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SEARCHING FOR A RESTRAINT ON THE EUROPEAN LEVIATHAN

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Abstract

The purpose of this paper is to analyze the effect of fiscal decentralization on the government size in the European Union member states. The Two-Stage Least squares procedure is applied on the panel data for the period 2000-2010. The regression model which is constructed includes the total amount of government tax revenue as a dependent variable. The revenue and expenditure variable for fiscal decentralization are put as main explanatory variables. The empirical results support the theoretical assumptions for the restrictive influence of the revenue decentralization as well as the increasing effect of the expenditure decentralization on the government intrusion into economy measured via the amount of tax revenue.

Keywords: local share of total government revenue, the ratio of local expenditure to GDP, tax revenues, government intrusion into economy, revenue-maximizing behavior.
JEL classification H77; R55; H71; H72.

1. INTRODUCTION

Economists and politicians are interested in the optimization of the size of government. Some of them analyze the behavior of public authority in terms of the absence of constraints on its monopolistic place in tax levying. Then the most expected behavior of the governments is to abuse with their monopolistic power and to seek revenue maximizing. Thus, the size of government will increase and also the government intrusion into economy. These assumptions are made into a system in the Leviathan model developed by Brennan and Buchanan (1977, 1978, 1980).

The size of government is normally related to the government intrusion into the economy. Therefore, we could agree that a smaller intrusion is a fundamental precondition for the development of free market economy. Thus, the developed economies aim at purifying the market mechanism and the developing economies aim at building capacity for economic development.

In the economic literature, many authors agree that decentralization is a reliable "tool" for confining the government size within certain limits. There is a set of theoretical constructions concerning the role of fiscal decentralization as a restraint on the size of

government. However, the empirical support of these conceptual predictions is still unpersuasive and ambiguous.

Furthermore, decentralization is included in a lot of policies intending to urge forward the quality and the transparency of public government, the efficiency in public sector, the economic development, democracy, etc. At the early stage of the economic transition, the post-socialist Central and Eastern Europe countries adopted the decentralization as an instrument contributing to the democratization of society. Furthermore, fiscal decentralization also was a part of the reform packages in these countries during the whole democratic transition. Despite the realized importance of fiscal decentralization, it was not often linked to neither the government size nor economic growth. These objectives were rather related to the privatization of government assets.

The achievements of many countries in restraining the government size by the means of fiscal decentralization are still contestable. The European Union member states have implemented straightforward and coordinated decentralization policy since 1980s. Their efforts in this scope are incorporated in some acts of the EU law. One of the main benefits for the newly integrated countries is that they have the chance to adopt the achievements and the best practice of the old members.

Therefore, the purpose of this paper is to analyze the influence of fiscal decentralization on the size of government in the European Union for the period of 2000 - 2010. Separately, we are able to estimate the actual state of the reforms and their results immediately before and after the EU membership of the new member states. The intrusion into the economy is analyzed in terms of the total amount of tax revenue, which is adopted as a measure for the size of government. Moreover, tendency among the EU members to achieve an approximately similar redistribution of GDP through state budget is also valid for recent years (Stoilova, 2010, p.94).

2. LITERATURE REVIEW

The first attempts of empirical work on this topic do not confirm the hypothesis of the Leviathan State. The most cited study of Oates (1985) is focused on the relationship between the total tax revenue and two fiscal centralization ratios: the state share of total government revenues and the state share of total government expenditure. The results of his study "suggest that there does not exist a strong, systematic relationship between the size of government and the degree of centralization of the public sector" (Oates, 1985, p. 756). Thus, the revenue-maximizing hypothesis (the Leviathan State Hypothesis) is not empirically confirmed. The investigation of Nelson (1986) focused on the United States does not empirically confirm the revenues-maximizing hypothesis at state government level. He found a negative impact of fiscal decentralization on tax revenues in state budgets.

Using the ratio of total government expenditure to GDP as a measure for the size of government, the most important result which Joulfaian and Marlow (1991) find is the negative influence of the local share of total government expenditure and the number of local governments on the ratio of interest. The analysis of Ehdaie (1994) has found a negative influence of the revenue side of decentralization on the public sector size.

