Relationship between Fiscal Decentralization and Economic Growth in European Union Countries and Slovakia[1]

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Abstract

Results in the area related to fiscal decentralization and economic growth are frequently inconsistent and somewhat ambiguous, although the fiscal federalism theory clearly promotes the fiscal decentralization gains in favour of efficiency and economic growth. Paper focuses on investigating the inverted U-shaped relationship between fiscal decentralization and economic growth using the GMM model (Generalized Method of Moments). After these results were obtained, real values of Slovakia are compared to GMM – EU-26 trend. The results of GMM estimation include a threshold value of fiscal decentralization, revealing the point at which a positive relation between fiscal decentralization and economic growth turns into negative. GMM estimation of the EU-26 countries sample confirms the inverted U-shaped relationship in case of revenue and tax decentralization. Expenditure decentralization seems to be insignificant. The case of Slovakia shows the conformity with the EU trend, what is evident in the case of tax decentralization and less in revenue decentralization.

Keywords: *fiscal decentralization, economic growth, non – linear relation, generalized method of moments*

JEL Classification: H71, H72, H77, O40

Introduction

Fiscal decentralization is usually defined as shift of decision – making power to sub-national governments. Its importance started to be highlighted in the 1970's following the introduction of initial papers of Tiebout (1956), Musgrave

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(1959) or Oates (1972) into the public finance theory (Stegarescu, 2004). In Eastern Europe many post-communist countries (including Slovakia) started the public sector reforming process later, in the last decade of 20th century, with some derogation from the optimal fiscal decentralization implementation (Aristovnik, 2012).

In Slovakia the government paid attention to the possibilities of the fiscal decentralization in the last decade of the 20th century, when the massive reforming process of public sector, public finance and public administration began. The situation was mentioned by Horváthová (2011). Specific steps in field of fiscal decentralization were gradually implemented since the year 2001. The regional level of self-government was established, after the responsibilities were shifted to the lower government levels (regions and municipalities) and finally the shift of resources was realized. This schedule of steps refers on the problem mentioned in Rodríguez-Pose and Gill (2003) or Aristovnik (2012). The shift of powers and resources was divided. That diminished the fiscal decentralization success in the period immediate to its implementation. Promoted fiscal decentralization gains on economy occurred with time delay (Horváthová et al., 2012) and were accelerated by the incoming economic expansion in the country. Backset was observed in 2009, when the financial crisis worsened the conditions. Currently, the Slovakia attained the period of transition and is regarded as market-oriented economy. The question remains on whether and to what extent Slovakia follows the EU tendencies.

Theoretical and empirical literature provides certain rupture of fiscal decentralization impact on the economic growth. Promotion of fiscal decentralization economic gains contrary to its menaces motivated us to think about the fiscal decentralization eligibility. This has led us to research focusing on non-linear impact of fiscal decentralization on economic growth. The aim of the presented paper is to find a threshold value of fiscal decentralization for EU member states at which a positive relation between fiscal decentralization and economic growth turns negative. We used available data to confirm the similarity between EU trend and trends Slovakia. For that purpose, we estimate a non-linear dynamic panel data model for EU member states using generalised method of moments (GMM) framework. The situation in Slovakia is analysed and compared to the results obtained for the EU sample. The inverted relationship between fiscal decentralization and economic growth in Slovakia is analysed in accordance with the EU trend.

The paper is organized in a following manner. After the introduction, the literature review of the research performed in this field is presented. Second part contains a theoretical assumption of a model and a description of a GMM

methodology framework is included as well. Third part presents measurement concepts and data involved to the GMM estimation. Fourth part shows the results obtained. It is followed by concluding part. Finally, the Appendix is presented.

1. Literature Review

Davoodi and Zou (1998) mention two economic arguments in favour of fiscal decentralization based on research of Tiebout (1956) and Oates (1972). First, in the case of public service delivery local governments are better positioned than the national government, because they dispose with an information advantage. Consequently, decentralization will increase economic efficiency. Second, match of local preferences and local governments is ensured by population mobility and competition for public services delivery among local governments.

Thießen (2003) mentions an absence of a formalised theory on the relationship between fiscal decentralization and economic growth. He discusses some of the fiscal decentralization gains and losses regarding the diversification hypothesis (or Oates' Decentralization theorem, see Oates, 1972), Leviathan hypothesis (Brennan and Buchanan, 1980, later Oates, 1985) and productivity enhancement hypothesis (Martinez-Vazquez and McNab, 2003). Ebel and Yilmaz (2002) promote a higher participation, accountability and transparency in the decision making process in favour of fiscal decentralization. Džupka, Klasová and Kováč (2016) stress the benefits of public support on sub-national level, when sub-national governments might create better conditions to retain local sources related to local specifics. Undesirable effect of fiscal decentralization occurs in case of low per capita income level, small size of country or scarcity of good local taxes. Rather questionable is also the quality of local government (corruption on local level, Prud'homme, 1995) or contribution of fiscal decentralization to the macroeconomic stabilization (problem of fiscal imbalance, Tanzi, 1995).

According to Breuss and Eller (2004) there are three main reasons why the fiscal decentralization might influence the economic growth. One of the fiscal decentralization objectives is enhancing the economic growth and efficiency in the allocation of public resources. Next, the sustained increase of the per capita income is an explicit goal of government. Finally, per capita growth is easier to measure and to interpret than other economic performance indicators (Breuss and Eller, 2004, p. 2).

However, results of recent empirical studies are often inconclusive and ambiguous, sensitive to the choice of data sample and investigated period of interest. Martinez-Vazquez and McNab (2001; 2003) and also other relevant studies in this field claim to demonstrate the direct effect of fiscal decentralization on

economic growth. These studies present opinion that fiscal decentralization enhances the consumer and producer efficiency what stimulates the economic growth. Deficiency of research focusing on its indirect influence creates an important part of latter paper. The question of the fiscal decentralization indirectly influencing horizontal fiscal imbalances and macroeconomic stability is here opened. Breuss and Eller (2004) give an overview of related research and their findings highlight the miscellaneous nature of the fiscal decentralization's impact on economic growth.

