The analysis of KPIs of public debt management in Romania and the possible effect to fiscal insurance

Olga BODRUG

Bucharest University of Economic Studies

e-mail bodrugolga294@gmail.com

Abstract: *This paper develops the research horizon on the possibility that effective public debt management in Romania will have effect on fiscal insurance. The reason for choosing this theme, which also confirms its importance, is given by the fact that traditionally fiscal policy behavior in emerging economies is considered permissive, so the risk of fiscal imbalance is high (Mendonça and Pessanha, 2014). The first part of the analysis estimates the total market value of government debt on basis of the issue of outstanding debt securities and market value for each year in 2007-2017, through a primary market issuance model. Subsequently, based on these values, an indicator measuring the capacity of the public debt to act as fiscal insurance, proposed by Faraglia, Marcet and Scott (2008), is determined. In the second part, we calculate the persistence indicators that can be considered KPIs (Key Performance Indicators) of the level of public debt management based on the previously estimated market value for the period 2007-2017 and their evolution compared to the indicators of persistence calculated by Bodrug (2018), based on the nominal value of the public debt. Since these indicators can be influenced by various factors, in the last part, through univariate regression models, the sensitivity of the relative persistence of debt ratios is measured, depending on the exposure to the currency risk, with a predominant emphasis on the EUR/RON exchange rate, and depending on the exposure to the average maturity of the issues in the primary market. Taking into account more aspects, we have come to a different conclusion regarding the possibility of Romania to generate a fiscal insurance effect because of the efficiency of the public debt management.*

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INTRODUCTION

In an external context dominated by a sovereign debt crisis, strongly propagated in the European Union, the issue of Romania's public debt sustainability is of paramount importance. Sovereign debt is represented by bonds issued by a particular state in a foreign currency to finance the country's growth. World Bank reports show that world public debt doubled between 2007 and 2016, despite the austerity measures taken, reaching about $ 60,000 billion at the end of September 2016. At the end of 2015, Japan had a debt representing 240% of GDP, Italy - 133%, the US - 104%, Spain - 99%, France - 96%, Canada - 92%, Great Britain - 90%, Germany - 71 %.

Economists estimate an increase in the debt of developed Western countries, level of indebtedness that can reach over 250% of GDP in 2050, economically unsustainable. China has great growth potential. According to a study by the London Institute for Economic and Business Research (CEBR), China will become the world's No. 1 global economic force in 2032, making it the world's largest creditor. Against the backdrop of the same trends, in the next 5-10 years, the level of market confidence in the ability of Western states to manage their sovereign debt will be diminished, which will lead to an increase in external financing costs, with huge disparities between euro area countries.

The external causes of the debt crisis in Europe are: global economic slowdown and the accumulation of macroeconomic and fiscal imbalances. Greece is at the center of the sovereign debt crisis in the eurozone, being the first to call for financial assistance to other EU members and IMF. Bodrug (2018) showed that Romania recorded a low level of indebtedness in 1995 – 2017 and that it is important to note the rapid growth of recent years, especially due to the effects of the crisis. Since 2008, Romania has been one of the countries with the highest level of public debt growth. Debt rates rose from 13.2% in 2008 to 37.3% - in 2012. The main cause was the increase in the budget deficit, due to the bankruptcy of many companies, the increase in the unemployment rate and the worsening of the banking system.

(Lojsch et al., 2011) asserts that an increase in indebtedness may involve negative impacts on the economy, such as increasing the cost of government funding and reducing private investment, leading to a decline in potential economic growth. In addition, a

degree of excessive indebtedness may create a situation of fiscal vulnerability that threatens the liquidity and solvency conditions of the state. (Hemming et al., 2003). In the report on financial stability, NBR Governor Mugur Isarescu defines the sustainability of public debt, from the perspective of macro stability, as an essential component of lasting economic growth. In order not to repeat the experience of Greece, Romania needs a lasting integration and convergence with the standard of living in the European Union.

In order to finance deficits, refinance public debt and stimulate economic growth during the recession, many of the governments of more developed countries such as the USA, UK, France, Italy have applied economic policies based on indebtedness. The same can be said about Romania, where the increase in public debt in recent years shows that this country has become dependent on the borrowed resources. (Tatu, 2014). The coverage of the budget deficit, together with the strengthening of international reserves, was achieved through loans from the IMF and the European Commission.

