Theoretical and Applied Economics
Volume XXI (2014), No. 10(599), pp. 7-20

How growth-friendly are productive public expenditures? An empirical analysis for Eastern Europe

Petru-Ovidiu MURA
West University of Timisoara
petru.mura@e-uvt.ro

Abstract. *This paper investigated the effects of productive public expenditures over economic growth, using a panel-model approach, in 6 East-European countries during 1990-2013. The paper contributes to the specific literature, showing how different types of productive public expenditures influence economic growth, under an extended set of economic and socio-political control variables. The findings revealed that education, R&D and infrastructure expenditure are positively correlated with economic growth, while health expenditure seems to have a negative impact.*

Keywords: productive public expenditure, economic growth, correlation, fixed-effects, panel-model.

JEL Classification: H51, H52, H54, O40.
REL Classification: 8E, 8K, 10D.

1. Introduction

It is widely accepted that productive public expenditure, such as infrastructure, research and development, the provision of high-quality education and medical services, contributes to the rising of an economy. The Lisbon Strategy and its successor, the newly adopted Europe 2020 strategy, supportive of "smart, sustainable and inclusive growth", acknowledge the positive potential impact of tax policy on long-term economic activity, especially given the legacy of the economic and financial crisis. This positive impact would result from the composition of public expenditure (with respect to its likely growth-friendliness), and not their size or fiscal revenues size, nor from fiscal balance.

The solution would be the restructuring of public expenditure, by increasing the share of productive expenditure, i.e. those which have a positive effect on production factors (capital and labor). Accordingly, the structure of public spending can become a useful tool in terms of influencing the level and the rate of economic growth through their impact on aggregate supply. At the core of this new tax policy strategy are public policy models based on endogenous growth, which are, in fact, an extension of the theory of endogenous growth.

Barro and Sala-i-Martin (1995) divide public expenditures into two main categories:

i) productive expenses, which include: public services, defense, public order and national safety, education, health, housing, public services and development, environmental protection; these items are also named "growth-friendly expenditures" (European Commission, 2012).
ii) non-productive expenses, such as: culture, recreation and religion, social protection, economic actions.

Productive public expenditures carry an impact upon the efficiency of the private sector, generating positive externalities to firms, and have a positive effect on the marginal productivity of capital and labour. Non-productive public spending have a direct benefit for households (Angelopoulos et al., 2006; Devarajan et al., 1996), affect the welfare of the consumers, but do not change the efficiency of the private sector (Barro and Sala-i-Martin, 1995).

Although empirical evidence regarding the encouraging of endogenous growth through tax policy are "mixed", a series of studies include among productive public spending the following: public investment, R&D, education, health, defense, public order, transportation, communications and environmental protection (Afonso et al., 2005; Angelopoulos et al., 2006; Barro, 1990; Romero de Avila and Strauch, 2003).

The main objective of this study is to empirically evaluate the impact of productive public spending on economic growth for six EU-member states from Eastern Europe (relatively unexplored in this area), using a panel-model approach, for the period 1990-2013. Specifically, the study explores the relative impact of different components of public expenditure (education, health, R&D, infrastructure) on economic growth. The paper contributes to the literature in the field, showing how different types of productive public spending influence economic growth in Eastern Europe, under an extended set of economic and socio-political control variables. The main finding suggests that education, infrastructure and R&D expenditures positively affect economic growth, while health expenditures are negatively correlated with the process.

The rest of the paper is structured as follows: Section 2 presents the literature review, Section 3 highlights the methodology and data, Section 4 contains the results, while Section 5 concludes.

2. Literature review

Economic growth determinants is one of the richest areas of research in modern economics, since "economists have, in some sense, always known that growth is important" (Barro and Sala-i-Martin, 1995). A large empirical and theoretical literature promotes the idea that government spending is a productive input to firms' production functions, and thus to economic growth. Starting with the seminal contribution of Barro (1990), who identified the existence of a positive correlation between government spending and long run economic growth, the consequences of this observation have been mainly discussed in the context of growth models.

The studies testing empirically the relationship between public expenditures and economic growth highlight different effects of public spending on economic growth, ranging from positive impact, negative impact or even insignificant correlation. The literature contains a relatively wide range of estimates (see Sturm et al., 1998), with a marginal product of public capital that is much higher than that of private capital, almost equal to it, far below and, sometimes, even negative.