Valuable and often mentioned is early contribution of Davoodi and Zou (1998) that provides a cross-country study of the relationship between fiscal decentralization and economic growth finding a negative relationship between them in developing countries. The explanation is that in developed countries there is not a linkage between fiscal decentralization and economic growth. Zhang and Zou (1998) investigated the influence of fiscal decentralization on economic growth in Chinese provinces. Their results present the finding that higher degree of expenditure decentralization is connected with lower provincial economic growth. Thießen (2003) realizes the estimation of the direct influence of fiscal decentralization on economic growth. He observes an inverted U-shaped (also called hump-shaped) relationship between fiscal decentralization and economic growth in OECD countries. Akai, Nishimura and Sakata (2007) stress the complementarity relationship between fiscal decentralization and economic growth in the US states. They observe a non-linear hump-shaped linkage and promote further revenue decentralization by computing the optimal degree of fiscal decentralization measured by expenditure decentralization and revenue decentralization. Rodríguez-Pose and Krøijer's (2009) findings are about the significant negative relationship between two among three relevant fiscal decentralization indicators included in the analysis and economic growth made on the sample of Central and Eastern European countries (CEECs). Their results support the importance of the local governments' own revenue sources that better fit local preferences and promote greater economic efficiency. Contrary, expenditure and transfer to lower government levels are negatively correlated with economic growth. Samini et al. (2010) provide a non-linear model of fiscal decentralization and economic growth for 30 provinces of Iran, where the positive association between fiscal decentralization and provincial economic growth has been found (Samini et al., 2010, p. 131). Rodríguez-Pose and Ezcurra (2011) supported results of Rodríguez-Pose and Krøijer (2009) using data of different countries. In the case of OECD countries, they found a negative and significant association between fiscal decentralization and economic growth. They also investigated the importance of other decentralization indicators (political or administrative decentralization), but without conclusive results.

The case of Eastern Europe countries is elaborated in Aristovnik (2012). He mentions that the common tendency of countries in question is financing lower government levels through shared taxes and transfer. There are only few countries including Slovakia, which shifted some revenue autonomy to lower government levels. Aristovnik (2012) finds a weak positive correlation between fiscal decentralization and economic growth in Eastern European countries which are also EU member states. He admits that fiscal decentralization might accelerate economic growth. Hereby, he agrees with study of Rodríguez-Pose and Krøijer (2009), where shift of expenditure and transfers has negative impact on economic performance in CEECs, while tax decentralization might bring positive economic benefits over time (Aristovnik, 2012, p. 17).

2. Theoretical Assumptions of the Model

Expectations about the fiscal decentralization influence on economic growth are usually positive and linked to the promotion of fiscal decentralization gains in related theoretical framework. Literature provides results for both negative impacts on economic growth (see Rodríguez-Pose and Krøijer, 2009, for sample of CEECs, or Rodríguez-Pose and Ezcurra, 2011 for sample of OECD countries) and positive impacts on economic growth (see e.g. Rodríguez-Pose and Krøijer, 2009, partially in case of tax decentralization; Samini et al. (2010) in case of Iran provinces; Rodríguez-Pose and Ezcurra (2011) in case of OECD countries). The research confirmed an existence of a hum-shaped relationship between fiscal decentralization and economic growth (see Thießen, 2003, or Akai, Nishimura and Sakata, 2007). Excessive expenditure decentralization might lead to excessive sub-national spending which lowers the economic growth (Davoodi and Zou, 1998). Stegarescu (2004) stresses excessive degree of fiscal decentralization with terms of secession. In this situation the additional costs are activated to cover the requirements of bureaucracy and public sector organization. New institutions and rules have to be set up and new national public goods have to be provided. In the sense of Stegarescu's paper the federation is preferable to secession. On the other hand, in the case of excessive revenue decentralization including decentralization of the tax power, wrong revenue assignment brings an inadequate use of tax instruments by local authorities (Davoodi and Zou, 1998, p. 254) in expense of central government.

Expectations about the impact of the GDP per capita initial level on economic growth are negative in accordance with neoclassical growth theories confirmed by Rodríguez-Pose and Krøijer (2009), Akai, Nishimura and Sakata (2007) or Thießen (2003). Negative sign of the control variable indicates the conditional

convergence, i.e., other variables being equal; countries that start poorer tend to grow faster in (Davoodi and Zou, 1998, p. 254) in the sense of convergence hypothesis.

Population size's effect on economic growth is expected as negative. Different sign was revealed by Davoodi and Zou (1998), Rodríguez-Pose and Krøijer (2009), Rodríguez-Pose and Ezcurra (2011) or Akai, Nishimura and Sakata (2007), contrary to Thießen (2003) which confirmed the negative relationship. According to Šuliková et al. (2015, p. 950) the negative relation between GDP per capita growth and population growth is typical for developing countries, positive relation might be explained by lower fertility rate in developed economies.

Positive effect of human capital on economic growth is expected, contrary to results of Rodríguez-Pose and Krøijer (2009). Human capital is quantified here by illiteracy and secondary school enrolment. Davoodi and Zou (1998) find also negative influence of secondary school enrolment on economic growth. Šuliková et al. (2015) measured the human capital using the average length of total schooling in years finding its positive influence on economic growth. Zhang and Zou (1998) use as a human capital proxy the growth rate of provincial labour force revealing its positive effect. For the same purpose an indicator of the dependency ratio with expected negative impact on economic growth is used. This expectation is confirmed in in Šuliková et al. (2015) where the dependency ratio is used to capture the productivity of the labour force and financial burden evoked by ageing of the population. Akai, Nishimura and Sakata (2007) used a number of patents as proxy to human capital. Thießen (2003) deliberates upon the unemployment rate to catch the macroeconomic disturbance, expecting and confirming its negative effect on economic growth.

