

AN EMPIRICAL STUDY ON PUBLIC DEBT'S DETERMINANTS: EVIDENCE FROM ROMANIA

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Abstract

The need for coordinating economic and budgetary policies in the Economic and Monetary Union, the awareness that pile of high public debt threatens future generations, increasing tax burden on a globalized market and the impact of population aging process on public finances has led to controversial opinions. Continuously borrowing resources and maintaining them consistently over time means to have a sustainable public debt, an important objective of any state fiscal policy. A sustainable public debt is the result of trade and monetary policy and budgetary decisions.

The national debt is at the center of the current crisis of the Peripheral European countries. The objective of the paper is to provide a better understanding of public debt dynamics in Romania in the period 2000 to 2011. We decompose the changes in public debt to GDP ratio into macroeconomic components attributable to primary fiscal deficits, real interest rate, real GDP growth, and to the variations on foreign currency denominated debt.

The research findings suggest that the reaction of the public debt to GDP ratio to the real growth rate of the output increased after the financial crisis. The real interest rate on government bonds remained a significant determinant of public debt in the entire sample period. Also, we find little effectiveness of monetary policy as an automatic stabilizer through the entire sample period.

Keywords: public debt, sustainability, determinants, model.

1. Introduction

The public debt is at the center of the current crisis of the Peripheral European countries like Greece, Ireland and Portugal that have already been intervened by the European Commission, the European Central Bank and the International Monetary Fund. Meanwhile, financial markets are showing doubts about the ability of Spain and Italy to fulfill their obligations towards their creditors without a similar intervention.

Governments may accumulate public debt to support public and profitable investment, for example in physical infrastructures and human resources by public spending in education and healthcare. Also, in advanced economies, the existence of developed social safety nets partially financed by public deficits that respond, for example, to the increase of the unemployment rate has a vital role as economic automatic stabilizers. Public debt can grow in these circumstances to avoid distorting taxes fluctuations (Barro, 1979).

Nonetheless, increasing national debt and budget deficits have become a critical issue in many industrialized and emerging economies. In recent decades, many countries have accumulated large stocks of public debt, usually followed by increases in the public sector size and irresponsible fiscal and budgetary policies. These developments raised concerns about debt sustainability with the possible consequences of debt monetization that originates inflation, tax rises and/or expenditures cuts that entail substantial economic costs, or in extreme cases sovereign debt default.

Romania, a recent joiner to the European Union (EU) - 2007, in spite of retaining its ability to devalue the currency, is actually suffering as a consequence of the Euro Zone crisis, and nowadays the country's public debt reached its greatest ever record forcing the government to implement austerity measures and to borrow from the International Monetary Fund (IMF).

The objective of this paper is to provide a better understanding of public debt dynamics in Romania in the period from the first quarter of 2000 to the second quarter of 2011, which covers both previous and next time periods to the recent financial crisis that started in August 2007.

Our empirical strategy is: first, to decompose changes in public debt to GDP ratio into macroeconomic components attributable to primary fiscal deficits, real interest rate, real GDP growth, and to the gains or losses on foreign currency denominated debt as a result of exchange rate variation; second, to analyze the contribution of each factor to the debt dynamics.

The paper is organized as follows: section 2 briefly describes the current development of public debt in Romania, as well as its structure; section 3 describes the model to be tested and the used data set; section 4 presents and discusses the estimated results and, finally, section 5 draws some final conclusions.

2. Recent dynamics of Romania's public debt

Public debt as a percentage of GDP in Romania reached 34.3 percents in the second quarter of 2011, which is still relatively low by international standards (see Figure 1).

