

8. PUBLIC DEBT AND ECONOMIC GROWTH IN THE EU POST-COMMUNIST COUNTRIES

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Abstract

Our paper empirically explores the relationship between the ratio of government debt to Gross Domestic Product (GDP) and the per capita GDP growth rate for a sample of 10 former Communist countries, currently members of the EU 27, for the 1999-2010 period. The results show a statistically significant non-linear relationship between the government debt to GDP ratio and the per capita GDP growth rate for all the analyzed countries. We have found that the government debt turning point is around 50%. If the government debt to GDP ratio exceeds this level, it could generate a negative impact on the GDP growth rate. The 95% confidence intervals for the debt turning point start as low as 40% of GDP, which calls for more prudent government debt policies.

Keywords: public debt, economic growth, fiscal policy, returning point, sustainability of public finance

JEL Classification: H63, O10, E62

1. Introduction

The analysis of public debt is not necessarily a modern concern, since the history of public finances was often marred by dramatic situations. Poor management and inadequate use of the collected funds led, in certain periods of time, to desperate circumstances. The high public debt accumulated in the last years by the EU countries has seriously questioned the health of the public finances and the sustainability of the European fiscal and budgetary policies. Many European leaders face the challenges of rethinking these policies and adopting prudent indebtedness measures. The ultimate goal is attaining a sustainable level of the public debt and a debt portfolio structure (regarding sources, costs, maturities and risks) adequate to each country's peculiarities.

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Another issue to address is the ethics of debt, given that future generations will be confronted with reimbursing these debts, under a reduced employment rate and an ever-pressing ageing problem. The ageing population problem leads to the unsustainability of the pension system and to burgeoning budget costs for the future periods.

The sovereign debt crisis called for urgent measures of fiscal consolidation to be undertaken. The national authorities have applied these measures differently, reducing the budget expenditures, increasing budget revenues, especially the fiscal ones, or acting in both directions.

The public finance was brought to the forefront again after years of monetary policy prevalence. Healthy public finance derived out of public debt and interest burden cuts leads to bridging the gap between various distortions in taxes, while promoting productive public spending. Other possible benefits refer to economic growth and long-term workforce employment. This addresses the ageing problem and, thus, the growing pressure of public expenditures caused by pensions and healthcare systems' deficits.

Numerous studies, some of them briefly presented in section two of this article, prove the necessity to analyze the correlation between the economic growth rate and the degree of indebtedness of various countries, considering the aggravation of the sovereign debt crisis in the EU. New research areas have been developed by the ideological debates concerning the priorities that the state authorities should consider in order to speed up the economic recovery. For instance, should one sacrifice the budgetary balance, by allowing budget deficits according to the necessities, in order to stimulate the economic growth, or should one prefer a more prudent debt policy and deficit adjustments?

The most significant results on this topic (Reinhart and Rogoff, 2010; Checherita and Rother, 2010) concluded that there is a non-linear relationship between the public debt and economic growth in the developed, industrialized countries. The results of the above-mentioned studies revealed a debt turning point of around 90%-100% of the Gross Domestic Product (GDP), proving that beyond this level the economic growth was affected.

The aim of this article is to analyze the correlation between the GDP per capita growth rate and the public debt to GDP ratio for a group of 10 post-communist countries in Eastern and Central Europe, based on the 2010 Checherita and Rother model. Previous researches were performed on the industrialized and developed countries and/or on the emerging economies from other parts of the world.

We consider that the study of the growth-public debt nexus is even more relevant for the former communist, developing countries in Central and Eastern Europe, as they face multiple constraints, namely the need to allocate public financial resources for development and infrastructure, observing the conditions of the 2012 European Fiscal Compact as well as mobilizing a lower quota of their GDP to the consolidated public budgets as a mean to support the economic development. In effect, we aim to determine the public debt turning point for the 10 developing countries, members of the EU 27, by means of an econometric model. To our knowledge, there was no other study to address this issue for that sample countries and that period. The structure of this article encompasses the following sections: a literature review is presented in Section 2, the

factual evidence is presented in Section 3, the empirical model and the data used are discussed in Section 4, while the conclusions and discussions are presented in Section 5.