Expectations about the physical capital are positive. They are confirmed in Rodríguez-Pose and Krøijer (2009), where positive effect on economic growth is not instant but with two years lag. In Davoodi and Zou (1998) the physical capital is measured as proxy with average real investment share of GDP. The authors find the expected impact on economic growth. Zhang and Zou (1998) use an investment rate as endogenous variable of economic growth finding its positive impact similarly to Davoodi and Zou (1998). Šuliková et al. (2015) use as proxy to physical capital the indicator of gross fixed capital formation. The negative impact on economic growth is indicated.

The negative impact of inflation rate on economic growth is expected in many studies. It is confirmed by Rodríguez-Pose and Krøijer (2009) using the GDP growth deflator or Šuliková et al. (2015) using the Consumer Price Index, contrary to results of Zhang and Zou (1998) showing its positive impact on economic growth. They argue that inflation can generate both positive and negative

effects on economic growth. The raise of inflation encourages people to invest in physical capital increasing the rate of economic growth, but also increases the transaction costs of economic activities decreasing the rate of economic growth. Thießen (2003) uses an inflation rate as proxy to macroeconomic disturbances finding its inhibitive impact on capital formation.

Positive expected effect of the country openness on economic growth matches results of Akai, Nishimura and Sakata (2007), Rodríguez-Pose and Ezcurra (2011) or Šuliková et al. (2015) and also Zhang and Zou (1998). The main argument why economy openness leads to higher economic growth consists in more efficient allocation of resources due to inter-country competition.

Expectations about the public debt's influence on economic growth are negative following the research of Šuliková et al. (2015). Excessive public debt is harmful for economic growth. World financial crisis affected the EU economies in 2009. Expectation about its inhibitive influence on economic performance is investigated using a dummy variable.

Applied Methodology – the GMM Framework

In order to estimate the impact of fiscal decentralization and other control variables on economic growth we decided to apply a dynamic panel data model. According to Croissant and Millo (2008), the estimation of dynamic models and a lack of exogeneity of the regressors can be solved by applying a generalized method of moments (GMM) framework. The GMM estimator is therefore used in dynamic panel data models (see e.g. Arellano and Bond, 1991):

$$y_{it} = \rho y_{it-1} + \beta^T x_{it} + \mu_i + \epsilon_{it} \tag{1}$$

where

y_{it-1} – a lagged dependent variable allowing for a dynamic form,

x_{it} – a vector of regressors,

μ_i – an individual error component,

ϵ_{it} – an error term.

In the GMM framework, the model is first differenced in order to eliminate the individual effect (Croissant and Millo, 2008):

$$\Delta y_{it} = \rho \Delta y_{it-1} + \beta^T \Delta x_{it} + \Delta \epsilon_{it} \tag{2}$$

Even though the estimation is inconsistent because $\Delta \epsilon_{it}$ is correlated with Δy_{it-1}, the GMM estimator enables to solve the endogeneity problem using instrumental variables. Here, y_{it-2} is a valid, but weak instrument. The GMM estimator uses the fact that the number of valid instruments is growing with time t (Croissant and Millo, 2008).

3. Measures, Data and Estimation

3.1. Measures of Fiscal Decentralization and Economic Growth

Considering measures of the fiscal decentralization, there are some common approaches applied in a prevalent part of existing scientific contributions. Frequently used indicators refer on those proposed by OECD (1999) or World Bank (2001).

In Davoodi and Zou (1998) the sub-national share of total government spending as a measure of fiscal decentralization has been used. Similarly, Thießen (2003) uses a share of sub-national government expenditures on consolidated government expenditures as the best known indicator of fiscal decentralization.

Akai, Nishimura and Sakata (2007, p. 350) use the frequently used local expenditure share in the total budget of the governments (the ratio of local government expenditure to combined state and local government expenditure) and local revenue share in the total budget of the governments (the ratio of local government revenue to combined state and local government revenue).

Rodríguez-Pose and Krøijer (2009) work with sub-national expenditures as a percentage of total expenditures, sub-national revenues as a percentage of total revenues tax revenue as a percentage of total sub-national revenues and grants, transfers to sub-national governments from other levels of government as a percentage of total sub-national revenues and grants and vertical fiscal imbalance to explain the degree to which sub-national governments rely on central government revenues to support their expenditures.

Samini et al. (2010) uses ratio of provincial tax revenue to consolidated government tax revenue and ratio of provincial tax revenue to consolidated government total revenue.

Rodríguez-Pose and Ezcurra (2011) use various fiscal decentralization indicators. Expenditure on health, on economic affairs, on education and on social protection is amending indicators of decentralization of total expenditure, of total revenue, of current expenditure and of capital expenditure. The fiscal decentralization measures set are completed with political decentralization and administrative decentralization. Majority of studies use a real GDP per capita growth rate as a measure of economic growth.

According to Breuss and Eller (2004) there are only few exceptions as Akai, Nishimura and Sakata (2004), measuring the economic volatility, or Thießen (2003) measuring the economic growth most frequently based on the real GDP per capita growth, and also using the total factor productivity growth and real gross fixed capital as dependent variable.

Data and Estimation

We estimate a dynamic panel data model for EU-26 (i.e. the EU-28 except Malta and Croatia, which have been excluded from our sample due to missing data for Croatia and extremely low fiscal decentralization rate in Malta). The annual data cover time period from 1997 to 2015. To GMM estimation mentioned hereinbefore, a vector of control variables is involved. It contains the initial level of GDP per capita, population size, school enrolment, investments, inflation rate, economy openness, dependency ratio, public debt and a dummy variable for the world financial crisis in 2009. The choice of each explicative variable is explained in the section of basic assumptions of the research. Variables involved to the estimation model, details of labelling, error interpretation supplemented by the information about the data sources are listed in Appendix.