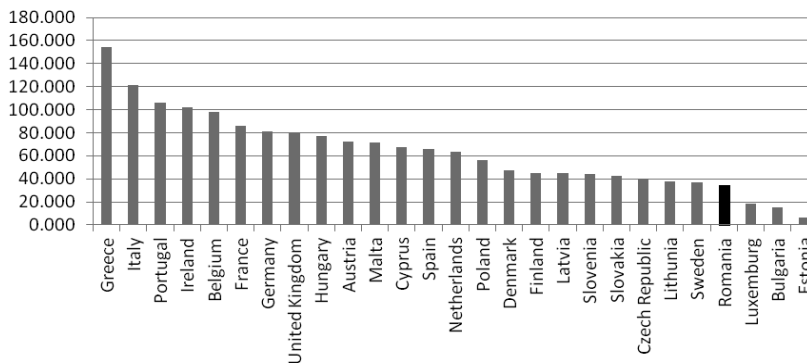


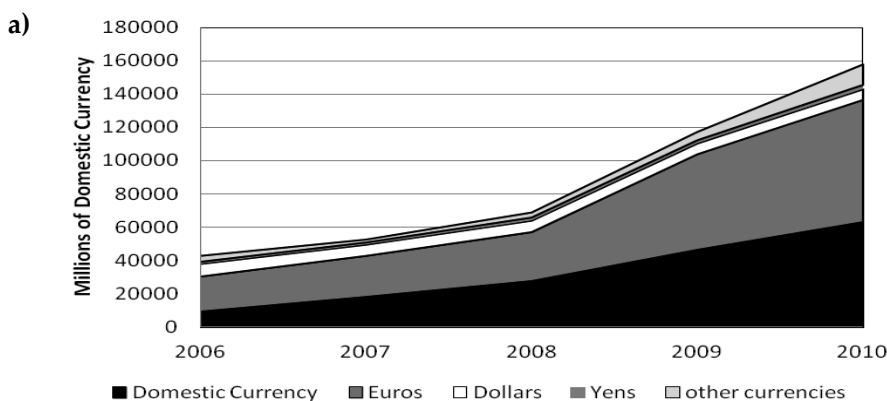
Figure 1: Public Debt to GDP Ratio in the EU (Second Quarter of 2011)

Source: Authors' own calculations based on IMF eLibrary data

Despite this fact, it is known that debt intolerance thresholds vary across countries, being determined by the country's record of default and inflation, and by poor financial structures and financial systems (Reinhart *et al.*, 2003). For example, the IMF World Economic Outlook (2003) states that monetary policy as a countercyclical tool is less effective in countries with high public debt: for industrial countries it is defined as above 75 percent of GDP, and for emerging markets (such as Romania) - as above 25 percent of GDP.

Also, the currency composition of the debt and its maturity structure are relevant to access the vulnerability of a country to a debt crisis (World Bank, 2005).

In fact, even a modest debt to GDP ratio can hide unsustainable public debt dynamics when a large share of public debt is denominated in foreign currency. When this is the case, countries are particularly vulnerable to the devaluation of the domestic currency. In Romania, the share of the domestic currency denominated debt has increased until 2008, and remained stable after that. In 2010, there is still a larger share of debt denominated in foreign currency (60 percent) than in Lei (see Figure 2).



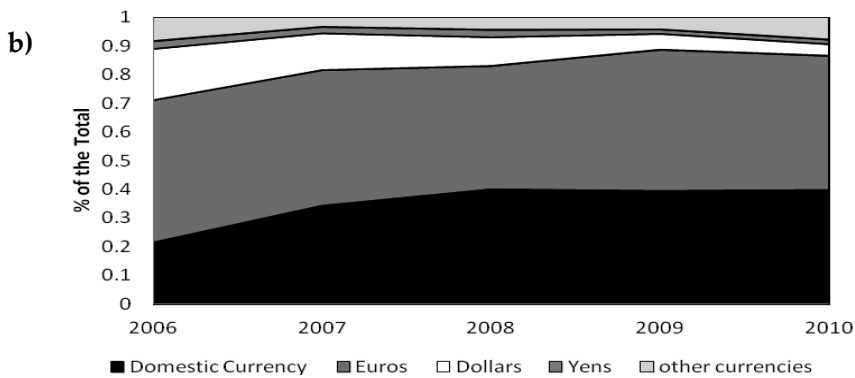


Figure 2: Public debt structure: Domestic vs. foreign currency denominated debt

Source: Authors' own calculations based on Eurostat Government Finance Statistics

Furthermore, a large percentage of short-term debt exposes a country to interest rate volatility, making public debt highly sensitive to the increase in the interest rates. After showing a tendency to decrease in the beginning of 2000, the percentage of short-term debt increased again after 2006, due to the budget's need to borrow resources in order to be able to ensure current expense pay, such as the budgetary salaries and pensions. In 2010, about 20 percent of the public debt has maturity less than one year (see Figure 3).

