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## **An Application of Debt Laffer Curve: Empirical Evidence for Romania's case<sup>♦</sup>**

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### **ABSTRACT**

The recent economic and financial crisis emphasized the vulnerabilities at international level and among them is the public debt. The aim of this paper is to analyse the debt Laffer curve for Romania's case to see if country suffer from debt overhang. Data on public debt for the period 2013-2014 showed that Romania is on the right side of the debt Laffer curve, far from the peak of debt beyond which we can talk about a shift on the wrong side of the curve.

**Keywords:** Laffer curve, public debt, economic crisis, fiscal policy

**JEL Codes:** H63, G15, E62

### **1. Introduction**

The economic and financial crisis has brought into attention of economists an old problem of advanced economies in Europe: public debt. In recent years public debt-to-GDP ratio reached alarming levels. In some European Union (EU) member states public debt-to-GDP ratio exceeded 100%. In this case, the government borrows more than the whole economy produce and this should be an warning signal for all agents in the economy, especially for future generations who will bear the burden of current borrowing.

Public debt has become a problem of worldwide interest after crisis, this is why many researchers in economics focused on this problem in recent years. Ghosh, Kim, Mendoza, Ostry and Qureshi (2011) argued that stimulus spending and lower revenues in the Great Recession contributed to some of the

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highest public debt-to-GDP ratios and primary deficits in advanced economies seen in the past forty years. They considered that many of these countries is expected to continue facing large financing needs over the coming years and that will make credit markets more concerned about the ability of some of them (especially Greece, Ireland, Portugal and Spain) to service their debts.

Reinhart and Rogoff (2011) pointed out that advanced economies recorded the highest level of public debt since the end of World War II. They argued that the combination of high and climbing public debts and the protracted process of private deleveraging makes it likely that the period between 2008 and 2017 to be described as a decade of debt.

Adema, Fron and Ladaique (2011) have shown that from 1980 to 2007, public social spendings increased by more than 20% across the Organization for Economic Co-operation and Development (OECD) member states and public expenditure on health and pensions are the largest social spending items. Kotlikoff and Hagist (2005) have indicated that healthcare expenditures have been growing much more rapidly than GDP in OECD countries. They argued that if the growth rate of benefits will be maintained at the current level in the next four decades, the OECD member states will face substantial budget deficits.

Health expenditure have grown due to ageing population in all EU member states over the period 1995-2012. The growth rate of health expenditure has increased rapidly and has exceeded the growth rate of GDP. Significant increases in health spending were registered in Netherlands (78%), Bulgaria (64.3%), Malta (52.6%), United Kingdom (46.3%), Lithuania (43.9%)<sup>1</sup>. Analyzing statistical data we can observe that social protection expenditure have increased in EU member states in last years. The largest increase was registered by Portugal where social protection expenditure rose by 55% in 2011 comparative to 1995. Other countries where social protection expenditure has increased are: Romania (29.5%), Malta (24.6%), Ireland (24.3%), Lithuania (23.5%), Greece (22.7%)<sup>2</sup>.The increasing public expenditure was financed from borrowed money.

In this paper we focus on Romania's case because it's one of the countries where public debt grew very fast in recent years. Even if Romania is among the countries with a low level of public debt as a share of GDP, the growth of public debt manifested internationally was present also in Romania after the financial and economic crisis.

When the crisis hit Romania, the level of public debt was low, but it has greatly increased after the economic and financial crisis, Romania being among the countries that have experienced the greatest increase in public debt after 2008. In 2008, public debt as a share of GDP was 13.4%, but in 2012 almost tripled compared to 2008 (37.9%). According to International Monetary Fund projections, the public debt will remain high in the coming years. For 2014 is estimated that the public debt to GDP ratio will be 38.1%, in 2015 public debt to GDP ratio will be 37.2%, 36.9% in 2016, 36.6% in 2017 and 36.2% in 2018.

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<sup>1</sup>Own calculation based on annual data for health expenditure available from Eurostat extracted from 1995-2012(The results are available from the author on request)

<sup>2</sup>Own calculation based on annual data for social protection expenditure available from Eurostat extracted from 1995-2012 (The results are available from the author on request)

The main cause of the increase in public debt was the large budget deficit of Romania which got worse because the number of unemployed people had increased, the companies have ceased operations because of bankruptcy and the situation in the banking system got worse because of bad loans. After the crisis, Romania began to borrow money from International Monetary Fund and European Commission to cover the budget deficit and to strengthen international reserves. In this context, we want to see if Romania suffer of debt overhang using debt Laffer curve.

The rest of the paper proceeds as follows. Section 2 presents some theoretical issues related to debt Laffer curve and the results of the studies on this subject. Section 3 presents the methodology used to analyze if Romania is on the right or wrong side of the debt Laffer curve. In section 4 are described the data used to achieve the debt Laffer curve and the interpretation of the results obtained. In the end, the conclusions of this paper are presented.

