Trace statistic	0.01 Critical value (trace statistic)	Max-eigen statistic	0.01 Critical value (max-eigen statistic)
0	0.205	57.813	19.937*	18.520	17.234*
1	0.073	14.339	6.635*	6.635	10.666*

Note: The star *denotes rejection of null hypothesis at 1% significance
Source: Authors' calculation.

The cointegration among two observed variables exists at 1% significance. Both tests point to the existence two cointegrating relations. It is important to note that first cointegrating vector is mostly correlated with the stationary part of the model (Johansen, Juselius, 1990). Based on this fact, cointegration relation, i.e. long-run equation (with *t*-statistics in brackets) is given by:

$$\begin{aligned} Y = -0.003 - 1.230 \cdot T \\ (-6.860) \end{aligned} \quad (5)$$

Therefore, in the long-run personal income tax is significant in explaining output. Moreover, the long-run impact of personal income tax deviation is negative, what is in line with previous empirical research and economic theory. Regarding the correction of disequilibrium, the error correction term (ECT) obtained on the basis of the equation (5) equals -0.8755, whereat corresponding *t-statistics* equals -6.803 and points to the significance of error correction term. The negative sign of ECT points to the conclusion that variables return to equilibrium, while its absolute value is related to the adjustment speed. Therefore, 87.55% of disequilibrium is corrected in each months and output returns to the equilibrium level for approximately 1.14 month.

The diagnostics of the model adequacy is also conducted. Firstly, White heteroskedasticity test is conducted for long-run model. The *chi-square* test statistic equals 49.459, with corresponding *p-value* of 0.649, suggesting that the null hypothesis of homoscedasticity cannot be rejected at any reasonable significance level. Moreover, the LM test of autocorrelation is conducted. At 1% significance level the null hypothesis of no autocorrelation of residuals cannot be rejected up to lag length k=12, since all corresponding empirical significance levels are more than 0.01. Therefore, stated diagnostic tests show that stated model is appropriate.

Conclusion

The impact of taxation on economic growth has been permanent question in economic theory for decades. Since the endogenous model appeared in economic theory, researchers have put effort in analysing the effect of taxation on economic growth. The previous empirical research has shown conflicting results, what is mostly the consequence of different data used in analysis, different econometrics methodologies used, different structure of taxation in different countries and problems concerning measuring specific tax variables. The effect of taxation on economic growth largely depends on structure and level of taxation. In this research the long-run impact of personal income tax on economic development is examined. The analysis is conducted using Johansen cointegration approach. Since the eigenvalue and trace tests show the existence of cointegration among taxes and industrial production, the long-run cointegration equation is estimated. In the long-run personal income taxation has significant and negative impact on economic development. This result is in line with economic theory and previous empirical research.

Finally, the main limitations of the conducted empirical research are mostly related to approximation of data used in model. Data used to approximate the output are monthly volume indices of industrial production, while personal income taxation is approximated by monthly personal income tax revenues. Furthermore, in this research the bivariate econometric model is used. In future research other forms of taxation as well as other macroeconomic variables should be included in cointegration analysis as possible determinants of economic development.

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