The empirical study of Jin and Zou (2002) show that the expenditure side of decentralization increases the government size and the revenue side of decentralization reduces it. Rodden (2003) found a weak negative effect of lagged subnational own-source share of total government revenue on the ratio of total government expenditure to GDP.

When first lag is not used, the effects are positive. He also estimated a small positive impact of grants on the same ratio. Despite these results, a large negative long-run effect is registered for the ratio of autonomous subnational tax revenue to total government revenue, when dummies for “high” and “low” tax autonomy have been included in estimations.

The Swiss Confederation is an important example for a traditionally high degree of decentralization. The two-stage least squares estimation of Feld, Kirchgässner and Schaltegger (2003) supports the hypothesis for a negative impact of revenue decentralization on both total cantonal government revenue and the total amount of cantonal tax revenue. The tax competition does not play its depressing role for the cantonal government ability to generate tax receipts.

Meloche, Vaillancourt, Yilmaz (2004) use the subnational share of total government revenue and the subnational share of total government spending as measures for fiscal decentralization and find a positive effect of these variables on the public sector size in the Central and Eastern European countries in transition. They also find a negative impact of the subnational tax autonomy.

Shah (2006) conducts a cross-country regression analysis on the influence of fiscal decentralization on macroeconomic governance. He found a statistically insignificant negative impact of a quantitative indicator for fiscal decentralization on the total amount of government expenditure. Other his contribution is the indication of a strong positive effect of fiscal transfers on the government size measured through total government expenditure.

Prohl and Schneider (2009) test whether decentralization reduces the size of government and estimate the quantitative impact of fiscal federalism on the government size in the OECD countries. They apply the General Method of Moments technique and find the statistically significant influence of both revenue and expenditure decentralization on the growth of government.

A highly elaborated approach is developed by Crowley and Sobel (2011). Basing on its results, they "are able to confirm the positive role of intergovernmental competition and fiscal decentralization in constraining the Leviathan behavior of governments" (Crowley and Sobel, 2011, p.27)

Cinera, Estanche and Wolf (2012) measure fiscal decentralization via subnational share of total government expenditure by functions and estimate its effects on the total amount of government expenditure for each function. Their study is focused on thirty European countries. Main result they have found is a statistically significant negative impact of the subnational share of total government expenditure on the total amount of government spending.

The paper of Eyraud and Badiaremind (2013) is focused on the fiscal decentralization and fiscal performance in the old member states of the European Union. They assert that "highly-decentralized countries have larger public sectors" (Eyraud and Badiaremind, 2013). Testing empirically this assumption, the authors find a positive correlation between the share of subnational own spending in general government spending and the ratio of general government expenditure to GDP in the EU-15.

Reviewing the empirical literature, Golem (2010) summarizes that "little consensus has emerged on the effect of fiscal decentralization and the size of government"(Golem, 2010, p.63). Furthermore, she cites as a concluding remark the observation by Rodden (2003) – “those who are alarmed that the global trend toward fiscal decentralization entails dangerous tax competition have little to fear, and those who envision smaller, more efficient government have little to celebrate" (Rodden, 2003, p.724).

3. CONCEPTUAL FRAMEWORK

According to the Leviathan model, government tends to maximize its size and its tax revenues up to the peak of the Laffer curve. The Leviathan power of government is restrained by constitutional constraints and the competition among subnational jurisdictions. The insights for the positive effects of subnational governments' competition are completely systematized by Tiebout (1956). In the context, Rodden reminds us that "for good or ill, fiscal decentralization is commonly thought to restrict the growth of government spending" (Rodden, 2003, p. 695).

The possible logics of this restrictive effect of fiscal decentralization on the public sector size could be expressed as follows. Total government spending (g) is equal to total government revenue (r) in terms of balanced budget.

$$g = r \quad (1)$$

Total government revenue is a sum of tax revenues (t), quasi-tax revenues (q) and pure nontax revenues (n).

$$r = t + q + n \quad (2)$$

Total tax revenues are a sum of different tax items. In the framework of fiscal decentralization, the total tax revenue is collected at three government levels – central, provincial and local. Let c be central tax revenues, p is provincial tax revenue and l is local tax revenue. Thus,

$$t = c + p + l \quad (3)$$

The positive effects of fiscal decentralization arise in terms of competition among subnational jurisdictions (μ). According to the Tiebout model (1956), the subnational jurisdictions attract citizens through its revenue-expenditure patterns and consumer-voters choose desired one on the base of comparisons between revenue-expenditure patterns of identical subnational units. Thus, fiscal decentralization, accompanied with interjurisdictional competition, exerts an incentive influence on public spending and tax levying at subnational government level.