## **2. Debt Laffer curve: Theoretical aspects**

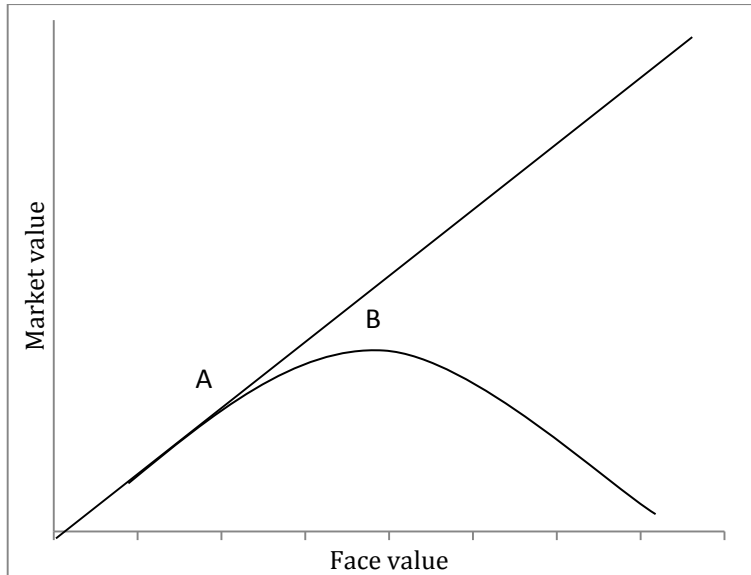
Laffer curve was used as a tool to optimize tax revenue in order to eliminate or reduce the fiscal deficit. Given the rapid increase of public debt in recent decades, researchers in economics have examined the debt Laffer curve as an evaluation tool that lenders can use to assess the solvency of a debtor country.

Debt Laffer curve was analyzed first by Sachs (1989) in the context of debt overhang. He showed that in this case, debt forgiveness leads not only to maintain the current market value of securities, but also to increase expected value of monetary flows related to repayment of obligations of debtor countries. When a country is borrowing too much, its ability to finance decrease and thus the risk of default occurs. Creditors calculate the expected value of reimbursements they receive according to risk of default. If the expected value is less than the face value of the debt, reducing the nominal (or face) value of debt reduce the risk of default and leads to an increase in expected value of future repayments.

Krugman (1989) has shown that is a link between a country's ability to service debt and the current level of public debt. He showed that when a country accumulates too much debt, in other words when payment obligations exceed its ability to pay, payment obligations act as a marginal tax rate: if the state succeed to obtain better results than those expected, benefits will return to creditors and not to the state. In these circumstances, the government may be discouraged to improve economic performances because the benefits are going rather to creditors than to country.

Starting from the idea that accumulated debt in current period must be repaid in the next period and future investment earnings will be capital outflows to creditors, Cohen (1989) showed that the debtor country benefits are very small and this leads to more debt to repay previously debts and to finance new investments.

**Figure 1 Debt Laffer curve**



Analyzing Figure 1, we can see that between market value and face value of public debt is a relation 1-to-1 up to a certain point (point A) because when debt is low, creditors expect that the full debt will be paid. Agénor and Aizenman (2005) showed that when the point A is passed because of increase of nominal value of debt, default risk increases, which means that the probability to repay the loan is less than 1. When nominal value rises above point A, market value begins to rise more slowly. This is explained by the fact that the more a country accumulates debt, the harder it becomes to finance because the risk of default increases. Thus, accumulating debt leads to a decrease in the market value and marginal profitability of debt begins to decline right to the point A, but the market value of debt still increasing. If debt level rise above a certain threshold (point B), increasing the nominal value cannot compensate the decline in market value and country suffers from debt overhang.

When the nominal value of debt of a country is less than the market value, there are two cases: either country is to the left of point B (this is the maximum market value of public debt that a country can achieve) or to the right. If the nominal value of debt lies between points A and B, we say that the country is on the right side of Laffer curve, in which case the debt reduction will not lead to an increase in its market value. If the nominal value of debt is to the right of point B, we say that the country is on the wrong side of the curve or otherwise the country is over indebted, and creditors may be discouraged by the prospects of the country which can lead to a significant decrease in investment. In this case the reduction of nominal value of debt leads to an increase in its market value. This is advantageous both for creditors and debtors. For creditor the advantage refers to the increasing of capacity of debtor to honor its payment obligations and the debtor have the advantage that he gains from the reducing of total amount of debt and increasing the creditworthiness which leads to attract lenders and investment growth.

There is a small number of researchers who analyzed debt Laffer curve, so the number of papers on this topic is limited and the answer to question “Represent Debt Laffer curve a useful tool to analyze the situation of highly indebted countries?” is not clear.