II. Literature review

Currently, the popularity of expansionary fiscal policies among governments is still difficult to dispute. Despite such popularity, the fundamentals of these policies and their chances of success are the subject of numerous arguments. The explosive increase in budget deficits along with a significant drop in fiscal revenues implies an increasing reliance on massive financing from domestic or foreign private sectors. The obvious question that arises is clear: who will bear the burden of using these funds?

Deficit financing has to rely on public loans, domestic or foreign, as long as it is not accomplished by means of inflationary pressures or direct monetary issue. Such loans lead to an increase in public debt and to future fiscal burden on domestic taxpayers.

However, the anticipation of higher taxes leads, according to the American economist Robert Barro's interpretation of the Ricardian equivalence postulate (1974, 1979), to an increase in savings and a reduction in spending. This situation does not fit the premises of an anti-cyclic policy of stimulating the current aggregate demand.

Martin Feldstein (1976) argued that Barro ignored economic and population growth. Feldstein demonstrated that the creation of public debt decreases savings in a growing economy. Another of Barro's critics, James M. Buchanan (1976), stated that this question was raised by Ricardo and elaborated upon by De Viti. Some of Buchanan's arguments against Barro's idea related to his failure to compare the differential impacts of taxation and debt issue.

Regardless of the approach of choice, the idea that there is no free lunch in the economy is widely accepted, as the future repayment of current loans will inevitably lead to a decreased level of investments and, therefore, to lower economic growth. A budget deficit will be financed in part or in full by deflecting the savings of households or companies (Friedman, 1971) towards the public sector. The investments and the spending generated by the public sector will be made at the expense of the investments and spending that could have been made by the private sector, in the absence of the government intervention. Barro (2009) concluded that the fiscal policy multiplier would be null or insignificant. Furthermore, the lack of efficiency and the distortions caused by the public enterprises in the economy should be taken into account. The absence of economic incentives and the structural derogation from the economic calculus represents, according to Ludwig von Mises (1952), the base principle for a rational allocation of the resources.

Using fully modified OLS panel, Ying *et al.* (2014) determined, for the ASEAN countries, that economic globalization had a significantly positive influence upon economic growth. However, the authors have shown that social globalization has a negative influence upon economic growth, while political globalization had a negative, yet non-significant, effect.

Albu (2013) used a model to analyze the impact of foreign direct investments (FDI) upon GDP growth in the EU. He also investigated the FDI - Export- GDP relationship for the

last decade in Romania. The author stressed the importance of the FDI as a means to ensure the efficiency of foreign trade and support the overall economic growth.

The relation between economic growth, budgetary deficits, public debt and interest rates was the subject of ample researches (Blanchard 1984; Chalk, 2000; Rankin and Roffia, 2003; Schclarek, 2004; Gale and Orszag, 2004; Reinhart and Rogoff, 2010; Taylor *et al.*, 2012, Egert, 2013, Pescatori *et al.*, 2014).

Reinhart and Rogoff (2010) obtained significant results in this area. Their findings showed that the relation between government debt and real GDP growth rate is weak for a less than 90% debt to GDP ratio. Over the 90% threshold, the median rates of growth drop by 1 percentage point (pp), whereas the average growth decreases even more.

Furthermore, their study revealed that the emerging markets had a lower threshold for the total foreign debt (public and private), which was usually denominated in foreign currency. When this level exceeds 60% of the GDP the annual economic growth decreases by approximately 2 pp.

These results raised ample debates, especially in the political decisional environment and the media. Irons and Bivens (2010), as well as Pescatori *et al.* (2014) discuss the relevance of the 90% threshold mentioned by Reinhart and Rogoff. They claim that danger does not come from the lack of means to sustain budget deficits and public debt service, but rather from the absence of political action triggered by budgetary deficits concerns and the destination of borrowed funds. The current budget deficits clearly affect the future interest rates (Gale and Orszag, 2004). Governments are forced to resort to loans, both in domestic and foreign markets, to finance current deficits. This, in turn, influences the demand for loan capital, placing upward pressures upon the interest rate and leads to a decrease in the saving and investing rates in the private sector (Reinhart and Rogoff, 2010).