Therefore, the benefits of revenue decentralization are related to urging forward more efficient tax collection. The last fact results in a change of the level of fiscal effort (φ), which "is affected by the level of tax rates applied, by the level of exemption granted, and by the tax enforcement effort exerted by the tax administration authorities" (Martinez-Vasquez and Boex, 1997). The fiscal effort is also linked to the taxpayer compliance.

According to these assumptions, the fiscal effort could be expressed as a function of the subnational competition:

$$\varphi = f(\mu) \quad (4)$$

The total amount of tax revenue could be expressed as a function of both the taxable resource (ρ) and the fiscal effort:

$$t = f(\rho, \varphi) \text{ (5)}$$

Let us suppose that local governments finance their spending programs with a fixed amount of public resource. The urging force of the competition compels local governments to seek optimization of the public spending and to achieve higher effects of public expenditure at a fixed level of costs. Therefore, normal public good provision and service would need a lower amount of (tax) revenue at a subnational government level.

Thus, the main result from reducing the level of fiscal effort, fuller taxpayer compliance and more efficient financing spending programs is developed below. Firstly,

$$t = c + p + l + \alpha \text{ (6)}$$

where α is the component expressing effects of higher efficiency. Thus, the predictions are confirmed that "regions with the same fiscal capacity may collect different amounts of revenue as a result of different levels of taxpayer compliance" (Martinez-Vasquez and Boex, 1997). The component α is a function of the level of fiscal effort:

$$\alpha = f(\varphi) \text{ (7)}$$

and also $\alpha = f(\mu)$. (8)

Therefore, the equality concerning the total amount of tax revenue (6) shows that, ceteris paribus, the component α is a surplus, i.e. money exempted from usage.

Thus, public authority could reduce the nominal tax burden with α because the same quantitative effect can be achieved with a little tax rates but effectively distributed and administrated. Therefore government could be able to reduce total tax burden as a results of the efficiency gains.

As a result, we reach to the original Leviathan hypothesis – "total government intrusion into the economy should be smaller, ceteris paribus, the greater the extent to which taxes and expenditures are decentralized" (Brennan and Buchanan, 1980, p.185) – which "assumes the inseparability of tax and expenditure decentralization" (Golem, 2010, p.55). Thus, "the counties pursuing the objective of a smaller public sector but just decentralizing their spending powers should decentralize their taxing decisions as well" (Ehdaie, 1994, p.16). A plausible analogy has been made by Rodden and written as follows: "just as tax competition in an era of globalization is believed to place constraints on the revenue-raising capacity of governments, inter-jurisdictional competition within decentralized countries is believed to hamper government's ability to tax" (Rodden, 2003, p.695).

4. EMPIRICAL METHODOLOGY AND DATA

The method adopted in the present study is the regression on pooled panel data. The main reason for this choice is the potential for achieving a higher degree of the representativeness of the resuts.

Taking into account the frame described above, we can estimate the influence of fiscal decentralization on the government size. Furthermore, we can find the significance and the reliability of each revenue source. The regression model is developed as follows:

$$TGR_{it} = b_1 + b_2 FD_{it} + b_3 LGS_{it} + b_4 VAT_{it} + b_5 ASC_{it} + b_6 TII_{it} + \varepsilon_{it} \quad (9)$$

where TGR_{it} – total government revenues from taxes and social contributions presented as a ratio to GDP, FD_{it} – local share of total government revenue, LGS_{it} – local governments spending presented as a ratio to GDP, VAT_{it} – revenues from value added taxes presented as a ratio to GDP, ASC_{it} – revenues from actual social contribution presented as a ratio to GDP, TII_{it} – revenues from individual income taxes presented as a ratio to GDP, ε_{it} – error term. The parameters of regression model are b_1, b_2, b_3, b_4, b_5, b_6.