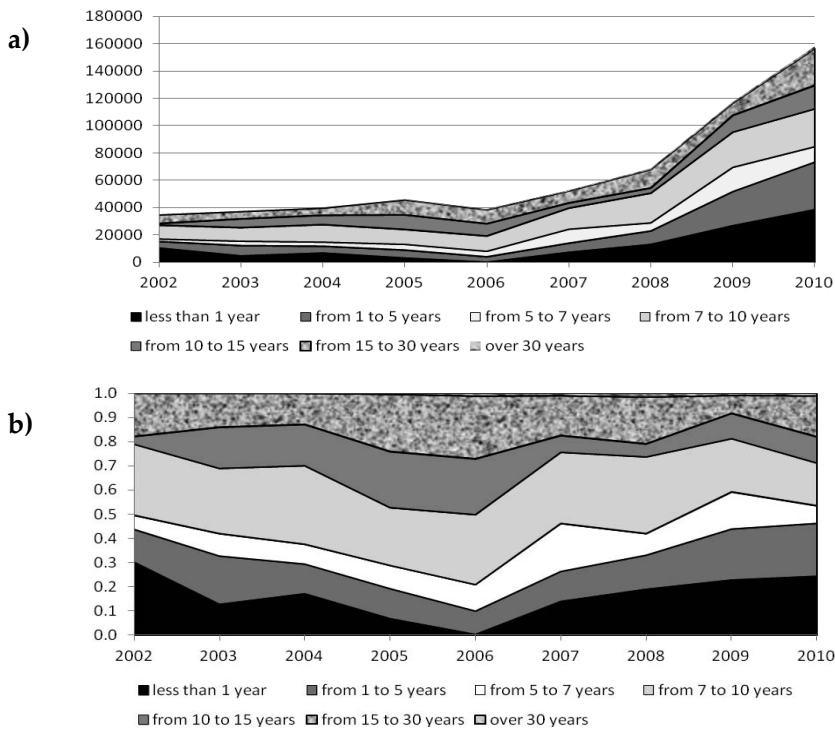


Figure 3: Public debt maturity structure

Source: Authors' own calculations based on Eurostat Government Finance Statistics

At the beginning of the 1990s, Romania recorded a consolidated value of public debt under than the other former planned economies such as Czech Republic, Hungary and Poland. In the period 1992-1995, it showed reasonable values of 15-17 percent of the GDP.

A large increase of the debt to GDP ratio occurred after 1995. In the period 1996-1997, it increased by about 16 percents. The cause was the rise of the external indebtedness in these two years by 12.2 percents. By this time, public debt to GDP ratio had already exceeded the corresponding macroeconomic indicator in the Czech Republic, and the difference to Poland and Hungary was reduced significantly. In the period from 1995 to 2001, the debt to GDP ratio grew significantly from 7 percent, recorded in 1995, to about 26 percent in 2001.

The public debt to GDP ratio declined steadily from the last quarter of 2002 until the acute phase of the recent financial crisis following the Lehman Brother Collapse in September 15 of 2008 (reaching de decade record low of 11.6 percents of GDP in the third quarter of 2008), in line with the requirements of the Stability and Growth Pact of the EU. The reasons for this sharp reduction were the economic reforms implemented towards the accession to EU, the increase of the growth rate of GDP, and a deceleration in issuing new debt. After that, it climbed sharply to 34.3 percents of GDP in the second quarter of 2011 (see Figure 4).

From visual inspection of Figure 5 emerges as the main reason the sharp decline in the GDP growth rates that implies a significant decline in tax revenues. For example, in 2008 the economic growth was 7.3 percents of the GDP, while in 2009, the economy contracted by 7.1 percents of GDP, as the result of the financial crisis that reduced domestic and foreign demand. This conclusion is certainly in line with the findings of Reinhart and Rogoff (2009a; 2009b) that documented that after a serious financial crisis, public debt increases on average with 86 percents, the reason being generally the decline in the tax revenues due to slow GDP growth rate or even recession.

Additional determinants of the growth of public debt were the higher interest rates on the foreign markets (LIBOR and EURIBOR), higher yields on government securities (see Figure 5 c.). The restricted access to external financing on international markets, and the exchange rate depreciation against the main foreign currencies in the government debt portfolio like the Euro and the Dollar (see Figure 5 d.) (Ministry of Public Finance, Strategy concerning the management of public debt 2011-2013).