An important contribution to the relevant literature belongs to Barro (1991), who based his study on a cross-section analysis including 98 developing countries, for a period spanning from 1960 to 1985. Using average annual growth rates in real GDP per capita and the ratio of real government consumption to real GDP, he finds that public consumption is negatively correlated with growth, while public investment's impact on economic development seems insignificant. Two years later, Easterly and Rebelo (1993), in a broad cross-section of countries, with data

for the period 1970-1988, investigated the relationship between per capita growth and (sectoral) public investment, in the presence of conditional variables. Their main finding suggests that the share of public investment in transport and communication infrastructure is consistently correlated with growth.

In another empirical analysis, Ghura (1995), using pooled time-series and cross-section data for 20 years (1970-1990), in the case of 33 African countries, discovers a negative relationship between government consumption and economic growth. A similar result is obtained by Guseh (1997), in a study on the effects of government size on the rate of economic growth, using OLS estimation method and data for the period 1960-1985, available for 59 middle-income developing countries. The main result of this paper is that growth in government size has negative effects on economic growth, which greatly amplifies in non-democratic socialist systems. Knoop (1999) explores the impact of government size on economic growth in the US economy, within the framework of an endogenous growth model. Using regression analysis and time series data from 1970 to 1995, his study demonstrates that a decrease of public expenditures generates an adverse impact on economic growth and welfare. In the same manner, the results obtained by Fölster and Henrekson (2001), when conducting a panel study on a sample of rich countries over the period 1970-1995, reveal that large public expenditures affect growth negatively.

Furthermore, Devarajan et al. (1996) find evidence for 43 developing countries, for the period 1970-1990, suggesting that the share of total public expenditure has no significant effect on economic growth (the used method is OLS regression). However, the authors identify a significant composition effect of government expenditure: increases in the share of current expenditure have a significant positive impact on economic growth, while increases in the share of capital expenditure have a significant negative effect. According to the authors, these results may be due to the fact that excessive use of apparently productive expenditures in developing countries could make them unproductive. In a study for the Greek economy, Alexiou (2007), after disaggregating government spending and empirically testing of the relationship, finds a positive association between the growth in the components of government spending and GDP growth. Expanding his study for seven transition economies in the South Eastern Europe (SEE), Alexiou (2009) comes to the conclusion that four out of the five variables used in the estimation (government spending on capital formation, development assistance, private investment and trade-openness) have positive and significant effect on economic growth (the only variable found to be statistically insignificant is population).

An important category of public expenditure which has been investigated in connection with economic growth is infrastructure. Canning and Pedroni (2004), in an endogenous growth model with constant returns to aggregate capital, investigate the long run impact of infrastructure provision on per capita income in a panel of countries, over the period 1950-1992. The results suggest that, generally, infrastructure induces long run growth effects, i.e. positive shocks to infrastructure stocks raise long-run income per capita. Some studies use physical measure of infrastructure in testing its impact on economic growth (number of kilometers of paved roads, kilowatts of electricity generating capacity, and the number of telephones). Such a study belongs to Sanchez-Robles (1998), who used both infrastructure expenditure and physical units to quantify the independent variable, in a sample of 76 countries. When using infrastructure expenditure, the author finds a negative growth impact, but when she includes indicators of physical units of infrastructure, she finds they are positively and significantly correlated with growth.

Public education expenditure is another category of public spending whose connection with economic growth was investigated, since they are thought to be a key to sustained economic growth. A positive impact is empirically proved by Blankenau et al. (2007): using panel data from 23 developed countries over the period 1960-2000, the authors find a positive relationship between public education expenditures and long-run growth, but only when controlling for the government budget constraint. However, the empirical findings on the relationship between growth and public education expenditures remain mixed.

Regarding public health spending and economic growth, the studies are based on the hypothesis that health can affect economic growth through its impact on human and physical capital accumulation, assuming that healthier people are more productive (Bloom and Canning, 2000; Jack and Lewis, 2009). This assumption is confirmed by Elmi and Sadeghi (2012), after they investigate the causality and co-integration relationships between economic growth and health care expenditures in developing countries during 1990-2009. Also, Baltagi and Moscone (2010) studied the long-run economic relationship between health care expenditure and income, using a panel of 20 OECD countries during 1971-2004. Their main finding suggests that health care is a necessity rather than a luxury, with an elasticity much smaller than that estimated in other OECD studies.