In his study, Schclarek (2004) concluded that a significant relation between the government debt and economic growth could not be identified for the industrialized countries. For the developing countries, lower total external debt levels are associated with higher growth rates. The reverse is not caused by private external debt but rather by the incidence of public external debt.

Buiter (2010) maintains that in the U.S., the primary deficit should be reduced by 8% of GDP when the real interest rate and the economic growth rate cannot be influenced by the means of government policies. Otherwise, the public debt will become unsustainable. Taylor *et al.* (2012) claim that if the GDP growth rates were positive and higher than the real interest rate such an austerity measure would become unnecessary in order to obtain the sustainability of the public debt. The observance of this correlation ensures a downward trend for the debt to GDP ratio even if the evolution of the primary deficit to GDP ratio is positive. The results of the analysis have shown that the primary federal deficit and the net government financing had an expansionary evolution during the recession periods. This proved the counter-cyclical role of the fiscal policy. A 1 pp contraction of the real GDP for just one quarter determines a 0.7 pp increase in the debt to GDP ratio for the entire year; the reverse is also true.

The results of this analysis largely support the findings of the Reinhart and Rogoff study (2010), which associated a high level of the debt to GDP ratio with a reduced GDP

growth rate. The main difference is that a high level of the debt to GDP ratio is considered the result of a low economic growth rate and not a cause of the latter, as stipulated by Reinhart and Rogoff. An increase in the US economic growth rate from 2.7% in 2011 to 3.7% in 2012 would reduce the primary deficit from 8.3% to 6.8% of the GDP, thereby having a positive influence on the debt to GDP ratio.

A significant number of economists feel that stimulating the economic growth along with a low real interest rate is essential in effectively addressing the public debt issue. Collignon and Mundschenk also supported this point of view (1999), focusing on the fiscal and public debt sustainability of the EMU countries for the period prior to its inception. The two authors maintain that this model should consider fiscal sustainability, ensured by proper fiscal policies as well as the evolution of the inflation rate, since the absolute level of the public debt will increase according to the evolution of the current deficit (primary deficit plus the nominal interest rate).

It is essential to restart economic growth at a level above the real interest rate, rather than the adjustment of the short-term deficit by means of severe austerity (Collignon and Mundschenk, 1999; Taylor et al. 2012). The specificity of the Eurozone is characterized by the fact that its periphery countries are strongly influenced by the macroeconomic environment and by the shocks transmitted by the globalized economy. Checherita and Rother (2010) have used a model based on the equation of conditional convergence for 12 Euro Area countries to show the relationship between the debt to GDP ratio and the GDP per capita growth rate. The results of the study have shown a significant non-linear statistical relation between the public debt to GDP ratio and the GDP per capita growth rate for the 12 analyzed countries. The return point of indebtedness of this concave relation is situated on average between 90% and 100% for the sample. Hence, going over this threshold can negatively impact the economic growth.

The Checherita and Rother study was the starting point of our study; however, we try to study the relation between public debt and growth for the former communist Central and Eastern European countries, since they have quite different short and long-term goals and means compared to the other European Union countries.

III. The facts

The economic and financial crisis of the last years had a significant impact upon the public finance of the EU member countries. Starting from a relatively stable position in 2007, the budgetary deficits and public debts have deteriorated rapidly, reaching unprecedented levels in the European Union. While in 2007 the budgetary deficits were below 1% of the GDP for the EU 27, in 2010 there were frequent cases of countries with deficits of over 7% of the GDP. The public debts have deteriorated even more, from around 59% of the GDP in 2007 to 80% of the GDP in 2010 for the EU 27.