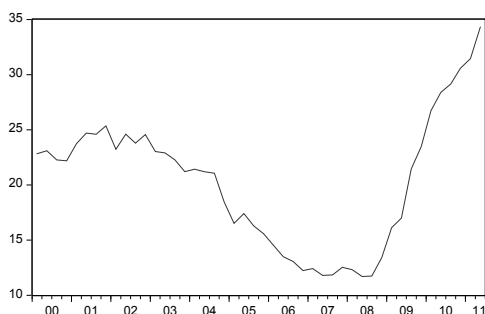


Figure 4: Romania' Public Debt to GDP Ratio

Source: Authors' own calculations based on IMF eLibrary data

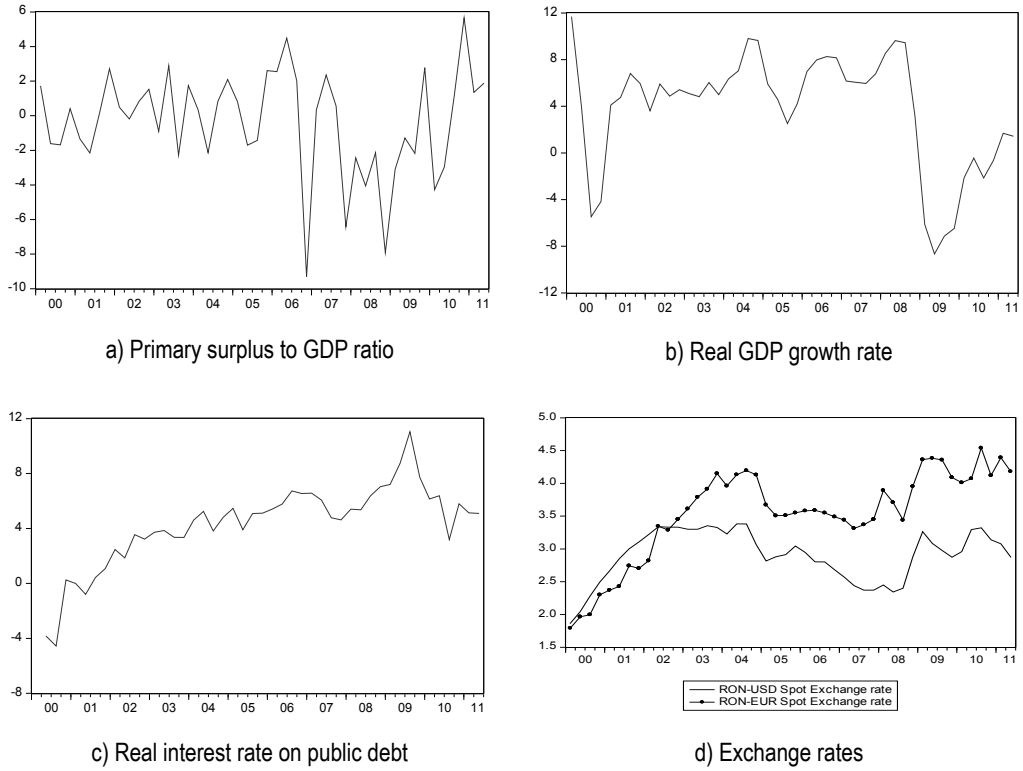


Figure 5: Determinants of public debt dynamics

Source: Authors' own calculations based on IMF eLibrary data

3. Model and data set

The background of the empirical model is the government budget constraint equation in each period t :

$$B_t = (G_t - T_t) + (1 + i_t^D) \times B_{t-1}^D + (1 + i_t^F) \times B_{t-1}^F \times S_t + \Delta BM_t \quad (1)$$

According to equation (1), the variation of total public debt at the time t denominated in domestic currency, B_t , depends on the current primary deficit: non interest total general government expenditures during period t , G_t , minus total general government revenue during period t , T_t , on the public debt incurring in the past, including the interest payments on government borrowing, and on changes of the monetary base, ΔBM_t .

As Romania is issuing debt in local currency, as well as in foreign currency, we split the sovereign debt inherent from the period $(t-1)$ into domestic, B_{t-1}^D , and foreign currency denominated debt, B_{t-1}^F . In equation (1), i_t^D is the nominal interest rate applied to domestic denominated debt, i_t^F is the nominal interest rate applied to foreign currency denominated debt, and S_t is the nominal exchange rate defined as Lei per foreign currency.