In respect to R&D spending and their influence over growth, Ulku (2004) investigates the main postulations of the R&D based growth models (innovation is created in the R&D sectors and it enables sustainable economic growth). The sample contains 20 OECD and 10 non-OECD countries, for the period 1981–1997, and the results suggest a positive relationship between per capita GDP and

innovation in both OECD and non-OECD countries. This positive correlation has also been confirmed by studies using international panel data, such as Frantzen (2000) and Griffith et al. (2002).

Finally, regarding Central and East European countries, Dincă and Dincă (2013) explore the link between the structure and share of government expenditure into GDP and the real GDP per capita, for 10 countries and 11 years (2002-2012). After performing the linear regression, the authors suggest that GDP/capita is positively correlated with public order and safety expenditures, as well as with economic actions, while national defense and general public services are negatively linked. Supposedly enhancing for the long-term development of any society, health and education expenditures seem to have an insignificant impact on economic development. Last but not least, with data covering the period 1990-2011 for Romania, Braşoveanu and Braşoveanu (2007) investigate the link between public expenditures and economic growth and they reveal three main conclusions: total public expenditures are negatively correlated to economic growth, as well as unproductive spending, while productive public spending seem to be positively linked to economic growth.

3. Methodology and data

The impact of productive public expenditures on economic growth is analyzed using a set of unbalanced data, with 6 cross-sections (6 countries, i.e. Romania, Hungary, Bulgaria, Poland, Czech Republic and Slovakia) for the period 1990-2013, using a panel model approach. We use a panel model since it allows us to control for individual heterogeneity and panel data give more informative data, more variability, less collinearity among the variables, and more efficiency (Baltagi, 2008). The countries were selected taking into account two criteria: geographical criterion and common recent historic background (former communist countries). In addition, there is certain homogeneity in the group of countries selected for the study, since the Eastern Europe economies share important economic and cultural features. As well, the studied period was 1990-2013 considering availability of data.

In order to explore the relationship between productive public expenditures and economic growth, we consider economic growth as dependent variable, while as interest variables we select four types of public expenditures, viewed as productive spending in the literature.

The dependent variable is GDP at purchaser's prices (γ), expressed in current U.S. dollars, and represents the sum of gross value added by all resident producers in

the economy plus any product taxes and minus any subsidies not included in the value of the products.

The interest independent variables are:

i) public education expenditure (λ), which measures the total public expenditure (current and capital) on education expressed as a percentage of the Gross Domestic Product (GDP) in a given year;
ii) public health expenditure (χ), which consists of recurrent and capital spending from government (central and local) budgets, external borrowings and grants, and social health insurance funds (expressed as a percentage of GDP).
iii) research and development expenditure (δ) are current and capital expenditures (both public and private) on creative work undertaken systematically to increase knowledge, including knowledge of humanity, culture, and society, and the use of knowledge for new applications (expressed as a percentage of GDP).
iv) public infrastructure expenditure (ι), measuring the total inland transport infrastructure investment (expressed as a percentage of GDP).

Since our main hypothesis considers that productive public spending influence the level of GDP, the basic function has the following form:

$$\gamma = f(\lambda, \chi, \delta, \iota), \quad (1)$$

where: γ – GDP at purchaser's prices, and λ, χ, δ, ι – the chosen productive public expenditures.

Using natural logarithm of variable γ, the basic OLS naive panel-model is as follows:

$$\ln(\gamma_{it}) = \alpha + \beta_0\lambda_{it} + \beta_1\chi_{it} + \beta_2\delta_{it} + \beta_3\iota_{it} + \varepsilon_{it} \quad (2)$$

where: α – intercept, $\beta_{0,\ldots,3}$ – slops of interest expenditure variables, i – country, t – time, and ε_{it} – the error term, which varies over both country, and time.