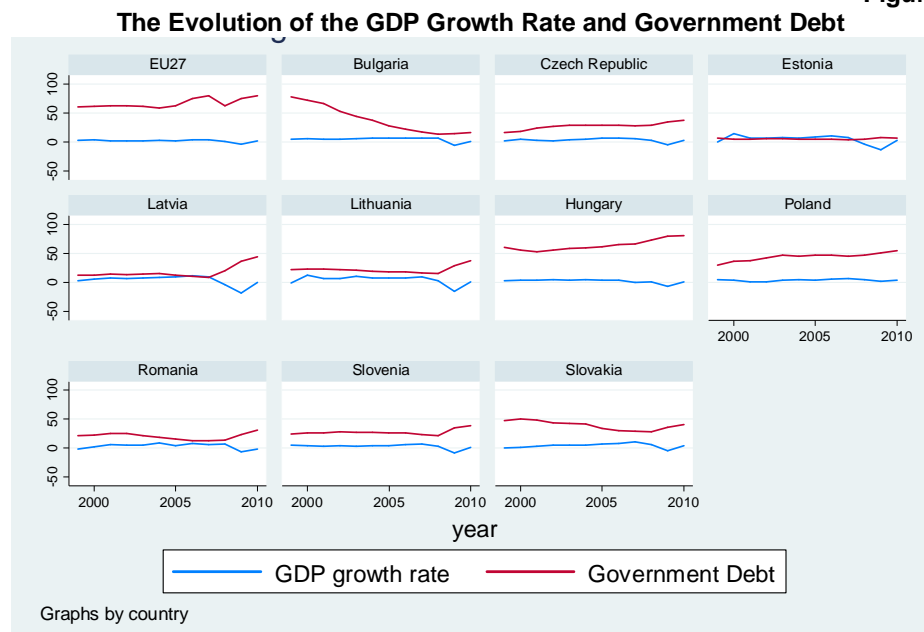
Public debts crises have been a recurrent issue with notable examples being the 1970's oil crisis, as well as the 1980's economic contraction. Since the negative effects of these downturns were never fully contained, they fueled the current growth rates of the public debt. The lessons of the previous crises had to be learned all over again. The escalation of public debt exerts a strong upward pressure upon interest rates and crowds out private domestic investments.

At the end of 2010, 14 EU countries have registered debt to GDP ratios of over 60%. The highest levels were in Greece (144.9%), Italy (118.4%), Belgium (96.2%), Ireland (94.9%) and Portugal (93.3%). Lower levels were encountered in Estonia (6.7%), Bulgaria (16.3%), Luxemburg (19.1%), Romania (31%), the Czech Republic (37.6%), Lithuania (38%), Slovenia (38.8%) and Sweden (39.7%).

The real economic negative growth of -4.2% in 2009 generated an automatic reduction in public revenues and an increase in the public expenditures as percentage of GDP.

Figure 1 presents the evolutions of the economic growth and government debt for all the 10 analyzed countries referring to the 1999 – 2010 period of time.

Figure 1



Source: Data provided by AMECO.

The discretionary measures introduced to support the financial sector and aggregate demand has increased the burden upon public finance. The fiscal policy interventions were instrumental in stabilizing the economy; however, as economic growth is restored the authorities should eliminate them as they impose an intolerable burden upon the public finance.

The countries we have chosen for our analysis have several common features: they are all post-communist EU members, most of them employ a flat rate taxation system, they have a low GDP per capita, well below the 24,000 Euro average for EU 27³ and they show low levels of the public debt as compared to the EU 27 average (Table 1).

³ The lowest levels in 2010 were in Bulgaria (4,800 Euro per capita) and Romania (5,800 Euro per capita), whereas the highest levels were in Slovenia (17,400 Euro per capita) and the Czech Republic (14,200 Euro per capita).