It is common to write the government budget constraint in a style that expresses the growth of debt to GDP ratio in terms of the ratio of the primary deficit to GDP, the real interest rate and the GDP growth rate.

Diving both sides of equation (1) by the nominal GDP, neglecting debt monetization, and defining lower case variables as upper case variables expressed as a proportion of GDP, we can rewrite equation (1) as the public debt dynamics equation:

$$b_t - b_{t-1} = (g_t - t_t) + (i_t^D - \pi_t - y) \times b_{t-1}^D + (i_t^F - \pi_t - y_t + s_t) \times b_{t-1}^F \quad (2)$$

Where:

π_t – is the inflation rate;

y_t – is the growth rate of real GDP; and

s_t – is the percentage change of the exchange rate.

Accordingly, the public debt to GDP ratio changes as a result of the primary deficit; the ‘automatic debt dynamics’ determined by the real interest rate on public debt and the actual rate of growth of GDP; the capital gains or losses on foreign currency denominated debt as the result of exchange rate fluctuation.

Based on equation (2), we estimated by OLS and using the Newey-West procedure (Newey and West, 1987) to correct the resulting problems of heteroscedasticity and autocorrelation the following model:

$$\Delta DEBT_t = \beta_0 + \beta_1 DEBT_{t-1} + \beta_2 PSURPLUS_t + \beta_4 RIR_t + \beta_5 GDPGR_t + \beta_6 EXCUSD_t + EXCEUR_t + \gamma X_t + \varepsilon_t \quad (3)$$

Where:

$\Delta DEBT_t$ – is the variation of the total amount of public debt as a percentage of GDP at time t ;

$DEBT_{t-1}$ – is the public debt as a percentage of GDP in the previous period;

$PSURPLUS_t$ – is the primary government surplus as a percentage of GDP;

RIR_t – is the actual average interest rate paid on public debt;

$GDPGR_t$ – is the real rate of GDP growth;

$EXCUSD_t$ – is the Leu-Dollar exchange rate defined as the number of lei per dollar;

$EXCEUR_t$ – is the Leu-Euro exchange rate defined as the number of lei per Euro;

$X_{i,t}$ – is a vector of other control variables; and

ε_t – is a random disturbance term.

The vector of control variables includes: the degree of openness of the economy at current prices, measured as total trade (sum of imports and exports) as a percentage of GDP, $OPEN_t$; the net foreign direct investment as a percentage of GDP, FDI_t ; and a set of dummy variables, $ELECT_t$, $ELECT1_t$, $ELECT2_t$ and $ELECT3_t$ that are (1) if there is a parliamentary election in a given quarter, and in one, two or three quarters ahead respectively, and (0) otherwise. Trade openness is a variable darned often present in monetary policy models since early times (Cameron, 1978; Myrdal, 1960). Openness should have a positive impact on economic growth, which contributes to the reduction of the debt to GDP ratio (Berg and Krueger, 2003).

The reason for the inclusion of FDI_t is that it leads to an increase of productivity and hence to a decrease of the debt to GDP ratio. Reinhart and Rogoff (2008) found that this variable is relevant to explain the debt to GDP ratio in low and middle income countries. The election dummies are included to verify the so called opportunistic hypothesis that states that incumbent governments boost the economy prior to elections, in order to maximize their probabilities of being re-elected; hence, producing political business cycles (see the early contributions of Nordhaus (1975), Lindbeck (1975), Hibbs (1977), and MacRae (1977)). Further contributions can be found in Alesina and Roubini (1992), Rogoff (1990), and Shi and Svensson (2006). The empirical literature on this hypothesis remains, however, rather inconclusive (see Schneider, 2010).

Then, following Barro (1979) and Bohn (1998), we admit that the primary deficit is a function of temporary government expenditures, defined as the difference between non interest government spending as a percentage of GDP, G_t , and its trend, $\bar{G}_t$, computed using the Hodrick-Prescott filter and as a function of the cyclical state of the economy, defined as the difference between the unemployment rate, U_t , and its Hodrick-Prescott trend, $\bar{U}_t$. The output gap is an alternative to the unemployment gap. However, unemployment rate has several advantages (Fernandes and Mota, 2011): it is more objective in its quantification; it is accessible to the public in general on a monthly basis, and it is waited by the markets as a good indicator of the state of the economy. Moreover, since it directly affects the well-being of the electors and their opinions of the government, politicians feel obliged to respond to it by means of appropriate discretionary fiscal policy.