The results from the White Heteroskedasticity Test presented in Appendix 1 reject the null hypothesis for absence of heteroskedasticity for each group of interest. Hence, the phenomenon exists in terms of each sample. Because of this fact the Two-Stage Least Squares method is adopted as an estimation procedure. Moreover, the variables included in the regression equation are strongly correlated in terms of each group (See Appendix 2). Taking into account the degree of correlation in most of the couples of independent variables, the lagged values of the variables are chosen as instrumental variables. Excluding the local government spending, the independent variables are revenue-side items of state budget. The budget is an annual financial plan. Hence, it would be difficult to expect a direct link between the amount of total government spending for current year and the tax revenues collected during the previous year. The lagged values of the variable of interest are used as instrumental variables in the study of Ehdaie (1994).

The period of analysis covers the years from 2000 to 2010. The source of quantitative data for each variable is the Eurostat, Government Finance Statistics.

5. REGRESSION RESULTS

The correlation coefficients calculated for each pair of variables are presented in the second appendix. We estimated the correlations between the variables included in the regression model in order to identify the phenomenon of multicollinearity (Ramanathan, 1995, pp. 309-328). There are accurate procedures of tests for multicollinearity, which are not applied in the present analysis. The multicollinearity is not related to any strong distortions of the regression results and reductions of the efficiency of the estimation procedure (Ramanathan, 1995, pp. 309-328). Hence, the need of its deep estimation is not very high.

Appendix 2.1 presents the correlations we have calculated for the European Union. There are comparatively high values of the coefficients for some pairs. According to the results, the strongest correlation is between the local share of total government revenue and the local government expenditure. The revenues from individual income taxation are strongly correlated with the revenue variable for fiscal decentralization. The value of correlation between the same variable and local government spending is very high. It is important to be noted the negative correlation coefficient between the revenues from income taxes and actual social contribution as well as the similar positive value of the correlation between revenues from value added taxes and local governments spending.

Appendix 2.2 presents the correlations for the same pairs of variables estimated for the new member states. The values of coefficients defer from the correlations for the EU-27 but still are very high. The present correlation between the local share of total government revenue and local government spending is lower than the coefficient calculated for the EU-

27. It could be explained with a higher degree of fiscal dependence of local governments in the new member states.

The high values of the correlations among the variables of interest are dominant in terms of the old member states. The specific of these coefficients is that their values are higher than these ones estimated for both the EU-27 and the new member states. The correlations are exclusively strong and that causes the phenomenon of multicollinearity. It is important to be noted that the value of coefficient for the pair of local share of total government revenue and local government spending is the highest in terms of the old member states. It is near to functional relationship and could be considered as reliable evidence for a high degree of fiscal autonomy of local governments in the EU-15. The other important result is the correlation between the revenues from the individual income taxes and the local share of total government revenue as well as between the revenues from the same taxes and local government spending. This is an empirical evidence for the role of income taxes as a revenue source for the local budgets in the old member states.

The statistics concerning the unit root status of the variables are given as an appendix. Respectively, Appendix 3 includes the results of the group Augmented Dicky and Fuller test for each sample of interest - the European Union, the old member states and the new member states. According to the outputs, the variables separately and as a whole are free from unit roots processes. The dynamics of the variable for revenue decentralization in terms of the new member states show the non-stationary process. These specifics predict likelihood for the presence of the non-liner relationship between the factor and the dependent variable. The adopted procedure solves in a considerable degree the problem with these relationships.

The parameters of the regression model are calculated through applying the estimation procedure on panel data for the EU-27. Moreover, the estimation procedure is separately applied on panels for the new member states and the old member states. That has been done to be achieved a higher degree of exactitude of the analysis and to be facilitated the comparisons. The regression results are presented in Table 1.