Table 1

The Fiscal Situation of the Analyzed Countries

	Public deficit (% of GDP)			Public debt (% of GDP)			Real GDP growth rate		
	2007	2010	2011	2007	2010	2011	2007	2010	2011
EU 27	-0.9	-6.6	-4.7	80.1	80.1	82.5	3.2	2	1.5
Bulgaria	1.2	-3.1	-2.5	17.2	16.3	17.5	6.4	0.4	1.7
Czech Rep.	-0.7	-4.8	-4.1	27.9	37.6	39.9	5.7	2.7	2.0
Estonia	2.4	0.2	0.8	3.7	6.7	5.8	7.5	2.3	8.3
Latvia	-0.4	-8.3	-4.1	9.0	44.7	44.8	9.6	-0.3	5.0
Lithuania	-1.0	-7.0	-4.9	16.8	38.0	37.7	9.8	1.4	5.9
Hungary	-5.1	-4.2	3.5	67.0	81.3	75.9	0.1	1.3	1.8
Poland	-1.9	-7.8	-5.6	45.0	54.9	56.7	6.8	3.9	4.8
Romania	-2.9	-6.9	-4.9	12.8	31.0	34.0	6.3	-1.6	1.1
Slovenia	0.0	-5.8	-5.7	23.1	38.8	45.5	6.9	1.4	-0.2
Slovak Rep.	-1.8	-7.7	-5.8	29.6	41.0	44.5	10.5	4.2	2.7

Source: AMECO.

Public authorities in these countries have applied different measures for fiscal consolidation, adjusting the deficits by reducing the budget expenditures and stimulating the economic activity. These measures are presented in Table 2.

Table 2

The Budgetary Dimension of the European Economic Recovery Plan Crisis Measures in 2009 and 2010, % of GDP

	Discretionary stimulus		Consolidation measures	
	2009	2010	2009	2010
EU 27	1.5	1.4	-0.4	-0.7
Bulgaria	0.3	1.0	-3.3	-3.3
Czech Republic	2.3	1.2	0.0	-1.1
Estonia	0.0	1.2	-9.2	-10.7
Latvia	1.5	0.1	-4.5	-11.7
Lithuania	0.0	0.0	-7.6	-12.5
Hungary	0.5	2.1	-2.2	-5.5
Poland	1.6	3.2	-0.6	-0.5
Romania	0.2	0.3	-0.6	-0.5
Slovenia	1.5	1.8	-1.0	-1.7
Slovakia	0.4	0.5	-0.5	-1.1

Source: EU Commission Services.

In order to overcome the sovereign debt crisis and ensure a medium and long-term sustainability of their public finance, the EU countries have adopted the Fiscal Compact in March 2012. The Treaty refers to the consolidation of fiscal discipline by imposing automatic sanctions and a closer surveillance by the EU. The main provision is the limit of 0.5% of the GDP for the annual structural deficit.

This pledge has to be enforced within a span of maximum one year from the adoption of the Treaty. Should the public debt be significantly below 60% of the GDP, and the risks to the long term sustainability of the public finance be reduced, the maximum

structural deficit can rise to 1% of the GDP. On medium and long term, the 0.5% limit of the GDP for the structural deficit will lead to a substantial decrease in the public debt as percentage of the GDP. We have to ask though is this desirable for the economies of the analyzed countries?

IV. Empirical Model and Data

We investigate the relationship between the GDP growth rate and a series of variables such as debt, short-term interest rate, openness of the economy and gross capital formation. We used a sample of 10 former communist countries, namely Bulgaria, the Czech Republic, Estonia, Latvia, Lithuania, Hungary, Poland, Romania, Slovenia, and Slovak Republic. Data originates primarily in the European Union statistics database Eurostat, covering the 1999 to 2010 period on a yearly basis.

The empirical model is expanded to include the level of gross government debt as a share in GDP. We used a quadratic equation, as we were interested in determining whether there was a non-linear impact of the government debt upon the GDP growth rate, having in mind that describing debt in a linear form would not yield significant results. The use of the quadratic equation was preferred also because it leads to determining the debt turning point.