To account for a structural break after 2007 caused by the recent financial crisis, we include an interaction term between the explanatory variables and a dummy variable, $CRISIS_{i,t}$. The Quandt-Andrews unknown breakpoint test (Andrews, 1993; Andrews and Ploberger, 1994) indicates a structural break in the regression in the first quarter of 2009 (where the LR F-statistic reaches a maximum of 5.679 - see Figure 6). Accordingly, $CRISIS_{i,t}$ takes the value of (1) for all the quarters after the first quarter of 2009, and (0) for the quarters before.

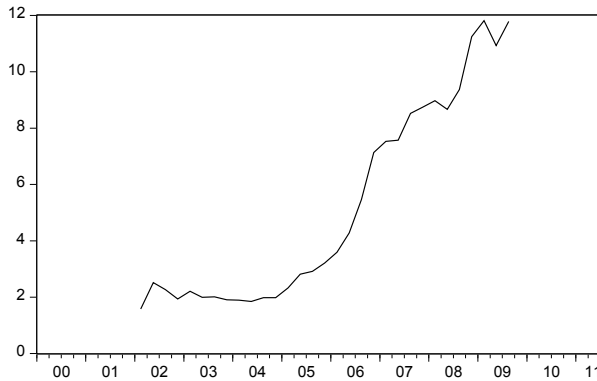


Figure 6: Quandt-Andrews unknown breakpoint test (LR F-statistic)

Source: Authors' own calculations based on IMF eLibrary data

In the estimation, we use quarterly data from IMF - International Financial Statistics, BOPS - Balance of Payments, GFS - Government Finance Statistics and Coordinated Direct Investment Survey, electronic databases provided by International Monetary Fund. The data covers the period from the first quarter of 2000 to the second quarter of 2011, which includes both previous and next periods to the recent financial crisis that started in August 2007. All the variables were seasonally adjusted.

The summary descriptive statistics are in Table 1. The dynamics of public debt to GDP ratio is displayed in Figure 4, and the main determinants of public debt are displayed in Figure 5.

Table 1: Summary statistics of variables

Variable	Mean	Standard Deviation	Max	Min	Variation (%) 2000:01–2011:02
$DEBT_t$	20.3	6.0	34.3	11.6	50.44
$PDEFICIT_t$	-0.3	3.4	5.9	-12.1	10.21
G_t	36.3	5.6	48.7	24.7	-16.11
U_t	7.0	2.3	12.9	3.8	-54.37
RIR_t	4.291	2.954	11.040	-4.554	232.46
$GDPGR_t$	3.8	4.9	11.6	-8.6	-87.63
$EXCUSA_t$	2.901	0.387	3.381	1.866	54.18
$EXCEUR_t$	3.535	0.694	4.539	1.790	113.58
$OPENC_t$	0.8	0.1	0.9	0.7	26.86
FDI_t	4.8	3.1	11.2	0.4	38.42

Source: Authors' own calculations based on IMF eLibrary data

4. The estimated results

Table 2 (column) presents the estimation results of the effect of the primary fiscal balance, the real interest rates, the real GDP growth, and the exchange rate variation on the dynamics of public debt (Equation 3). This is the baseline model. The regression is global significant, and the signs of the main explanatory variables are those that are expected. An increase of the primary surplus to GDP ratio originates a reduction in the public debt to GDP ratio while an increase of the real interest rate and a reduction of the GDP growth rate generate a positive variation of the debt to GDP ratio. The debt in the past years does not have a significant impact on the variation of the debt in the current period. This result means that governments did not show any urgency to respond to the increase of debt to GDP ratio.

Concerning the exchange rate variations, the Leu-Dollar exchange rate is significant and with the expect sign, meaning that a devaluation of the Leu against the Dollar increases the debt to GDP ratio while the Leu-Euro exchange rate is non-significant. Among the control variables, only foreign direct investment is crucial, implying that an influx of capital contributes to reduce the public debt to GDP ratio. The degree of openness of the economy is not significant, and we also did not find electoral cycles in the conduct of public debt.