Table no. 1 Parameters of the regression model exploring the European Leviathan

Variable	**EU-27**	**EU-15**	**NMS**
Constant	8.052*** (6.920)	9.886*** (4.602)	-0.899 (-0.527)
Local share of total government revenue (%)	-0.157*** (-6.378)	-0.139** (-2.056)	-0.081*** (-3.361)
Local governments expenditure (ratio to GDP)	0.226*** (3.762)	0.290** (1.991)	0.106** (2.123)
Revenues from Value Added Taxes (ratio to GDP)	0.816*** (7.519)	0.949*** (4.772)	1.735*** (12.551)
Revenues from social contributions (ratio to GDP)	1.013*** (30.087)	0.959*** (19.294)	1.123*** (21.700)
Revenues from taxes on individual income (ratio to GDP)	1.193*** (29.493)	0.967*** (15.523)	1.133*** (12.037)
R-squared	0.943930	0.942832	0.927368
Adjusted R-squared	0.942884	0.940888	0.923808
S.E. of regression	1.471735	1.367765	1.057174
Durbin-Watson statistic	0.295902	0.326609	0.623341
Mean dependent variable	36.73029	40.09608	32.60556
S.D. dependent variable	6.158147	5.625656	3.829932

Sum squared residuals	580.4892	275.0049	113.9969
Observations	261	153	108

Note: t-test in parentheses

*** significant at 1%; ** significant at 5%; * significant at 10%

Source: [Eurostat, Author's calculations]

The explanatory power of the model is very high across the samples of interest. The hypothesis for positive serial correlation is confirmed by the Durbin-Watson statistic. This resut is normal and expected because the dependent and independent variables are the two sides of state budget.

According to the results, an increase in the local share of total government revenue would lead to a decrease in the total amount of government revenue from taxes and social contributions. Thus, the hypothesis for Leviathan restraint is confirmed for the European Union members. The regression coefficient is negative and statistically significant for the whole EU-27 sample, as well as for the separate samples of both the old and the new member states. The coefficient has the highest value for the whole EU-27 group. The negative effect of this factor on total government revenue is significantly stronger for the EU-15 countries than the new members. It could be explained with the degree of economic and social development of the old members. The other group includes mainly the former socialist countries from Central and Eastern Europe. Fiscal decentralization is relatively new phenomenon for these countries and therefore is it difficult to play its role for increasing in efficiency of total public sector. The present results show that fiscal decentralization contributes to the reduction of the size of government and its intrusion in the economy in the high-income European countries. Collecting revenues at a lower government level, the public authority succeeds to reduce the total tax burden and thus, ceteris paribus, to stimulate the investment activity of private sector. Another conclusion we could draw is that revenue-side decentralization is a reliable instrument for diminishing the government size and enhancing the potential for economicy growth in the new member states.

The necessity for decentralization of tax decisions is predicted by Ehdaie (1994). His empirical results show a positive effect of resources transferred from the central government to the subnational levels on the public sector size.

The present result is in accordance with the outputs of other studies on this topic. The assumptions for the restrictive role of revenue decentralization with respect to the government size are supported by the analyses of Ehdaie (1994), Rodden (2003), as well as this one of Feld, Kirchgässner and Schaltegger (2003) on the Swiss cantons.

Local government expenditure is presented as a ratio to the GDP. The regression coefficients expressing its influence have positive signs in terms of each analyzed sample. The coefficients are statistically significant at a low level of probability for error. The last fact allows to be accepted as reliable empirical evidence. The values of the estimated impact on the total amount of tax revenue are higher than these ones expressing the influence of the variable for revenue decentralization. The positive signs and comparatively high values could be explained with the fact reminded by Santerre (1991). He points out the conclusions of Mueller and Murrel (1986) that longer periods of democratic stability at country level are associated with a larger public sector. They find a positive correlation between the percentage of population voting (which is closely related to low-income voters) and the government size and thus support the Mellzer-Richard' hypothesis that "greater participation by low-income voters leads to more redistribution and greater government size" (Mueller and Murrel, 1986, p. 142). In this context, the increasing effects of local spending are the

strongest in terms of the more democratically stable old member states. Other similar insights are related to the intergovernmental transfers to sub-national entities within countries, which "cannot be simply explained without political variables representing electoral incentives - coming to a conclusion that grants are indeed determined/influenced to some extent by the political game" (Kalman, 2011, p. 5)

In a different context, Prohl and Schneider (2009) find that "the quantitative measure of expenditure decentralization has a sufficiently stronger explanatory power than those of revenue decentralization" (Prohl and Schneider, 2009, p. 659). However, their result is not in line with the present ones because it has a positive sign.