For the government of a state to be able to maintain existing programs and to meet the requirements of creditors without increasing the burden of public debt on the economy, it must manage their resources properly. Public debt consists of internal and external state borrowings contracted directly or guaranteed by the Government, the Ministry of Public Finance or the local public administration, Angeletos (2002) stresses that public debt management can be an important tool for reducing fiscal vulnerability. The objective of public debt management is not to unify the excessive burden of taxation, but to stabilize the effective level of public debt to comply with the fiscal policy rules. (Mendonça et al., 2011) recommends the use of a restrictive tax policy (tax increases or government spending cuts) to generate primary surpluses. Giavazzi and Missale (2004) suggest choices for low-cost government funding.

Particularly, the dependence of the interest rate structure on the long-term structure on the state of the economy and the sensitivity of the market value of public debt to the interest rate lead to protection against economic shocks through efficient management. To monitor the performance of debt management, results need to be evaluated against certain criteria. In practice, countries set different objectives, such as:

minimizing loan costs, ensuring a liquid market in risk-free assets, influencing short-term interest rates in support of monetary policy.

Starting from the above-mentioned aspects, Bodrug (2018) analyzed the sustainability of public debt in Romania through a dynamic model and determined whether public debt management had been effective in Romania for the past two decades so that it could be used as a insurance instrument in terms of absorption of tax shocks. The reason for choosing this theme, which also confirms its importance, is given by the fact that traditionally fiscal policy behavior in emerging economies is considered permissive, so the risk of fiscal imbalance is high (Mendonça and Pessanha, 2014).

To determine whether public debt management can generate a fiscal insurance effect in Romania, (Bodrug, 2018) uses 3 fiscal indicators proposed by Faraglia, Marcet and Scott (2008): coupon payments, ratio of market value of debt to GDP and persistence of the debt. Mendonça and Pessanha (2014) state that, in general, the market value of debt is not available and that a common practice in scientific research is to use the nominal amount of government debt. Being the first study in this respect on Romania's case, the article opened new horizons of research on this subject. The added value of this paper is given by the fact that we will determine the indicator of measuring the capacity of the public debt to act as fiscal insurance based on the market value of the public debt which we will estimate by applying a valuation model on government bond in circulation and the issues in the primary market.

In the case of government securities, we propose to estimate a total market value of public debt after we determine the maturity and the average coupon rate for the entire period under review. For primary issues, that are more numerous, we will calculate the maturity and average coupon rate for each year in the 2007-2017 period. Based on them, the nominal value and a benchmark / fixation rate, we propose to estimate the market value of public debt for each year. Later, we will determine a measure of public debt capacity to act as fiscal insurance, proposed by Faraglia, Marcet and Scott (2008).

In the second part of the analysis, we will calculate the persistence indicators, which can be considered KPIs (Key Performance Indicators) for the level of public debt management, based on the previously estimated market value of the public debt for the period 2007-2017. Further, we will capture the simultaneous evolution of them and the

persistence indicators calculated by Bodrug (2018) based on the nominal government debt.

In the third part, we considered important to see if these indicators can be significantly influenced by certain factors. Thus, by means of univariate regression models, we will measure the sensitivity of KPIs to the exposure to currency risk, with a predominant focus on sensitivity to the EUR / RON exchange rate, and to the exposure to the average maturity of primary market issues.

Finally, we will draw conclusions based on the results obtained and provide recommendations for improving the level of public debt management, which can have effect on fiscal insurance.

CHAPTER 1: Literature review

Faraglia et al. (2008) conducted an empirical study on the performance of public debt registered by OECD countries between 1970 and 2000, focusing on a specific objective, namely: The role of debt management in assuring against budget shocks so as to stabilize the level of indebtedness or support optimal taxation (or to minimize variations in the tax rate or the ratio Debt to Public / GDP). They point out that most of the fiscal indicators in the literature fail to analyze the role of public debt management in insurance against fiscal shocks to stabilize the debt / GDP ratio.

Focusing on the concept of fiscal insurance and the connection it involves between debt management and fiscal policy, Faraglia et al. (2008) asserts that the main purpose of public debt management during the analyzed period was not to ensure fiscal shocks. There is a limited number of evidence that debt management has led to policy isolation against unexpected fiscal shocks. However, the degree of fiscal insurance is not well connected with the transnational variations of the debt issuance models. In practice, most government debt managers focus on objectives that are broadly based on the notion of "minimizing the costs at risk".

Possible motivations for government's interest in using fiscal debt management as a goal are: tax optimization and debt stabilization. The authors believe that public debt management plays an important role in ensuring fiscal policy, despite the fact that prospects for monetary or fiscal policies change over time and asserts that the issues covered by the article on fiscal insurance measurement are purely informative.