Based on this estimation, we decompose the public debt dynamics into its significant components, following the methodology of the World Bank (2005), Public Debt and

Its Determinants in Market Access Countries (Figure 7). The results show that the real GDP growth rate contributed to a reduction of the debt to GDP ratio until the beginning of the financial turmoil. After that, the recession has been contributing to the increase of the debt ratio. Before the recent financial turmoil, foreign direct was also a crucial factor that contributed to the reduction of the public debt. Nonetheless, its influence diminished considerably after 2008. The Leu-Dollar exchange rate contributed to the reduction of public debt from 2002 to 2008. After the crisis, the devaluation of the Leu increased the domestic value of the foreign currency denominated debt, leading to an increase of the debt to GDP ratio. The real interest rate on public debt contributed to the increase in debt to GDP ratio throughout the whole period, and its impact increased after 2008. Primary budget had an impact either positive or negative to the public debt accumulation through the period, but its contribution is relatively small. This result has not changed much after 2008, which is an indicator of the limited importance of the automatic stabilizers in Romania.

Table 2: Estimation results
(Dependent variable: quarterly change of the debt to GDP ratio)

Variables	Model I Baseline		Model II Cyclical State of the Economy		Model III Crisis	
	Coef.	T-statistic	Coef.	T-statistic	Coef.	T-statistic
β_0	0.509	0.256	1.127	0.486	0.094	0.098
$DEBT_{t-1}$	0.0003	0.008	0.029	0.601	-0.037	-1.032
$PSURPLUS_t$	-0.086*	-1.897	-	-	-	-
$U_t - \bar{U}_t$	-	-	-0.179	-0.470	-	-
$G_t - \bar{G}_t$	-	-	0.067*	1.844	0.003	0.124
RIR_t	0.183**	2.627	0.221***	3.270	-0.076	-1.031
$GDPGR_t$	-0.087**	-2.231	-0.096**	-2.003	0.087*	1.922
$EXCUSD_t$	2.719**	2.343	2.998***	2.823	4.575***	2.786
$EXCUSD_t$	-0.193	-0.197	-0.163	-0.147	-	-
$OPENC_t$	-0.374	-0.120	-2.118	-0.650	-	-
FDI_t	-0.133*	-1.751	-0.114	-1.492	-0.009	-0.184
$ELECT_t$	-0.381	-1.337	-0.421	-1.189	-	-
$ELECT1_t$	0.460	0.675	0.490	0.722	-	-
$ELECT2_t$	0.014	0.033	0.041	0.092	-	-
$ELECT3_t$	0.390	0.566	0.236	0.310	-	-
$DEBT_{t-1} \times CRISIS_t$	-	-	-	-	0.076***	3.055
$(U_t - \bar{U}_t) \times CRISIS_t$	-	-	-	-	-	-
$(G_t - \bar{G}_t) \times CRISIS_t$	-	-	-	-	0.254***	3.204
$RIR_t \times CRISIS_t$	-	-	-	-	0.432***	3.981
$GDPGR_t \times CRISIS_t$	-	-	-	-	-0.236***	-3.375
$EXCUSD_t \times CRISIS_t$	-	-	-	-	2.146	-0.618

Variables	Model I Baseline		Model II Cyclical State of the Economy		Model III Crisis	
	Coef.	T-statistic	Coef.	T-statistic	Coef.	T-statistic
$FDI_t \times CRISIS_t$	-	-	-	-	-0.509	-1.632
R^2	0.573		0.572		0.768	
DW	2.659		2.617		2.738	
$F - statistic$	3.237		2.879		5.803	

Source: Authors' own calculations based on IMF eLibrary data, <http://elibrary-data.imf.org/>

Note:***, **, and * indicate significance at 1, 5 and 10 percent respectively (We used the Newey-West procedure to account for heteroscedasticity and autocorrelation).