The empirical model used is:

$$g_{it} = \alpha + \beta_1 \ln(\text{GDP/cap})_{it} + \beta_2 \text{debt}_{it}^2 + \beta_3 \text{debt}_{it} + \beta_4 \text{op_ec}_{it} + \beta_5 \text{pop_growth}_{it} + \beta_6 \text{int_rate}_{it} + \beta_7 \text{gfcf}_{it} + \beta_8 \text{gf_invs}_{it} + \beta_9 \text{gns}_{it} + \beta_{10} \text{gg_rev}_{it} + \beta_{11} \text{lab_prod}_{it} + \mu_i + \nu_t + \varepsilon_{it} \quad (1)$$

where:

g_i	the real growth rate of GDP per capita as a percentage change in the previous year, $i = \text{year}$, $t = \text{country}$;
$\ln(\text{GDP/cap})_{it}$	natural logarithm of the gross domestic product per capita in market prices;
debt_{it}	gross government debt as share of GDP;
op_ec_{it}	the sum of export and import shares into GDP;
pop_growth_{it}	the population growth rate of a given area;
int_rate_{it}	nominal short term interest rate;
gfcf_{it}	gross fixed capital formation as % of GDP in market prices;
gf_invs_{it}	general government fixed investment as % of GDP;
gns_{it}	gross national savings as % of GDP;
gg_rev_{it}	total general government revenue as % of GDP;
lab_prod_{it}	labor productivity per person employed, index EU 27=100;
μ_i	country fixed effects;
ν_t	time fixed effects;
ε_{it}	the error term.

We have processed the data using the Stata software. Because we work with cross-sectional time-series data, we test the regression method to be applied, fixed or random effects, running the Hausman test. The null hypothesis is that the preferred model is random effects vs. alternative fixed effects. We test whether the unique errors (u_i) are correlated with the regressors, the null hypothesis being that they are not (Green, 2008).

The test shows that: Prob>chi2 = 0.0000

Since Prob> chi2 <0.05 we can conclude that the appropriate method for this case is the fixed effects regression. Hence, we tested the need for year dummies and concluded that fixed time effects should be included in our model, since the dummies for all years were not all zero. As expected, a similar result was produced by the Breusch-Pagan Lagrange multiplier test.

Year dummies are included to control for common shocks, economic and monetary changes which occurred during the analyzed period of time. In addition, we included country dummies in order to capture each country's economic and social characteristics, which remain broadly unchanged over time.

Another test, which we have performed, is the modified Wald test for groupwise heteroskedasticity in the fixed effect regression model. We have obtained:

chi2 (10) = 65.45

Prob>chi2 = 0.0000

The results allow us to reject the null hypothesis of homoskedasticity and conclude we have heteroskedasticity. This causes standard errors to be biased. In order to address the problem of errors that are not independent and identically distributed we have used robust standard errors. This will not change the coefficient estimates, however it will affect the standard errors and significance tests.

As we work with a micro-panel sample data, we considered unnecessary to test the cross-sectional dependence and serial correlation, since they are normally relevant only for long time series macro-panel data.

The results for the robust errors time-fixed effects regression are shown in Table 3.

Table 3

Regression Results Using Time Fixed Effects with Robust Errors

Variable	Estimated coefficient level	Robust standard error
<i>ln(GDP/cap)</i>	_____	_____
<i>debt_sqr</i>	0.0016 *	(0.0009)
<i>Debt</i>	-0.1626*	(0.0977)
<i>Op_ec</i>	0.0903**	(0.0457)
<i>Pop_growth</i>	_____	_____
<i>Int_rate</i>	-0.0957***	(0.0395)
<i>Gfcf</i>	0.2334**	(0.1162)
<i>Gf_invs</i>	_____	_____
<i>Gns</i>	_____	_____
<i>Gg_rev</i>	-0.3909**	(0.1885)
<i>Lab_prod</i>	_____	_____
<i>Country dummies</i>	Dropped (9)	
<i>Year dummies</i>	Included (11; 2000-2010)	
<i>_cons</i>	50.2972	
<i>N</i>	120	
<i>R² within</i>	79.12%	

Notes: The dependent variable is economic growth rate. The table shows estimated coefficients and their significance level (*10%; **5%, ***1%). Standard errors (SE) are also shown in parentheses.

Source: The authors' calculations.

The total number of observations is 120. The robust errors, fixed effects regression dropped all country dummies since they had no statistical significance, meaning there are no social characteristics which remain broadly unchanged over the time and kept the 11 year-dummies.

Based on the determination coefficient we can conclude that 79.12% of the GDP growth rate is explained by the predictors chosen in our model. The p -value of F -statistic is 0.00, hence, the joint effect of all explanatory variables on the GDP growth rate is statistically significant.