(Mendonça, Pessanha, 2014) presents the empirical evidence for the effect of public debt management on fiscal insurance for Brazil, a rapidly developing, broad-based economy. This paper illustrates an empirical analysis that allows us to first assess the fiscal performance of the Brazilian economy. They have calculated four fiscal indicators in order to present the empirical evidence for the effect of public debt management on fiscal insurance.The findings indicate that there has been a reduction in tax vulnerability, but public debt management has not been effective in increasing tax provision.

(Bodrug, 2018) illustrates the evolution of Romania's indebtedness between 1995 and 2017, with estimates for the years 2018 and 2019. Subsequently, using the public debt dynamics model, it performs a brief analysis of its sustainability over the period 1997-2019. In the third stage, it evaluates the efficiency of public debt management through three fiscal indicators.

The results show that Romania has recorded a low level of indebtedness but has been rising rapidly in recent years, mainly due to the crisis. Romania's public debt has not been sustainable since 2007, excepting 2013-2015 period, the actual deficits being higher than those required for a stable debt path. The causes are: the increase in the value of loans, the diminishing of the GAP between the economic growth rate and the implicit interest rate on loans, which led to a higher debt burden. Romania did not show a higher level of public debt stability, so it could be used as a shock insurance instrument. Although the interest rates on which debt is paid diminished over the years, an increase / decrease in the interest rate as result of a shock to the economy was not offset by a fall / increase in the amount of government debt to protect the budget shocks. In addition, the relative persistence of the debt indicator showed poor debt management performance.

CHAPTER 2: Research Methodology

2.1 Estimation of the market value of public debt

The National Bank of Romania (NBR), as an agent of the Ministry of Public Finance (MFP), deals with the administration of the primary and secondary interbank market of government securities issued in the domestic market in dematerialized form, in lei and in foreign currency. Thus, the NBR organizes and conducts the activity of placement of government securities issues, establishing in accordance with the NBR Statute and its own regulations and based on the conventions concluded with MFP the rules on the organization and functioning of the secondary market of government securities. The NBR also acts as a single depository for all government securities issued in dematerialized form through the SaFIR System.

The market value of the debt differs from the nominal one only if the coupon rate is not adjusted according to the changes in the market, ie if the coupon rate is fixed. In order to determine the market value, the following steps are taken:

1. Identify the types of debt the state has
2. Identify how to contract

Types of credits	**Approach to evaluation**
Traded	The price is the reference for market value (P*NV = MV)
Not traded, with the variable coupon rate	The nominal value is approximately equal to the market value (NV~= MV)
Not traded, with fixed coupon rate	The market value is given by the present value of the payments made for those debts (PV = MV)

In the case of liquid assets traded, which are issued in national or foreign currency, the price is expressed as a percentage of the nominal value and the market value can be determined as a product between the face value of the issue and the price expressed as a nominal value.

P =% NV (1)

MV = NV * P (2)

In the case of non-tradable non-liquid credits, a statistic of all active issues is being sought at this time and the maturities and coupon rates are identified. Subsequently, maturity and average coupon rate are calculated, and payments are updated at a fixation rate, thus obtaining a present value that represents the market value of the debt.

There are two types of issues of government securities in circulation:

- Treasury certificates
- State bonds

Treasury certificates have a maturity of 0.5-1 year, so they are at market value. For government bonds it is necessary to calculate the maturity and the average coupon rate based on the following formulas:

$$\text{average maturity} = \sum_{k=1}^{n} \frac{NV\ k}{NV\ t} * m\ k \quad (3)$$

$$\text{average coupon rate} = \sum_{k=1}^{n} \frac{NV\ k}{NV\ t} * c\ r\ k \quad (4)$$

Where: NV k = face value of the bond k, NV t = total face value of bonds, m k = the maturity of the bond k, c r k = bond coupon rate k.

Further, the approach involves estimating the market value of the bonds as the present value of the payments the state makes at the average rate of the coupon obtained (c r), which is compared with the reference rate (r r). If r r> c r => We expect the nominal value to be lower, because the state borrowed cheaper and vice versa.