Positive signs are estimated for the regression coefficients expressing the influence of revenues from value added taxes. This is a main tax for the whole Union. Moreover, tendency to shift of tax burden on indirect taxes is seen from 2008 for the EU-27 (Stoilova, 2011, p.33) However, indirect taxes and particularly value added taxes have stronger importance as a revenue source of government in the new members. Stoilova (2011) also point out an increase in the revenues from value added taxes in the new member states even during the years of crisis. The last fact is due to more limited treatment with tax rates which are different from the standard ones. (Stoilova, 2011, p.35)

The regression coefficient expressing the impact of revenues from individual income taxes have identical character with the coefficients for the effects of social contributions. The revenues from income taxes are inextricably bound up with the actual social contributions paid. The empirical evidence is reliable, because the coefficients are statistically significant at the level of p-value less than 1%. The highest values are estimated for the new member states. These results show that direct taxes are comparatively strong revenue source for state budget in these countries. The last fact is a proof of the potential for building a tax system based on revenues from direct taxes or at least relative parity between the shares of both direct and indirect taxes.

Table 2 presents the descriptive statistic of the residuals for the samples of interest. The empirical distribution across the samples is akin to normal symmetric distribution. The test of Jarque-Bera also confirms the absence of statistically significant deviation from the normal distribution. Concequently, the parameters of the regression model, which have been estimated via the chosen method are reliable and the procedure is efficient in terms of the present research.

Table no. 2 Descriptive statistic on residuals in regression model

Indicator	**EU-27**	**EU-15**	**NMS**
Mean	-1.72e-14	2.32e-14	2.18e-15
Median	0.097762	0.097140	0.059125
Maximum	3.739355	2.753947	2.694181
Minimum	-2.844131	-2.900142	-2.304057
Std. Dev.	1.458195	1.345081	1.032178
Skewness	0.096369	-0.096399	0.106459
Kurtosis	2.593225	2.546867	2.734026
Jarque-Bera	2.313176	1.545937	0.522342
Probability	0.314558	0.461641	0.770149

Source: [Eurostat, Author's calculations]

6. CONCLUSIONS

The local share of total government revenue is an appropriate instrument for optimizing the public sector and restraining the Leviathan behavior of public authority. The empirical analysis proved the negative effect of this variable on the government size and the government intrusion into economy. Moreover, this instrument is more powerful in terms of high income countries, i.e. the old member states of the European Union.

The local government expenditure exerts significant positive influence on the government size measured by total amount of tax revenue. Furthermore, the amount of local spending affects the government size and intrusion into economy more strongly than decentralized revenues.. The increasing impact of expenditure decentralization exceeds the decreasing effect of revenue decentralization in terms of each sample of interest. These results could be accepted as a peculiar "price of democracy". Expectedly, the positive effects also are the highest in the democratically stable old members of the European Union.

However, the present results are preliminary as long as the analysis has been limited in any directions. The local share of total government spending which is a measure for expenditure-side decentralization hasn't been taken into account. The ratio of local revenue to GDP hasn't also been used into the analysis. Their influence on the total government revenue will be a subject of future comprehensive research.

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Appendix 1

Appendix 1.1. White Heteroskedasticity Test for the EU-27

White Heteroskedasticity Test:

F-statistic	9.049024	Probability	0.000000
Obs*R-squared	114.4181	Probability	0.000000

Source: Eurostat, Author's calculations
Null hypothesis: no heteroskedasticity

Appendix 1.2. White Heteroskedasticity Test for the OMS

White Heteroskedasticity Test:

F-statistic	18.03599	Probability	0.000000
Obs*R-squared	112.5149	Probability	0.000000

Source: Eurostat, Author's calculations
Null hypothesis: no heteroskedasticity

Appendix 1.1. White Heteroskedasticity Test for the NMS

White Heteroskedasticity Test:

F-statistic	3.095657	Probability	0.000137
Obs*R-squared	45.12824	Probability	0.001060

Null hypothesis: no heteroskedasticity
Source: [Eurostat, Author's calculations]

Appendix 2

Appendix 2.1. Correlations between the variables included in regression model for the EU-27

Variable	TGR	FD	LGS	VAT	ASC	TII
TGR	1.000					
FD	0.253*	1.000				
LGS	0.533*	0.902*	1.000			
VAT	0.198	0.295*	0.390*	1.000		
ASC	0.162	-0.343*	-0.351*	-0.356*	1.000	
TII	0.797*	0.503*	0.730*	0.238*	-0.393*	1.000