The effects of productive expenditure variables are isolated entering two types of control variables: one derived from the appropriate growth literature, and another one containing robustness variables. In this case, the extended linear model becomes:

$$\ln(\gamma_{it}) = \alpha + \beta_0\lambda_{it} + \beta_1\chi_{it} + \beta_2\delta_{it} + \beta_3\iota_{it} + \sum_{k=1}^{n}\beta_k X_{k,it} + \mu_i + \eta_t + \varepsilon_{it} \quad (3)$$

where: α – intercept, $\beta_{0,\ldots,3}$ – coefficients of interest expenditure variables, β_k – coefficient of control independent variable k by n type, X – control independent variables, μ_i – stands for country fixed effects, η_t – time-specific effect that controls for unaccounted common time-varying factors, i – country, t – time, ε_{it} – the error term.

The first set of control variables is originated in the appropriate growth literature and includes: gross fixed capital formation (investments), employment, foreign direct investment, economy openness, inflation, fiscal burden and government debt. Gross fixed capital formation consists of resident producers' investments, deducting disposals, in fixed assets during a given period, as a percentage of GDP. The employment rate is calculated by dividing the number of persons aged 20 to 64 in employment by the total population of the same age group. The third control variable, net FDI, illustrates the net inflows (new investment inflows less disinvestment) in the reporting economy from foreign investors, and is divided by GDP. Economy openness is measured by the exports of goods and services (% of GDP), which represent the value of all goods and other market services provided to the rest of the world. Inflation shows the rate of price change in the economy as a whole, while fiscal burden refers to total receipts from taxes and social contributions divided by GDP. The last control variable, government debt, captures general government gross debt as percent of GDP.

The variables for robustness refer to property rights and freedom from corruption. The first variable explains the ability of individuals to accumulate private property, secured by clear laws that are fully enforced by the state (the score 100 means secure property rights, while a level of 0 suggests a weak protection of these rights). The second robustness variable, freedom from corruption, shows the intensity of corruption (the score 100 means low corruption, while a level of 0 indicates a very corrupt government).

All control variables presented above have consistent impact on economic growth, as Petrakos et al. (2007) argue. They are treated as elasticity, except the variables with no strictly positive values, such as inflation rate and net FDI. The descriptive statistics of variables and their sources are illustrated in Table 1, respectively Table 2 in Appendix.

In our panel-model approach, the model may have heterogeneity in the data. As the investigated sample is unbalanced, we test this property only in the case of cross-section fixed-effects model, because the period fixed-effects model is not appropriate for our sample (we argue that there aren't omitted variables that are the same for each entity in our sample, but vary over time) and the random effects panel-models are not consistent under unbalanced data-set. In this demarche, F-test allows us to choose between pooled model and fixed-effects model. The next section highlights the main empirical results of the explored function, performing several econometric scenarios (models 1-4), as Table 3, in Appendix, illustrates.

4. Results

The most important empirical result achieved after the statistical testing of the connection between productive public spending and economic growth, as Table 3 in Appendix reveals, is that all of the interest public expenditure variables appear significant in every scenario (only health expenditure variable is insignificant in OLS-cross-sectional fixed-effects model 4). Education, R&D and infrastructure expenditure variables are positively correlated with economic growth as dependent variable, while health expenditure variable seems to have a negative impact.

Of the control variables, only general government debt and property rights have statistical significance in each regression model, being positively related to economic growth. At the opposite pole lie economy openness, fiscal burden, inflation rate and freedom from corruption, which are significant in models (2) and (3), and negatively correlated with economic growth. Finally, gross fixed capital formation, employment rate and net FDI are statistically insignificant.

Further on, we initiate the hypothesis tests to choose between pooled model and fixed-effects model. As the sample is unbalanced and the period fixed-effects are not appropriate, only the cross-section fixed-effects are taken into account. The values of F-test and Chi-square for cross-section fixed-effects clearly reveal that the cross-section fixed-effects model is preferred to the OLS estimations. According to the cross-sectional fixed-effects model (4), three interest variables are significant (education, R&D and infrastructure spending), with positive effect on economic growth. Health expenditure variable remains negatively correlated with economic growth, but it becomes statistically insignificant. Two control variables are conclusive and have a positive impact on economic growth: public debt and property rights. As for the rest of the control variables, they have no statistical significance.