As we assume a non-linear impact of fiscal decentralization on economic growth (the so called inverted U-shaped or hump-shaped relation as already mentioned), we estimate the threshold value of fiscal decentralization at which expectedly positive relation between fiscal decentralization and economic growth turns negative using a quadratic functional form (as it is proposed by Checherita-Westphal and Rother, 2012; Presbitero, 2012). In order to avoid an endogeneity bias, we estimate a dynamic panel data model using Generalised method of moments (GMM) framework. As it is stated by Croissant and Millo (2008), dynamic panel data models and in general lack of strict exogeneity of the regressors pose further estimation problems, which can be dealt with using the GMM framework.

In our case, a fiscal decentralization is measured in three ways: (i) Revenue decentralization (share of sub-national revenues on total government revenues to GDP), (ii) Tax decentralization (share of sub-national tax revenues on sub-national total revenues to GDP), (iii) Expenditure decentralization (share of sub-national expenditure on total government expenditure to GDP).

Therefore, we estimate three types of non-linear dynamic panel data model, using the revenue decentralization (3), tax decentralization (4) and expenditure decentralization (5):

$$GDPPC_{Gt} =$$
$$\beta_0 + \beta_1 GDPPC_{Gt-1} + \beta_2 GDPPC_{Gt-2} + \beta_3 REVDEC_t$$
$$+ \beta_4 REVDEC_t^2 + \beta_5 GDPPC_{Lt} + \beta_6 INV_t + \beta_7 POP_{Lt} + \beta_8 DEP_t \quad (3)$$
$$+ \beta_9 OPEN_t + \beta_{10} DEBT_t + \beta_{11} SCHOOL_t + \beta_{12} HICP_t$$
$$+ \beta_{13} D_{09t} + u_t$$

$$GDPPC\_G_t =$$
$$\beta_0 + \beta_1 GDPPC\_G_{t-1} + \beta_2 GDPPC\_G_{t-2} + \beta_3 TAXDEC_t$$
$$+ \beta_4 TAXDEC_t^2 + \beta_5 GDPPC\_L_t + \beta_6 INV_t + \beta_7 POP\_L_t \qquad (4)$$
$$+ \beta_8 DEP_t + \beta_9 OPEN_t + \beta_{10} DEBT_t$$
$$+ \beta_{11} SCHOOL_t + \beta_{12} HICP_t + \beta_{13} D\_09_t + u_t$$

$$GDPPC\_G_t =$$
$$\beta_0 + \beta_1 GDPPC\_G_{t-1} + \beta_2 GDPPC\_G_{t-2} + \beta_3 EXPDEC_t$$
$$+ \beta_4 EXPDEC_t^2 + \beta_5 GDPPC\_L_t + \beta_6 INV_t + \beta_7 POP\_L_t \qquad (5)$$
$$+ \beta_8 DEP_t + \beta_9 OPEN_t + \beta_{10} DEBT_t$$
$$+ \beta_{11} SCHOOL_t + \beta_{12} HICP_t + \beta_{13} D\_09_t + u_t$$

Revenue decentralization, tax decentralization and expenditure decentralization are gradually lagged by 1, 2, 3 and 4 years, which allow showing lagged effects of fiscal decentralization on economic growth. Further, the estimation shows that school enrolment (SCHOOL) and inflation rate (HICP) are not significant and are consequently excluded from our model as their exclusion has no impact on estimation results.

4. Results and Discussion

In the case of revenue decentralization, the effect is not instant. It's lagged positive and significant influence on economic growth is observed after three and four periods (see Table 1 Model (4) and (5)). It corresponds to delayed decentralization gains caused by decentralization costs corresponding to the fiscal decentralization implementation in the new EU member states. Reaching the 23% (see Figure 1, threshold = 0.23) its influence on economic growth makes a U-turn and accordingly changes to negative. It means that extensive decentralization brings additional costs related to the bureaucracy and administration. The hump-shaped relationship between fiscal decentralization and economic growth is also confirmed.

Economic growth of EU member states is influenced positively by the level of investment supporting given assumptions. Negative effect of public debt and world financial crisis in 2009 is in accordance with expectations. Significant unexpected positive effect of dependency ratio and feeble significant unexpected positive effect of population size on economic growth is observed and might be explained by lower fertility rate in developed economies as the countries of EU are.

Table 1

The Non-linear Impact of Revenue Decentralization (REVDEC) on Economic Growth; Explained Variable: GDP per capita Growth (%)

Model/Variable	(1) Lag 0	(2) Lag 1	(3) Lag 2	(4) Lag 3	(5) Lag 4	(6) Lag 4
$GDPPC\_G_{t-1}$	–0.111*	–0.109*	–0.109*	–0.107*	–0.099.	–0.095.
$GDPPC\_G_{t-2}$	–0.132*	–0.132*	–0.138*	–0.132*	–0.171**	–0.184***
$REVDEC_t$	4.977					
$REVDEC_t^2$	–17.405					
$REVDEC_{t-1}$		–9.329				
$REVDEC_{t-1}^2$		16.493				
$REVDEC_{t-2}$			14.487			
$REVDEC_{t-2}^2$			–35.488			
$REVDEC_{t-3}$				68.173.		
$REVDEC_{t-3}^2$				–134.365.		
$REVDEC_{t-4}$					62.698.	53.255
$REVDEC_{t-4}^2$					–133.99*	–117.59*
GDPPC_L	–9.561	–9.989	–9.271	–9.882	–2.929	0.129
INV	1.080***	1.088***	1.090***	1.108***	1.126***	1.159***
POP_L	72.698.	72.285.	74.365.	89.583*	190.74.	212.90.
DEP	1.041*	1.017*	1.071*	1.142*	1.034*	0.824.
OPEN	0.009	0.014	0.007	0.015	0.005	0.006
DEBT	–0.168**	–0.168**	–0.168**	–0.174**	–0.199**	–0.178**
SCHOOL						–1.323
HICP						–0.154
D_09	–10.993***	–11.009***	–11.143***	–11.106***	–11.275***	–11.598***
Sargan Test	p = 1	p = 1	p = 1	p = 1	p = 1	p = 1
AC test (1)	p = 0.0026	p = 0.0023	p = 0.0025	p = 0.0020	p = 0.0025	p = 0.0026
AC test (2)	p = 0.0848	p = 0.0896	p = 0.0985	p = 0.0730	p = 0.3225	p = 0.2143
Wald test	p < 2.22e – 16	p < 2.22e – 16	p < 2.22e – 16	p < 2.22e – 16	p < 2.22e – 16	p < 2.22e – 16