Based on the computed results, we can conclude that there is a statistically significant non-linear relationship between the government debt to GDP ratio and the per capita GDP growth rate for all the 10 countries included in our sample for the 1999 to 2010 period.

The slope for government debt is -0.1626. This indicates that the GDP growth rate is expected to decrease by 0.1626 pp for each additional 1 pp growth in the gross government debt as share in the GDP. A more subtle result interpretation compares two countries having the same values for all the other explanatory variables, except for a 1 pp difference in their government debt to GDP ratio. We would expect the lower debt country to exceed the other country's annual GDP growth rate by 0.1626 pp.

Other statistically significant variables with potential impact over the per capita GDP growth rate during the analyzed period of time are the openness of the economy, short-term interest rate, gross fixed capital formation and general government revenues.

After running robust errors fixed-effects regression, including only statistically significant explanatory variables, we obtained another regression table, which suggested there is no statistically significant effect of the gross capital formation upon the GDP growth rate. Hence, we dropped this variable and performed the regression with only 5 explanatory variables. The results are shown in Table 4.

Table 4

Results Obtained by Processing Equation 2

Variable	Estimated coefficient level	Robust standard error
<i>debt.sqr</i>	0.0028 ***	(0.0010)
<i>Debt</i>	-0.2824 ***	(0.1083)
<i>Op_ec</i>	0.0929 ***	(0.0383)
<i>Int_rate</i>	-0.0928 ***	(0.0359)
<i>Gg_rev</i>	-0.3308 **	(0.1597)
<i>Country dummies</i>	Dropped (9)	
<i>Year dummies</i>	Included (11; 2000-2010)	
<i>_cons</i>	12.02	
<i>N</i>	120	
<i>R² within</i>	77.65%	

Notes: The dependent variable is economic growth rate. The table shows estimated coefficients and their significance level (**5%, ***1%). Standard errors (SE) are also shown in parentheses. Source: The authors' calculations.

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The total number of observations remains the same, 120. The robust errors fixed-effects regression dropped all the 9 country dummies and kept only the 11 year-dummies.

We can conclude that 77.65% of the GDP growth rate is explained by the predictors chosen in our model. The p -value of F -statistic is 0.00; hence, the joint effect of all 5 explanatory variables on the GDP growth rate is statistically significant.

The GDP growth rate model becomes:

$$g_{it} = 12.02 + 0.0028debt_{it}^2 - 0.2824debt_{it} + 0.0929op_{ec_{it}} - 0.0928int_{rate_{it}} - 0.3308gg_{rev_{it}} + \mu_i + v_t + \varepsilon_{it} \quad (2)$$

The slope for government debt is -0.2824. This indicates that the GDP growth rate could decrease by 0.2824 pp for each additional 1 pp growth in the gross government debt as share of GDP. Similarly, should the short-term interest rate increase by 0.0928 pp the GDP growth rate is expected to decrease by 1 pp. On the other hand we notice a positive impact of the economy openness. A 0.0929 pp increase in exports and imports as share in GDP could lead to a 1 pp increase in the GDP growth rate, if everything else remains unchanged.

Another important objective of our study was to identify the point at which the debt starts to negatively affect the GDP growth rate. We have used two alternative methods to obtain estimates for the turning point: the delta method and the bootstrapping method. The confidence intervals (CI) of the debt turning point are generated through the bootstrapping method based on a normal distribution, percentile distribution and bias-corrected distribution as shown in Table 5. Where the CIs are not shown, the bootstrapping procedure rendered unstable confidence intervals.

Table 5

The Debt Turning Point

Debt turning point	50.89%	Confidence interval
Delta method		(42.12, 59.66)
95% CI bootstrap		
- normal biased CI		
- percentile CI		(39.87, 67.24)
- bias corrected CI		(40.01, 67.59)

Source: The authors' calculations.

Confidence intervals are subsequently calculated based on the resulting distribution of the turning points. The bootstrapping method relies on relatively few assumptions and should be used with caution on smaller samples, similar to our study.