The main empirical output, for the 6 investigated countries during 1990-2013, suggests that education, R&D and infrastructure public expenditures are significant and positive correlated with economic growth, while health public spending exerts a negative influence on the dependent variable. As for the control variables, it seems that only public debt and property rights freedom have a significant and positive impact on economic growth.

5. Conclusions

The main purpose of this paper is to empirically investigate the link between productive public expenditures and economic growth, with the help of a panel dataset. Due to their capacity of increasing private capital marginal productivity, productive public spending is expected to exert a significant impact on economic growth. The main empirical result is that the influence of productive public

spending on economic growth is positive and statistically significant with regard to education, R&D and infrastructure expenditures. Our results are consistent with several other studies from the specific literature, such as Blankenau et al. (2007), Canning and Pedroni (2004) and Ulku (2004). As for public health expenditure, the negative sign could mean that in the health sector, the way of spending public money is inefficient, i.e. public investment may often be used for unproductive projects. Also, maintaining the health system in State ownership as a result of the communist legacy, together with the low rate of privatization and disruption of the planned economy's production as a result of the communism fall, have annihilated the positive effects of investment in human capital.

Since public expenditures are one of the most important policy instruments for governments, the study highlights several policy implications:

i) public deciders must pay an increased attention to education and finance it accordingly (especially in Romania, which has the lowest percent of GDP allocated to education in the European Union), because investments in education lead to human capital accumulation which, in turn, increases the productivity of the labor force.
ii) investing in health does not necessary mean higher health care spending; health investment should aim to improve the population's human and social capital, through improved nutrition, changing practices, better sanitation, innovations in medical technologies, and public health infrastructure.
iii) with a small current level of R&D expenditure (around 1% of GDP or below), authorities from East-European countries should intensify the efforts in order to sustain higher levels, considering the crucial role of innovation in the process of growth.

Our overall conclusion is that productive public expenditures can be a key determinant of growth, impacting the production function of the private sector. However, the conclusions of this cross-country analysis should be enriched by additional individual country empirical studies, which should take into account country specific characteristics affecting the public spending composition and also other determinants of growth.

Acknowledgements

This study was supported from the European Social Fund through Sectorial Operational Programme Human Resources Development 2007-2013, project number POSDRU/159/1.5/S/142115, project title "Performance and Excellence in Doctoral and Postdoctoral Research in Romanian Economics Science Domain". The author is also indebted to Mihai Mutaşcu and Silviu Cerna for useful suggestions and for their valuable help.

References

Afonso, A., Ebert, W., Schucknecht, L., Thöne, M. (2005). "Quality of public finances and growth", European Central Bank, *Working Paper Series*, No. 438

Alexiou, C. (2009). "Government Spending and Economic Growth: Econometric Evidence from the South Eastern Europe (SEE)", *Journal of Economic and Social Research* 11(1), pp. 1-16

Alexiou, C. (2007). "Unraveling the 'Mystery' Between Public Expenditure and Growth: Empirical Evidence from Greece." *International Journal of Economics* 1(1), pp. 21-31

Angelopoulos, K., Economides, G., Kamman, P. (2006). "Tax spending policies and economic growth: theoretical predictions and evidence from the OECD", *European Journal of Political Economy*

Aschauer, D.A. (1989). "Is Public Expenditure Productive?" *Journal of Monetary Economics*, 23, pp. 177-200

Baltagi, B.H. (2008) *Econometric Analysis of Panel Data*, Third Edition, John Wiley & Sons, Ltd.

Barro, R.J. (1990). "Government spending in a simple model of endogenous growth", *Journal of political Economy*, 98(1), pp. 103-117

Barro, R.J. (1991). "Economic Growth in a Cross Section of Countries," *Quarterly Journal of Economics*, 106, pp. 407-443

Barro, R.J., Sala-i-Martin, X. (1995). *Economic growth*, New York, McGraw Hill

Blankenau, W.F., Simpson, N.B., Tomljanovich, M. (2007). "Public Education Expenditures, Taxation, and Growth: Linking Data to Theory", *American Economic Review*, 97(2), pp. 393-397

Bloom, D.E., Canning D. (2000). "The Health and Wealth of Nations". *Science*, 287(5456), pp. 1207-1209