Note: *** = 0.001; ** = 0.01; * = 0.5; . = 0.1 denotes significance level. One way (individual) effect One step model. Balanced Panel: 26 countries (EU-28 except Croatia and Malta); time period: 1997 – 2015. REVDEC is gradually lagged by 1, 2, 3 and 4 years. Autocorrelation test (1) shows the presence of autocorrelation, however the autocorrelation test (2) shows that there is no problem with autocorrelation (p-value > 0.05). Sargan test checks for the exogeneity of used instruments; its p-value = 1, which means that the instruments are exogenous and valid.

Source: Own calculation.

Figure 1

Non-linear Impact of Revenue Decentralization on Economic Growth
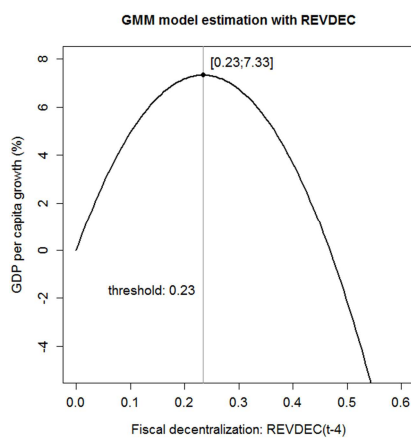
Note: Estimated equation is displayed, in which revenue decentralization is lagged by four years and became statistically significant (model (5), see Table 1). The estimated parabolic curve has the parameterization: $GDPPC\_G_t = 62.698\ REVDEC_{t-4} – 133.99\ (REVDEC_{t-4})^2$.

Source: Own calculation.

Model taking into account tax decentralization brings similar results as the model where revenue decentralization takes place. The significant positive effect of tax decentralization on economic growth appears in four period lagged model (see Table 2, model (5)). Its influence turns to negative reaching the level of 36% (see Figure 2, threshold = 0.36). As it is in a case of revenue decentralization, the extensive tax decentralization inhibits economic growth retrieving additional costs related to the administration and wrong assignment of tax instruments. Thus, the non-linear hump-shaped linkage between fiscal decentralization and economic growth is confirmed again.

T a b l e 2

The Non-linear Impact of Tax Decentralization (TAXDEC) on Economic Growth; Explained Variable: GDP per capita Growth (%)

Model/Variable	(1) Lag 0	(2) Lag 1	(3) Lag 2	(4) Lag 3	(5) Lag 4	(6) Lag 4
$GDPPC\_G_{t-1}$	−0.141**	−0.107*	−0.111*	−0.115*	−0.102*	−0.094.
$GDPPC\_G_{t-2}$	−0.148*	−0.142*	−0.144*	−0.135*	−0.179**	−0.197***
$TAXDEC_t$	−11.343					
$TAXDEC_t^2$	23.543					
$TAXDEC_{t-1}$		−8.075				
$TAXDEC_{t-1}^2$		22.755				
$TAXDEC_{t-2}$			42.160.			
$TAXDEC_{t-2}^2$			−58.897.			
$TAXDEC_{t-3}$				36.206		
$TAXDEC_{t-3}^2$				−42.300		
$TAXDEC_{t-4}$					78.650**	83.909**
$TAXDEC_{t-4}^2$					−108.60***	−113.00**
GDPPC_L	−8.499	−8.869	−8.332	−7.095	−0.477	3.485
INV	1.146***	1.105***	1.098***	1.083***	1.097***	1.144***
POP_L	142.836	78.656.	59.862	58.219	115.79	146.27
DEP	0.882*	0.978*	0.993*	0.996*	0.764.	0.496
OPEN	−0.006	0.012	0.004	0.014	−0.006	−0.004
DEBT	−0.156**	−0.161**	−0.169**	−0.176**	−0.178***	−0.157***
SCHOOL						−1.561
HICP						−0.254
D_09	−11.246***	−10.980***	−11.148***	−10.963***	−11.108***	−11.584***
Sargan Test	p = 1	p = 1	p = 1	p = 1	p = 1	p = 1
AC test (1)	p = 0.0021	p = 0.0030	p = 0.0029	p = 0.0023	p = 0.0018	p = 0.0018
AC test (2)	p = 0.1287	p = 0.0958	p = 0.0893	p = 0.1182	p = 0.3065	p = 0.1790
Wald test	p < 2.22e − 16	p < 2.22e − 16	p < 2.22e − 16	p < 2.22e − 16	p < 2.22e − 16	p < 2.22e − 16

Note: *** = 0.001; ** = 0.01; * = 0.5; **.** = 0.1 denotes significance level. One way (individual) effect One step model. Balanced Panel: 26 countries (EU-28 except Croatia and Malta), time period: 1997 – 2014 as data of TAXDEC are available only up to 2014 for 24 countries. TAXDEC is gradually lagged by 1, 2, 3 and 4 years. Autocorrelation test (1) shows the presence of autocorrelation, however the autocorrelation test (2) shows that there is no problem with autocorrelation (p-value > 0.05). Sargan test checks for the exogeneity of used instruments; its p-value = 1, which means that the instruments are exogenous and valid.