Note: * over the admissible values
Source: [Eurostat, Author's calculations]

Appendix 2.2. Correlations between the variables included in regression model for the NMS

Variable	TGR	FD	LGS	VAT	ASC	TII
TGR	1.000					
FD	-0.214*	1.000				
LGS	0.120	0.687*	1.000			
VAT	0.374*	-0.416*	-0.208*	1.000		
ASC	0.582*	0.437*	0.435*	-0.212*	1.000	
TII	0.565*	-0.423*	-0.100	0.060	-0.044	1.000

Note: * over the admissible values
Source: [Eurostat, Author's calculations]

Appendix 2.3. Correlations between the variables included in regression model for the OMS

Variable	TGR	FD	LGS	VAT	ASC	TII
TGR	1.000					
FD	0.477*	1.000				
LGS	0.616*	0.976*	1.000			
VAT	0.557*	0.608*	0.698*	1.000		
ASC	0.117*	-0.557*	-0.507*	-0.459*	1.000	
TII	0.731*	0.777*	0.849*	0.661*	-0.538*	1.000

Note: * over the admissible values
Source: [Eurostat, Author's calculations]

Appendix 3

Appendix 3.1. The group ADF test for the EU-27 members

Null Hypothesis: Unit root (individual unit root process)
Sample: 1 275
Series: TGR, FD, LGS, VAT, ASC, TII
Exogenous variables: Individual effects
User specified maximum lags
Automatic selection of lags based on SIC: 0
Total (balanced) observations: 1644
Cross-sections included: 6

Method	Statistic	Prob.**
ADF - Fisher Chi-square	88.0883	0.0000
ADF - Choi Z-stat	-7.81026	0.0000

** Probabilities for Fisher tests are computed using an asympotic Chi-square distribution. All other tests assume asymptotic normality.

Intermediate ADF test results UNTITLED

Series	Prob.	Lag	Max Lag	Obs
TGR	0.0007	0	2	274
FD	0.0020	0	2	274
LGS	0.0025	0	2	274
VAT	0.0000	0	2	274
ASC	0.0008	0	2	274
TII	0.0015	0	2	274

Source: [Eurostat, Author's calculations]

Appendix 3.2. The group ADF test for the old member states of the EU

Null Hypothesis: Unit root (individual unit root process)

Sample: 1 154

Series: TGR, FD, LGS, VAT, ASC, TII

Exogenous variables: Individual effects

User specified maximum lags

Automatic selection of lags based on SIC: 0

Total (balanced) observations: 918

Cross-sections included: 6

Method	Statistic	Prob.**
ADF - Fisher Chi-square	41.0294	0.0000
ADF - Choi Z-stat	-4.48398	0.0000

** Probabilities for Fisher tests are computed using an asympotic Chi-square distribution. All other tests assume asymptotic normality.

Intermediate ADF test results UNTITLED

Series	Prob.	Lag	Max Lag	Obs
TGR	0.0469	0	2	153
FD	0.0216	0	2	153
LGS	0.0283	0	2	153
VAT	0.0290	0	2	153
ASC	0.0177	0	2	153
TII	0.0840	0	2	153

Source: [Eurostat, Author's calculations]

Appendix 3.3. The group ADF test for the new member states of the EU

Null Hypothesis: Unit root (individual unit root process)

Sample: 1 121

Series: TGR, FD, LGS, VAT, ASC, TII

Exogenous variables: Individual effects

User specified maximum lags

Automatic selection of lags based on SIC: 0 to 1

Total number of observations: 707

Cross-sections included: 6

Method	Statistic	Prob.**
ADF - Fisher Chi-square	47.6937	0.0000
ADF - Choi Z-stat	-4.70255	0.0000

** Probabilities for Fisher tests are computed using an asympotic Chi-square distribution. All other tests assume asymptotic normality.

Intermediate ADF test results UNTITLED

Series	Prob.	Lag	Max Lag	Obs
TGR	0.0194	0	2	120
FD	0.4830	0	2	108
LGS	0.0275	0	2	120
VAT	0.0046	0	2	120
ASC	0.0347	0	2	120
TII	0.0011	1	2	119

Source: [Eurostat, Author's calculations]