Braşoveanu, L., Braşoveanu, I. (2007) "Efecte Ale Cheltuielilor Bugetare Asupra Creşterii Economice", *Studii şi cercetări de calcul economic şi cibernetică economică*, Nr. 1

Canning, D., Pedroni, P. (2004). *The effect of infrastructure on long run economic growth*, Harvard University

Devarajan, S., Swaroop, V., Zou, H.F. (1996). "The composition of public expenditure and economic growth", *Journal of Monetary Economics*, 37, pp. 314-344

Dincă, M.S., Dincă, G. (2013) "The Impact Of Government Expenditures Upon Economic Growth in Post-Communist Countries", *Scientific Annals of the „Alexandru Ioan Cuza" University of Iaşi Economic Sciences,* 60 (1), pp. 83-92

Easterly, W., Rebelo, S. (1993). "Fiscal Policy and Economic Growth", Journal of Monetary Economics, 32, pp. 417-458

Elmi, Z.M., Sadeghi, S. (2012) "Health Care Expenditures and Economic Growth in Developing Countries: Panel Co-Integration and Causality", *Middle-East Journal of Scientific Research* 12 (1), pp. 88-91

Enache, C. (2009). "Fiscal policy and economic growth in Romania", *Annales Universitatis Apulensis Series Oeconomica*, 11(1)

Fölster, S., Henrekson, M. (2001). "Growth Effects of Government Expenditure and Taxation in Rich Countries." *European Economic Review* 45(8), pp. 1501-1520

Frantzen, D., (2000) "R&D, Human Capital and International Technology Spillovers: A Cross Country Analysis," *Scandinavian Journal of Economics*, 102 (1), pp. 57-75

Ghura, D. (1995). "Macro Policies, External Forces, and Economic Growth in Sub-Saharan Africa." *Economic Development and Cultural Change* 43(4), pp. 759-778

Griffith, R., Redding, S., Van Reenen, J. (2004) "Mapping the Two Faces of R&D: Productivity Growth in a Panel of OECD Countries", *The Review of Economics and Statistics*, 86(4), pp. 883-895

Guseh, J.S. (1997) "Government Size and Economic Growth in Developing Countries: A Political-Economy Framework", *Journal of Macroeconomics* 19(1), pp. 175-192

Jack, W., Lewis, M. (2009). *Health Investment and Economic Growth: Macroeconomic Evidence and Microeconomic Foundations*. Washington: World Bank

Knoop, T.A. (1999). "Growth, Welfare, and the Size of Government", *Journal of Economic Inquiry* 37(1), pp. 103-119

Petrakos, G., Arvanitidis, P., Pavleas, S. (2007) "Determinants of Economic Growth: The Experts' View"*, DYNREG Working Papers*

Romero de Avila, D., Strauch, R. (2003). "Public Finances and long-term growth in Europe: evidence from a panel data analysis", *ECB Working Paper,* 246

Sanchez-Robles, B. (1998). "Infrastructure investment and growth: some empirical evidence", Contemporary Economic Policy, 16(1), pp. 98-108

Sturm, J.E., Kuper, G.H., de Haan, J. (1998). "Modelling government investment and economic growth on a macro level: A review", *The Welfare State, Public Investment, and Growth*, pp. 61-83

Ulku, H. (2004) "R&D, Innovation, and Economic Growth: An Empirical Analysis", *IMF Working Paper*, WP/04/185

European Commission (2012). *The Quality of Public Expenditures in the EU*, Occasional Papers, 125

Appendix

Table 1. *Descriptive statistics*

Variable	Mean	Median	Maximum	Minimum	Std. Dev.	Observations
GDP (US dollars)	8.93E+15	8.41E+10	5.29E+16	2.87E+10	1.34E+16	75
Public education expenditures as % of GDP	0.043321	0.0425	0.0591	0.02491	0.007504	75
Public health expenditures as % of GDP	0.049803	0.050767	0.066756	0.028508	0.008304	75
Investment in inland transport infrastructure as % of GDP	0.0138	0.012	0.032	0.004	0.006134	75
Research and development expenditure as % of GDP	0.007459	0.006336	0.016413	0.0037	0.003122	75
Gross fixed capital formation as % of GDP	0.036613	0.034	0.068	0.015	0.011468	75
Employment rate	0.650453	0.644	0.734	0.571	0.043396	75
Exports of goods and services as % of GDP	0.552129	0.589525	0.873109	0.23	0.174402	75
Net FDI as % of GDP	0.066431	0.043674	0.518958	-0.16418	0.093254	75
Inflation rate	0.09487	0.046394	1.548	-0.015816	0.200299	75
Fiscal burden as % of GDP	0.331653	0.331	0.405	0.266	0.037769	75
General government gross debt as % of GDP	0.383267	0.356	0.822	0.128	0.175413	75
Freedom from corruption	42.48	42	54	26	7.347292	75
Property rights	53.86667	50	70	30	15.99352	75