Source: Own calculation.

Positive impact of investment on economic growth matches expectations. Dependency ratio behaves contrary to assumptions. In addition, its significance is reduced in the four lag model. Public debt and dummy for financial crisis in 2009 affects the economic growth negatively as expected.

F i g u r e 2

Non-linear Impact of Tax Decentralization on Economic Growth

GMM model estimation with TAXDEC
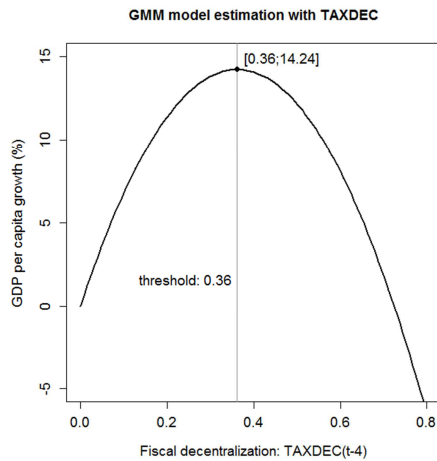
Note: Estimated equation is displayed, in which tax decentralization is lagged by four years and became statistically significant (model (5), see Table 2). The estimated parabolic curve has the parameterization: $GDPPC\_G_t = 78.650\ TAXDEC_{t-4} - 108.60\ (TAXDEC_{t-4})^2$.

Source: Own calculation.

F i g u r e 3

Non-linear Impact of Expenditure Decentralization on Economic Growth

GMM model estimation with EXPDEC
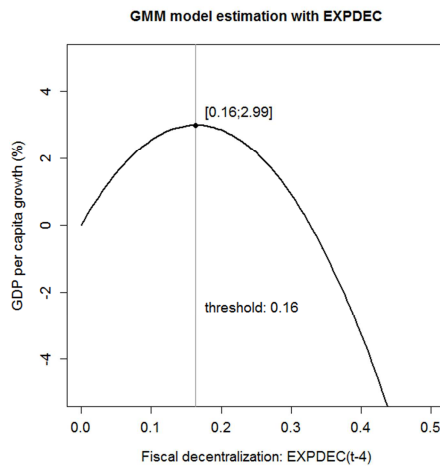
Note: Estimated equation is displayed, in which expenditure decentralization is lagged by four years (model (5), see Table 3). The estimated parabolic curve has the parameterization: $GDPPC\_G_t = 36.610\ EXPDEC_{t-4} - 111.890\ (EXPDEC_{t-4})^2$.

Source: Own calculation.

Models for expenditure decentralization exhibit the hump-shaped relationship between fiscal decentralization and economic growth, but the indicator of expenditure decentralization is not significant (see Table 3, for the threshold = 0.16 see Figure 3).

Significant expected positive effect on economic growth has the level of investment, negative effect have public debt and financial crisis. At 10% significance level the positive influence of population and dependency ratio (model 5) is observed contrary to given assumptions.

T a b l e 3

The Non-linear Impact of Expenditure Decentralization (EXPDEC) on Economic Growth; Explained Variable: GDP per capita Growth (%)

Model/Variable	(1) Lag 0	(2) Lag 1	(3) Lag 2	(4) Lag 3	(5) Lag 4	(6) Lag 4
$GDPPC\_G_{t-1}$	–0.115*	–0.110*	–0.111*	–0.117*	–0.103*	–0.099.
$GDPPC\_G_{t-2}$	–0.133*	–0.132*	–0.135*	–0.142*	–0.186***	–0.199***
$EXPDEC_t$	23.395					
$EXPDEC_t^2$	–23.741					
$EXPDEC_{t-1}$		29.369				
$EXPDEC_{t-1}^2$		–67.288				
$EXPDEC_{t-2}$			19.963			
$EXPDEC_{t-2}^2$			–63.422			
$EXPDEC_{t-3}$				29.523		
$EXPDEC_{t-3}^2$				–95.508.		
$EXPDEC_{t-4}$					36.610	25.081
$EXPDEC_{t-4}^2$					–111.890	–89.585
GDPPC_L	–10.299	–10.171	–8.896	–8.310	–1.193	1.841
INV	1.102***	1.100***	1.088***	1.119***	1.131***	1.159***
POP_L	80.225.	75.380.	70.122.	76.239.	180.260.	200.686.
DEP	1.049*	1.062*	1.051*	1.033*	0.910.	0.710
OPEN	0.015	0.012	0.004	0.005	–0.006	–0.004
DEBT	–0.161**	–0.166**	–0.170**	–0.173**	–0.195**	–0.174**
SCHOOL						–1.312
HICP						–0.148
D_09	–10.989***	–10.981***	–11.183***	–11.115***	–11.260***	–11.575***
Sargan Test	p = 1	p = 1	p = 1	p = 1	p = 1	p = 1
AC test (1)	p = 0.00255	p = 0.0022	p = 0.0025	p = 0.0027	p = 0.0028	0.002878
AC test (2)	p = 0.0757	p = 0.0951	p = 0.0743	p = 0.1400	p = 0.3984	0.26309
Wald test	p < 2.22e – 16	p < 2.22e – 16	p < 2.22e – 16	p < 2.22e – 16	p < 2.22e – 16	p < 2.22e – 16

Note: *** = 0.001; ** = 0.01; * = 0.5; **.** = 0.1 denotes significance level. One way (individual) effect One step model. Balanced Panel: 26 countries (EU-28 except Croatia and Malta), time period: 1997-2015. EXPDEC is gradually lagged by 1, 2, 3 and 4 years. Autocorrelation test (1) shows the presence of autocorrelation, however the autocorrelation test (2) shows that there is no problem with autocorrelation (p-value > 0.05). Sargan test checks for the exogeneity of used instruments; its p-value = 1, which means that the instruments are exogenous and valid.