Claessens (1990) showed that the market value of the debt depends on several explanatory variables such as the ratio of nominal value of debt to exports and the average growth rate of exports in the last 5 years. Also include two dummy variables: first dummy variable takes the value 1 if the country has arrears and 0 otherwise; second dummy variable takes the value 1 if the country had a debt forgiveness and 0 otherwise. Using available data for 29 countries for the period 1986-1988, he showed that 5 of the countries analyzed were on the wrong side of the curve (Bolivia, Sudan, Peru, Zambia and Nicaragua).

Claessens, Diwan, Froot and Krugman (1991) extended the study of Claessens (1990), analyzing on which part of debt Laffer curve are 35 countries, among them being those previously analyzed. On the wrong side of the curve were the 5 countries that were found in the study done by Claessens, their adding Argentina.

A more recent study on debt Laffer curve was done by Chaudhary and Anwar (2001). They analyzed data on public debt for 7 countries (Pakistan, India, Sri Lanka, Bangladesh, Maldives, Nepal, Bhutan) during 1970-1995 using the methodology proposed by Claessens (1990). The two authors have shown that the countries analyzed have high debt levels and their estimates revealed that is the debt continues to grow these countries will face increasing public debt burden in the future. Five of the countries analyzed by them were on the right side of Laffer curve, but very close to the point beyond which went on the wrong side. Maldives and Bhutan were on the wrong side of the debt Laffer curve. The both countries and their creditors would gain if the nominal value of debt will reduce.

There are several reasons why the study on debt Laffer curve is useful. First, it shows when debt reduction can be beneficial for a country (in case when country is on the wrong side of the curve). Second, debt Laffer curve can be used in schemes for reducing debt. Also, debt Laffer curve can be used to establish contractual conditions and obligations for loans in terms of net present value.

### **3. Methodology**

As we have seen, debt Laffer curve relates the relationship between face value and market value of debt, where market value is determined by the market price of debt. Unlike previous studies that started from the idea that the market price of debt depends on public debt to export ratio and growth rate of exports, in this papers we considered that the market price of debt depends on nominal value of debt.

We expect that between market price and nominal value of debt to be a negative relationship because when nominal value of debt increases, default risk increases, resulting a reduction in the market price of debt.

To analyze on which side of curve is the debtor country we estimated two models. In the first model we considered that between the market price and nominal value of debt is a linear relationship who can be expressed by the following equation:

$$P = \beta_0 + \beta_1 \times D \quad (1)$$

$P$  = market price of debt

$D$  = nominal value of debt

$\beta_0$  = constant that includes the impact of variables which were not included in the model

$\beta_1$  = coefficient associated to the face value of debt, indicating the impact of nominal value on market price of debt

To determine the market value of debt, we used the following relationship:

$$V = P \times D \quad (2)$$

$V$  = market value of debt

$P$  = market price of debt

$D$  = face value of debt

From equations (1) and (2) we obtain the following expression of the market value of debt:

$$V = \beta_0 \times D + \beta_1 \times D^2 \quad (3)$$

To see whether a country is on the right or wrong side of curve we should determine the maximum of the equation (3). For this is necessary to derive the equation in relation to  $D$  and equal to 0. If the difference between the maximum value of debt and the current value of debt is negative means that country is on the wrong side of curve. If the difference is close to 0, then the country is near the peak of the curve and if the difference is positive the country is on the right side of debt Laffer curve.

In the second model we considered that between logarithm of market price ( $\ln P$ ) and logarithm of face value of debt ( $\ln D$ ) is a relationship that can be expressed by the following equation:

$$\ln P = \beta_0 - \beta_1 \times \ln D \quad (4)$$

In this case the coefficient  $\beta_1$  should be interpreted as a coefficient of elasticity of the market price against face value of debt and it shows the percentage increase in the market price of debt when the face value of debt is reducing by 1%.

Equation (4) gives the following expression for the market price of debt:

$$P = e^{\beta_0 - \beta_1 \times \ln D} \quad (5)$$

Equation (5) can be rewritten as follows:

$$P = \alpha \times D^{-\beta_1} \quad , \text{ where} \quad (6)$$

$$\alpha = e^{\beta_0}$$

From equations (2) and (6) we can write the market value of debt as follows:

$$V = \alpha \times D^{1-\beta_1} \quad (7)$$

Differentiating equation (7) in relation to nominal value of debt, we obtain:

$$\frac{\partial V}{\partial D} = \alpha \times (1 - \beta_1) \times D^{-\beta_1} \quad (8)$$

Analyzing equation (8) we have one of the following:

- a.  $\beta_1 > 1$ . In this case derivative of market value relative to nominal value is negative, which means that as the nominal value of debt increases, the market value of debt decreases or otherwise function of the market value of debt is decreasing relative to the nominal value of debt. This situation corresponds to the case where the country is on the wrong side of the debt Laffer curve.
- b.  $\beta_1 < 1$ . In this case derivative of market value relative to face value is positive which means that the function of market value of debt is increasing relative to nominal value debt and the country is on the right side of debt Laffer curve.