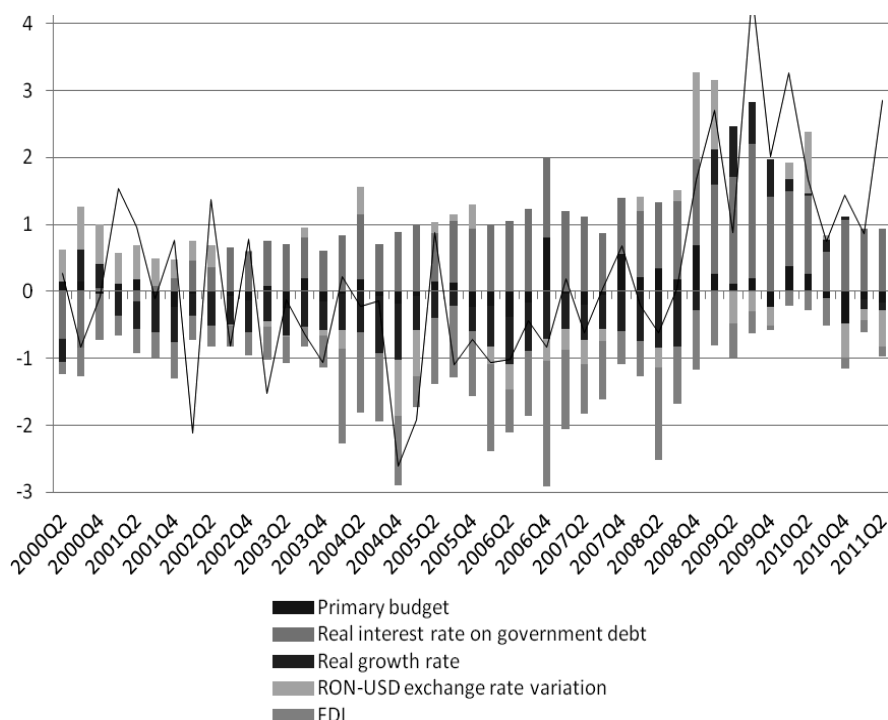


Figure 7: Determinants of public debt dynamics

Source: Authors' own calculations based on IMF eLibrary data

Note: Each column represents the contribution of each element to quarterly change of the debt to GDP ratio. A positive value means that a given factor contributed to an increase of the debt to GDP ratio. A negative value means that a given factor contributed to a decrease of the debt to GDP ratio.

Then we replace the primary surplus to GDP ratio by the temporary government expenditures and the cyclical state of the economy (see Table 2, column II). Between the two considered determinants of primary surplus, only the temporary expenditures variable is significant implying deficit spending in periods of economic downturn. However, the non-significance of the cyclical unemployment variable indicates a limited capacity of conducting counter-cyclical monetary policy by the Romanian authorities.

Model III analyses whether there is a structural break in the relationship between public debt growth and its determinants caused by the recent financial crisis. The results are in Table 2, column III. We consider only the significant variables included in Models I and II.

We find that the coefficient of the lagged public debt to GDP ratio turns significant and positive after 2008 while it is contrary, although not significant before 2007. This implies that after the economic crisis hit the world economy in the fall of 2007, the debt to GDP exhibits more persistence. We also note that temporary expenditures have a greater impact on the fluctuation of public debt (we read the reaction of public debt after 2008 as the sum of the estimated coefficients of $G_t - \bar{G}_t$ and $(G_t - \bar{G}_t) \times CRISIS_t$). The increasing difficulties of accessing international financial markets and the rise of the interest rates are also reflected in greater response of public debt to the real interest rate on public debt after 2008 (we read the response of public debt after 2008 as the sum of the estimated coefficients of RIR_t and $RIR_t \times CRISIS_t$). Finally, the impact of the growth rate of GDP also increased after 2008 (we read the response of public debt after 2008 as the sum of the estimated coefficients of $GDPGR_t$ and $GDPGR_t \times CRISIS_t$), which is mostly negative since GDP fell sharply after this period.

5. Conclusions

The objective of the study was to analyze the factors that influence the debt to GDP ratio in Romania. We found out that the primary fiscal balance, the real interest rate, the real GDP growth rate, and Leu-Dollar exchange rate variation are significant, while the Leu-Euro exchange rate is not. This result gives empirical support for the government target to increase the percentage of public debt expressed in domestic currency and to increase the Euro denominated government debt share in total foreign currency government debt in order to limit the currency risk of the debt portfolio.

We also confirm that the government has a limited capacity of using monetary policy as an automatic stabilizer on the basis on the non-significance of the coefficient of the fluctuation of public debt on the cyclical unemployment rate, which is particularly common in emerging economies such as Romania.

Finally, we found an increasing reaction of the public debt to macroeconomic determinants such as the GDP growth rate after the financial crisis, which implies that restoring the conditions for growth and to reduce the interest rate risks are of critical importance to manage the public debt.

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