Source: Own calculation.

F i g u r e 4

Comparison of Estimated Non-linear Impact of Revenue Decentralization, Tax Decentralization and Expenditure Decentralization on Economic Growth
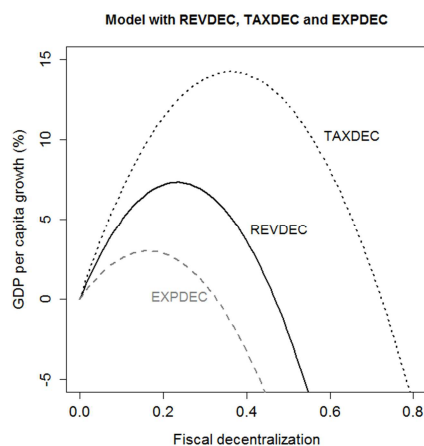
Note: Revenue decentralization (REVDEC), tax decentralization (TAXDEC) and expenditure decentralization (EXPDEC) are lagged by 4 years (i.e. for each measure of fiscal decentralization we display model (5), see Table 1, 2 and 3). The displayed parabolas: (1) GDPPC_Gt = 62.698 REVDECt-4 - 133.99 (REVDECt-4)², (2) GDPPC_Gt = 78.650 TAXDECt-4 -108.60 (TAXDECt-4)², (3) GDPPC_Gt = 36.610 EXPDECt-4 -111.890 (EXPDECt-4)².

Source: Own calculation.

Review of observed variable significance for each equation and each model is summarized in Table 4.

Comparing the inverted U-shaped or hump-shaped curves (see Figure 4) according to estimated models, for the revenue decentralization the threshold is 0.23; for the tax decentralization the threshold is 0,36 and if the expenditure decentralization were significant, its threshold is 0,16. Exceeding the threshold the gains of fiscal decentralization decay and the economic growth is inhibited.

T a b l e 4

Summary of the Variable Significance, Hump-shaped Relation in Grey

Model	REVDEC					TAXDEC					EXPDEC				
Lag/Variable	0	1	2	3	4	0	1	2	3	4	0	1	2	3	4
$GDPPC\_G_{t-1}$	(−)	(−)	(−)	(−)	(−)	(−)	(−)	(−)	(−)	(−)	(−)	(−)	(−)	(−)	(−)
$GDPPC\_G_{t-2}$	(−)	(−)	(−)	(−)	(−)	(−)	(−)	(−)	(−)	(−)	(−)	(−)	(−)	(−)	(−)
FD_t															
FD_t^2															
FD_{t-1}															
FD_{t-1}^2															
FD_{t-2}								(+)							
FD_{t-2}^2								(−)							
FD_{t-3}				(+)											
FD_{t-3}^2				(−)										(−)	
FD_{t-4}					(+)					(+)					
FD_{t-4}^2					(−)					(−)					
GDPPC_L															
INV	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)
POP_L	(+)	(+)	(+)	(+)	(+)		(+)				(+)	(+)	(+)	(+)	(+)
DEP	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)
OPEN															
DEBT	(−)	(−)	(−)	(−)	(−)	(−)	(−)	(−)	(−)	(−)	(−)	(−)	(−)	(−)	(−)
SCHOOL															
HICP															
D_09	(−)	(−)	(−)	(−)	(−)	(−)	(−)	(−)	(−)	(−)	(−)	(−)	(−)	(−)	(−)

Note: FD is corresponding fiscal decentralization indicator.
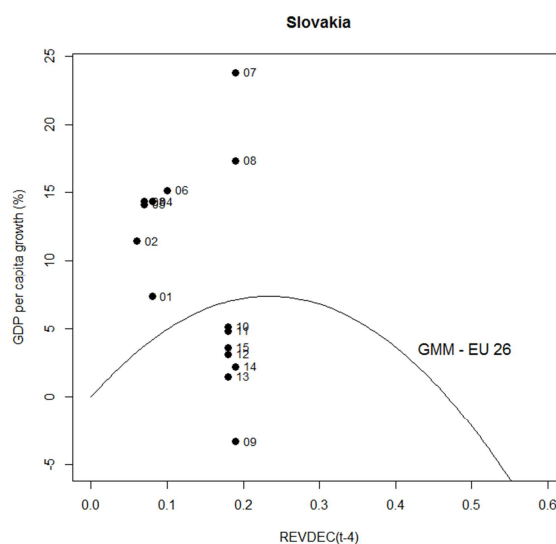
Source: Own calculation.

Does Slovakia Emulate the EU Trend?

When looking at estimated model with revenue decentralization, real data evolution in Slovakia corresponds approximately to the inverted U-shaped relationship between fiscal decentralization and economic growth in EU countries estimated by GMM model. Although the evolution in Slovakia does not emulate strictly the EU trend (curve of GMM – EU-26, see Figure 5), the principle of inverted U-shaped relationship between fiscal decentralization and economic growth is here preserved. Additionally, the positive relationship turns to negative somewhere near the threshold (0.23) what is considered as optimum degree of revenue decentralization. Revenue decentralization in the area of peak does not exceed the threshold value. The point 07 (year 2007) refers on the period of

economic expansion in the Slovakia. Balancing the revenue decentralization stagnancy and further decrease of economic growth, external factors as financial crisis might cause the break of the economic growth (point 09). In time of economic crisis, arrangements of central government level are predominant and decentralization should bend before centralized decision-making as mentions e.g. Oates (2005). That might be also a reason of the discontinuous behaviour of the revenue decentralization.