#### 4. Data and results obtained

Due to data limitations, in this paper we analyzed government debt securities for Romania in 2013 and 2014. Another reason why we could not analyze a long period is the fact that the secondary market for government debt securities began to grow in last years in Romania. The Romanian government has made 93 bonds issues during this period, their total value being 67.24 billion RON and the maturity ranging from 6 months to 15 years.

From Table 1 we can see that most of the debt is over 3 and 5 years. Also, debt with maturity over 1 year and 10 years are an important part of total debt of Romania. Regarding the average market price, it increase as maturity increases. This situation is normal since the market price is determined as the present value of future cash flows generated by the loans given the coupon rate and bond yield. As maturity is higher, coupon rate increases which increases the market price of debt.

**Table 1 Public debt structure**

<b>Maturity</b>	<b>Face value (billion RON)</b>	<b>Average market price of debt</b>
6M	3.42	0.9826
1Y	9.39	0.9568
2Y	3.09	1.0049
3Y	14.66	1.0112
4Y	4.47	1.0139
5Y	14.37	1.0225
6Y	6.70	1.0375
7Y	2.55	1.0287
10Y	8.28	1.0484
15Y	0.31	1.0497

*Source: Reuters*



Based on 93 observations we estimated the regression equation for the price of public debt under the two proposed models.

From Table 2 we can see that between the market price and face value of public debt exists a negative relationship, being respected the economic theory. For the first model we obtained that between market price and nominal value of debt is a significant relationship for a significance level of 10%.

**Table 2 The results of regression equation – model 1**

Dependent variable: P	
C	1,0223 (0,006068)*
D	-0,0102 (0,007015)
R <sup>2</sup>	0,02285

*In brackets is specified standard deviation.*

*\*Parameters are significant for a significance level of 10%.*

For model 1, the equation (1) can be rewritten as follows:

$$P = 1,0223 - 0,0102 \times D \quad (9)$$

From equations (2) and (6), the market value of debt has the following expression:

$$V = 1,0223 \times D - 0,0102 \times D^2 \quad (10)$$

To determine the maximum of debt described as the point beyond which Romania is on the wrong side of debt Laffer curve, we determined the first derivative of market value of debt in relation to the face value of debt.

$$\frac{\partial V}{\partial D} = 0 \quad (11)$$

$$1,0223 - 0,0102 \times D = 0 \quad (12)$$

We obtain the nominal value of debt beyond which Romania is on the wrong side of the curve as  $D^* = 100,23$  billion USD. Comparing  $D^*$  with the current level of debt, we can see that the difference between these two values is positive (32.99 billion USD), which implies that Romania is on the correct side of debt Laffer curve. However, we have some reservations about this model result given the fact that the link between market price and nominal value of debt is not significant for a significance level of 10%.

For the second model proposed we found that the relationship between dependent variable and the explanatory variable is significant for a significance level of 10%.

**Table 3 The results of regression equation – model 2**

<b>Dependent variable: lnP</b>	
C	0,2190 ( 0,117517)*
lnD	0,0101 ( 0,005805)*
R <sup>2</sup>	0,032362

*In brackets is specified standard deviation.*

*\*Parameters are significant for a significance level of 10%.*

Based on data from Table 3, we can see that the coefficient of elasticity is lower than 1 (0.0101) which means that the function of market value of debt is increasing relative to the nominal value. Thus, we can conclude that Romania is on the correct side of debt Laffer curve.

## 5. Conclusions

In the context of rapid growth of international debt in recent decades, the goal of this study was to analyze if Romania suffers from debt overhang. The increase of public debt in Romania in recent years shows that this country became dependent on borrowed resources. What is alarming is that some of the borrowed money are used to roll old debt. At international level we can speak of a true Ponzi scheme because old debts are achieved through new borrowing. Economic crisis has revealed that advanced economies in Europe have lived on credit, the use a Ponzi scheme to finance debts and to survive.

To analyze whether Romania is indebted, we estimate the debt Laffer curve. Debt Laffer curve estimation under both models proposed, showed that Romania is on the right side of the curve away from the point beyond which the country moves on the wrong side. This leads us to the conclusion that Romania doesn't suffer from debt overhang now, but some problems may occur if the public debt will increase fast as happened in recent years. However, International Monetary Fund projections until 2018 shows a very small change from year to year debt and the general trend is to reduce de debt. In this context, Romania will be on the correct side of debt Laffer curve in coming years.

For future studies on debt Laffer curve we intend to analyze on which side of the curve are very indebted European Union member states because this was not possible in this paper due the limited access to the data necessary to estimate debt Laffer curve.

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