Assuming that the reference rate will be maintained at the same value over the next three years, the present value of the state's payments at an average coupon rate is:

$$PV = \frac{CF}{1+r\ r} + \frac{CF}{(1+r\ r)\text{^}2} + \frac{CF}{(1+r\ r)\text{^}3} + \frac{VN}{(1+r\ r)\text{^}3} \quad (5)$$

CF = c r * NV (6)

Where: CF = Cash Flow, c r = average coupon rate, NV = total face value of bonds, r r = reference / fixing rate

If we assume that the average reference rate will change over time, then the present value of payments made by the state at an average coupon rate in the case of a 3-year analysis will be calculated based on the following formula:

$$PV = \frac{CF}{1+r\,r1} + \frac{CF}{(1+r\,r1)(1+r\,r2)} + \frac{CF}{(1+r\,r1)(1+r\,r2)(1+r\,r3)} + \frac{VN}{(1+r\,r1)(1+r\,r2)(1+r\,r3)} \quad (7)$$

2.2 Determination of KPIs

The persistence indicators measure the performance level of public debt management. Two performance indicators can be calculated: Ψ1k and Ψ2k, the difference being that Ψ2k is normalized by the degree of persistence in the primary deficit. A higher value of Ψ indicates a poor performance of debt management, and negative values reveal full market outcomes.

$$\Psi 1_k = P^k{}_{MV} - P^k{}_w \quad (8)$$

$$\Psi 2_k = (P^k{}_{VP} - P^k{}_w) / P^k{}_w \quad (9)$$

$$P^k{}_{MV} = (MV_t - MV_{t-k}) / k\,(MV_t - MV_{t-1}) \quad (10)$$

$$P^k{}_w = (w_t - w_{t-k}) / k\,(w_t - w_{t-1}) \quad (11)$$

Where: Ψ1k, Ψ2k = persistence indicators, w_t = primary deficit, MV_t = market value of public debt, P = weights.

The persistence of public debt may be reduced by adjusting the primary deficit resulting from changes in the profitability of securities. The effect of this change can be captured by the relative persistence of the market value of the debt to the primary deficit, which may prevent the measurement of debt management performance. Mendonça and Pessanha (2014) assert that the persistence of the indicator takes on remarkable reductions due to the increase in the primary surplus.

2.3 Sensitivity measurement of the KPIs

According to government debt management strategies in line with the budgetary indicators provided in the Fiscal-Budget Strategies and in line with international best practices defined in the World Bank and IMF Guidelines on the elaboration of public debt strategies and consultation with the NBR, The Ministry of Public Finance aims to achieve the following objectives:

* Ensuring the financing needs of central government and payment obligations, amid the minimization of medium and long-term costs

* Reduce the risks associated with the government debt portfolio
* Developing the internal market for government securities.

Strategies focus exclusively on the government debt portfolio structure, providing direction in which the authorities intend to act to secure funding and improve the debt portfolio structure. The main risk indicators that affect public debt are:

❖ Currency risk

- Debt weight in lei in total debt (% of total)
- Share of government debt in Euro in total foreign currency debt (% of total)

❖ Refinancing risk

- Share of debt due within 1 year (% of total)
- The weight of debt in RON maturing within 1 year (% of total)
- Average maturity for total debt (years)
- The remaining maturity of the debt in lei (years)

❖ Interest rate risk

- Share of debt that changes interest rate in one year (% of total)
- Share of lei debt that changes interest rate in one year (% of total)
- Average period until the next change in the interest rate for total debt (years)
- Average period until the next change in the interest rate for the debt in national currency (years)

Of all the risk indicators that may affect public debt, we considered that the main factors that may lead to changes in performance indicators are: exposure to currency risk and average maturity of issues in the primary market. Based on these considerations, we have developed single-factor regression models to highlight the sensitivity of the persistence indicators to the share of government debt denominated in foreign currency, the EUR / RON exchange rate and the average maturity of primary market issues.

$$Vi_t = \alpha 0 + \alpha 1 * Zi_t + \varepsilon_t \, , \, \varepsilon_t \sim N(0, \sigma^2) \quad (12)$$

Where:

Vit = vector of debt management performance indicators (Ψ1k and Ψ2k) - dependent variable

Zit = independent variables:

- Pd t = weight of government debt denominated in foreign currency in year t

- CVt = EUR / RON exchange rate of year t
- Matt = average maturity of issues in the primary market in year t

εt = residual variable

CHAPTER 3: Presentation of the results

3.1 Market value of public debt

There are two types of issues of government securities in circulation:

- Treasury certificates
- State bonds

Treasury certificates, enclosed in Appendix 1, have a maturity of 0.5-1 year, so they are at market value. For state bonds, whose dates are presented in Appendix 2, we will calculate a maturity and an average coupon rate, according to the methodology outlined above. Thus, we obtain an average maturity of government bond issues of around 7 years and an average coupon rate of approximately 4%.