F i g u r e 5

Confrontation of GMM Panel Data Estimation for EU (Revenue Decentralization Model see Table 1, model (5)) with Real Data Evolution in Slovakia
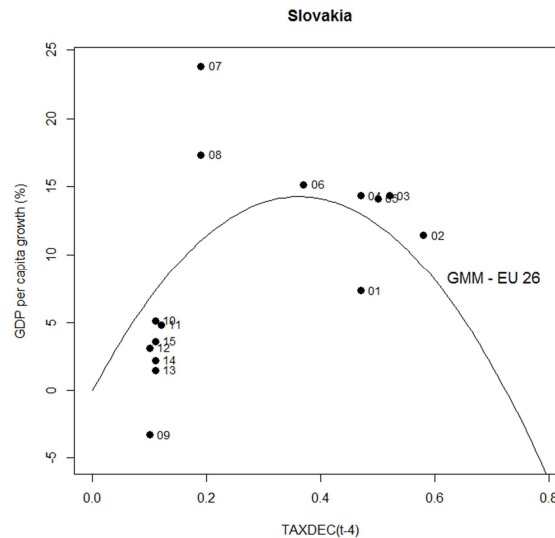

Note: Points 01 – 15 refer on time period 2001 – 2015, revenue decentralization is lagged by four years, e.g. point 01 corresponds to economic growth in 2001 and revenue decentralization in 1997.

Source: Own calculation.

Evolution of real data of tax decentralization in Slovakia (see Figure 6) corresponds better with the GMM – EU-26 curve as it was in the case of revenue decentralization. As the tax decentralization was decreasing during the analysed period in Slovakia real data get closer to the estimated parabola in the opposite direction. Reduction of excessive tax decentralization activated the economic performance. Passing the threshold value (0.36) the economic growth in Slovakia still increased due to the important economic expansion in 2007 (point 07). In 2009 the financial crisis affected all EU countries including the economy of Slovakia (point 09). Tax decentralization decreased below 0.2 and remained on this level. Here again, arrangements of central government level are preferred to decentralization.

Figure 6

Confrontation of GMM Panel Data Estimation for EU (Tax Decentralization Model see Table 2, model (5)) with Real Data Evolution in Slovakia

Note: Points 01 – 15 refer on time period 2001 – 2015, tax decentralization is lagged by four years, e.g. point 01 corresponds to economic growth in 2001 and tax decentralization in 1997.

Source: Own calculation.

Conclusions

The paper investigates for the inverted U-shaped relationship between fiscal decentralization and economic growth using a dynamic panel data model (GMM) for the sample of EU countries during a period from 1997 to 2015. Identified threshold value of fiscal decentralization represents a point, where the positive effect of fiscal decentralization on economic growth turns to negative. It corresponds to situation when fiscal decentralization gains leading to higher economic performance disappear. Further fiscal decentralization is considered as excessive and causes the economic growth inhibition. On the sample of EU-26 countries, the inverted U-shaped (or hump-shaped) relationship between fiscal decentralization and economic growth is confirmed in two of three different modes of fiscal decentralization measuring. Given assumption is supported by revenue decentralization (estimated threshold = 0.23) and tax decentralization (estimated threshold = 0.36). It should be pointed out that lagged influence of fiscal decentralization is important. GMM estimation reveals desired and statistically significant relationship using four years lag. The impact of expenditure decentralization on economic growth is evolving similarly, but the estimated

coefficients are insignificant. In order to avoid neglecting of control variables determining the economic growth, expected significant positive effect of invest-ments as proxy to physical capital was observed. In accordance with expecta-tions, data and model indicate that public debt and factor of world financial crisis in 2009 influence economic growth negatively. Population size and dependency ration have weak positive but unexpected effect on economic growth, which might be explained by the low fertility in developed countries as is argued in related literature. Proxy of human capital, initial level of GDP per capita and economy openness is not significant.

The transformation process of the post-communist Slovakia included wide reforms of public sector. Fiscal decentralization was introduced in 2001. Its po-tential impact on economic growth was marked by the undesirable division of responsibilities shift and shift of resources to lower government levels. It was also distorted by the expansion of economy in the next period. Later it suffered from the financial economic crisis coming in 2009. As the mentioned factors are common also for many other EU countries, especially post-communist (when considering also the procedure of the fiscal decentralization implementation), real values of fiscal decentralization and economic growth emulate the inverted U-shaped relationship between fiscal decentralization and economic growth es-timated by GMM model for EU-26 countries. This conformity is much more obvious in case of tax decentralization.

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A p p e n d i x

Variables Involved to GMM Estimations

Variable	Label	Explanation	Source
Economic Growth	GDPPC_G	GDP per capita growth based on gross domestic product at market prices	Eurostat (2016); OECD (2016); WB (2016)
Expenditure decentralization	EXPDEC	Share of sub-national expenditure to GDP	Eurostat (2016)
Revenue decentralization	REVDEC	Share of sub-national revenues to GDP	Eurostat (2016)
Tax decentralization	TAXDEC	Share of sub-national tax revenues on sub-national revenues to GDP,	Eurostat (2016)
Initial GDP pc	GDPPC_L	Initial level of GDP, logarithmic transformation of gross domestic product at market prices	Eurostat (2016), OECD (2016), WB (2016)
Population	POP_L	Logarithmic transformation of population based on population on 1 January – total	Eurostat (2016)
School enrolment	SCHOOL	Educational attainment for total population as proxy to human capital	Barro and Lee database (2000)
Investments	INV	As proxy to physical capital	Eurostat (2016)
Inflation rate	HICP	HICP annual average rate of change	Eurostat (2016)
Openness	OPEN	Sum of export of goods and services to GDP and imports of goods and services to GDP	Eurostat (2016)
Dependency ratio	DEP	Age dependency ratio, 1st variant (Population aged 0-14 and 65 and more to pop. aged 15-64) on productive population, proxy to human capital	Eurostat (2016)
Public debt	DEBT	Public debt to GDP based on government consolidated gross debt	Eurostat (2016), OECD (2016), WB (2016)
Financial crisis	D_09	Dummy variable for world financial crisis starting in 2009	–

Source: Own.