As Table 5 shows, the debt turning point for all 10 countries is 50.89%. This means that should the debt into GDP increase above this level, it could generate a negative impact upon the GDP growth rate. Within our sample the data ranges from 3.7% to 81.3%. The 95% confidence intervals for the debt turning point may start as low as 40% of GDP, which proves the need for more prudent government debt policies.

V. Conclusions and Discussions

The relationship between public debt and economic growth has been, in light of the current economic distress, a constant contention point between various schools of thought. Our research has investigated the impact of public debt upon economic growth using a sample of 10 emerging European countries, namely Bulgaria, the Czech Republic, Estonia, Latvia, Lithuania, Hungary, Poland, Romania, Slovenia, and the Slovak Republic.

We have generated a growth regression model using 10 independent variables: gross government debt as a share of GDP, openness of the economy, population growth rate, nominal short-term interest rate, gross fixed capital formation, government fixed investments, gross national savings, government revenue and labor productivity. Our research was based on the Checherita and Rother (2010) econometric model of annual per capita GDP growth rate with the notable addition of the rate of labor productivity. A series of variables was excluded from the present research due to a lack of sample data from emerging European countries.

After performing various tests we have concluded that only four variables have a statistically significant impact upon the GDP growth rate: gross government debt as share in GDP, nominal short term interest rate, openness of the economy and total government revenue as percentage of GDP.

Compared to the Checherita and Rother (2010) model, which revealed a debt turning point of 90-100% of the GDP, our analysis established a turning point of merely 50.89%. Such a blatant difference can be explained by the developmental differences between the two sample pools: highly industrialized, developed countries versus emerging economies. We can demonstrate this for Romania, which has a moderate public debt, of around 38% of the GDP in 2012.

The 2013 report of the Romanian Ministry of Finance mentions a 2012 GDP of 607 billion Lei (around 141 billion Euro), overall budget expenditures of 212 billion Lei (around 49.5 billion Euro or 35% of the GDP) and Interest expenses of 10.6 billion Lei (around 2.5 billion Euro, 1.8% of the GDP, respectively 5% of budget expenditures). Should the public debt increase to the 50% turning point, the effects upon the public expenditures would be significant. Using the existent interest rate values, the interest expenses would be over 14 billion Lei (around 3.3 billion Euro, 6.6% of the total budget expenditures, or an increase of 800 Mil. Euro per year), significantly impairing the government capacity of financing/co-financing new public investments or affecting the private sector of the economy as the government will most likely levy new taxes/increase the level of the existing taxes.

Our study generated a slightly different result (50% return point) compared to that of the Checherita and Rother research (90% to 100% return point) due to a substantial difference in the sample data, respectively 12 Euro Area developed countries and 40 years versus 10 EU developing countries in Central and Eastern Europe and 11 years. Our chosen time is conclusive, given the non-capitalist nature of these economies prior to 1989 and the high levels of state intervention during the 1990's. Also, Egert (2013) somehow confirms our findings, the author stating that the threshold beyond which negative growth effects appear is considerably higher, at about 50% for general government debt.

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Appendix 1

Variable	Variable name/description	Source
<i>g</i>	The real growth rate of GDP per capita as % change in the previous year	EU Commission
<i>debt</i>	Gross government debt as share in GDP	EU Commission
<i>op_ec</i>	The sum of export and import shares in GDP	EU Commission
<i>pop_growth</i>	The population growth of a given area on 1 st January of the year in question	WDI
<i>int_rate</i>	Nominal short-term interest rate	EU Commission
<i>gfcf</i>	Gross fixed capital formation as % of GDP, market prices	EU Commission
<i>gf_invs</i>	General government fixed investment as % of GDP	EU Commission
<i>gns</i>	Gross national savings as % of GDP	EU Commission
<i>gg_rev</i>	Total general government revenue as % of GDP	EU Commission
<i>lab_prod</i>	Labour productivity per person employed, index EU 27=100	EU Commission

Note: Sources of basic data are the European Commission's AMECO database and the World Bank's World Development Indicators (WDI).