Table 2. *Source of data*

Variable	Source
GDP (US dollars)	World Bank online database (2014)
Public education expenditures as % of GDP	Eurostat online database and National Institute for Statistics (Romania, 1990-2000)
Public health expenditures as % of GDP	World Bank online database (2014)
Investment in inland transport infrastructure as % of GDP	OECD online database
Research and development expenditure as % of GDP	World Bank online database (2014)
Gross fixed capital formation as % of GDP	Eurostat online database
Employment rate	Eurostat online database
Exports of goods and services as % of GDP	World Bank online database (2014)
Net FDI as % of GDP	World Bank online database (2014)
Inflation rate	World Bank online database (2014) and National Institute for Statistics (for Romania)
Fiscal burden as % of GDP	Eurostat online database and National Institute for Statistics (Romania, 1991-1994)
General government gross debt as % of GDP	Eurostat online database
Freedom from corruption	The Heritage Foundation online data-base (2014)
Property rights	The Heritage Foundation online data-base (2014)

Table 3. *Empirical results of panel regressions*

Dependent variable: ln GDP ($)				
Independent variables	Model			
	(1)	(2)	(3)	(4)
constant	110.8979*** (7.665416)	95.80597*** (5.246505)	58.98881* (1.681376)	88.80127** (2.372519)
ln public education expenditures as % of GDP	24.30527*** (6.132765)	12.80947** (2.394401)	14.94679*** (2.901003)	20.25558*** (2.701536)
ln public health expenditures as % of GDP	-12.56313*** (-3.148976)	-10.73938** (-2.154296)	-19.80925*** (-3.527553)	-6.750137 (-0.914745)
ln investment in inland transport infrastructure as % of GDP	4.559110*** (3.624106)	4.773621*** (3.518442)	5.689553*** (4.253679)	4.913260*** (3.605042)
ln R&D expenditure as % of GDP	4.462580** (2.275938)	11.63019*** (4.785331)	8.706927*** (3.075967)	8.988017** (2.179362)
ln gross fixed capital formation as % of GDP		0.880691 (0.447838)	1.553003 (0.781940)	-3.302793 (-1.357379)
ln employment rate		8.539567 (0.622549)	15.95870 (1.206055)	14.93502 (0.845289)
ln exports of goods and services as % of GDP		-8.408722*** (-4.211257)	-4.989685** (-2.268653)	6.648633 (1.567199)
net FDI as % of GDP		8.618793 (1.589264)	7.612722 (1.484671)	2.902025 (0.564565)
ln fiscal burden as % of GDP		-27.46104*** (-3.730928)	-29.52139*** (-4.224691)	-2.355777 (-0.197473)
inflation rate		-8.535826*** (-2.766205)	-8.033236*** (-2.726327)	-3.957314 (-1.081180)
ln general government gross debt as % of GDP		7.522978*** (3.882677)	6.494934*** (3.340357)	4.313663* (1.758306)
ln freedom from corruption			-7.839951** (-2.230054)	-5.277446 (-1.206538)
ln property rights			9.977434*** (2.657252)	18.43817*** (2.892385)
Type of estimation	OLS	OLS	OLS	OLS - FE:CS
		Model summary		
R squared	0.392755	0.721795	0.760799	0.805243
F-test for fixed effects				2.555866 (0.0375)
Chi-square				15.416368 (0.0087)

a. (...) denotes the t-stat;
b. FE:CS denotes cross-section fixed effects;
c. ***, ** and * denote significance at 1, 5 and 10% level of significance, respectively.