Average maturity (years)	7,01
Average coupon rate (%)	4,03

Next, we estimate the market value of these bonds as the present value of the state's payments at an average coupon rate (c r) of 4%, while the reference rate communicated by NBR (r r) is 4.52%. R r> c r => We expect the nominal value to be lower because the state has borrowed cheaper.

If we predict that the reference rate will be maintained at the same value in the next three years, the present value of the state's payments at an average coupon rate of 4% is 137.23 billion lei, which is actually the value market of public debt, which is less than the face value of 139.08 billion lei due to the fact that the average coupon rate is lower than the reference rate.

If we assume that in 2018 the benchmark will be 4.52%, but in 2019 it will reach 5% and 6% - in 2020, then the present value of the state's payments at an average

coupon rate of 4% is 134.86 billion lei, also lower than the face value of 139.08 billion lei, due to the fact that the average coupon rate is lower than the expected reference rates.

In the case of primary issues, which are more numerous, we were able to calculate the average maturity and the average coupon rate for each year in 2007-2017 on basis of the formulas captured in the research methodology. Subsequently, based on them, the nominal value and the fixation rate, we could estimate the market value of the debt for each year. The results are shown in the following table:

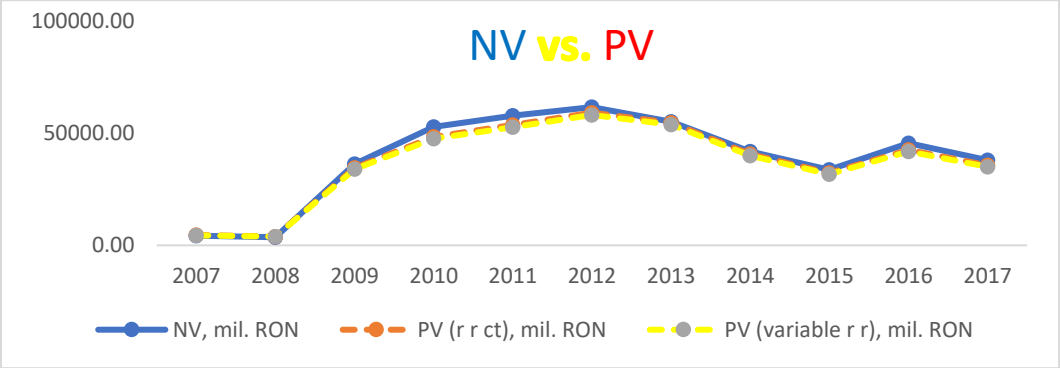
Table 1 **Market Value of the public debt**

Year	Average maturity (years)	Average coupon rate (%)	NV, mil. RON	MV (r r ct), mil. RON	MV (r r variabilă), mil. RON
2007	5.46	6.39	4323.40	4545.54	4469.98
2008	3.85	8.10	3592.70	3946.15	3882.11
2009	1.90	2.90	36271.87	34656.61	34048.47
2010	1.54	1.48	52856.39	48446.19	47575.23
2011	1.96	1.90	57939.27	53768.50	52808.87
2012	2.07	3.06	61729.35	59256.11	58219.11
2013	3.50	4.28	55168.66	54807.94	53867.45
2014	4.16	3.52	41957.96	40810.30	40101.49
2015	3.57	2.90	33777.50	32274.65	31708.33
2016	4.00	2.14	45599.95	42614.11	41856.65
2017	3.65	2.28	38081.60	35741.96	35108.25

Source: author calculations based on NBR data

Analyzing this table, we can see the ante and post-crisis effects on average maturity and the average coupon rate, so that their lower values were recorded during the crisis period (2009-2012). As for the market / present value of government debt, estimated using both a constant reference rate and variable rates, we note that it is slightly higher than the nominal value only in situations where the coupon rate was higher than the reference rate 4.52% (in 2007 and 2008), resulting in the state borrowing more expensive. Otherwise, the market value is lower than the nominal value and follows its trend, as can be seen in Chart 1.

Chart 1 **Simultaneous evolution of Nominal Value and Present Value of government debt**



Source: author calculations based on NBR data

Next, we can determine the fiscal indicator number 2 - the ratio of the market value of the debt to GDP, which measures the capacity of the public debt to act as fiscal insurance. (Bodrug, 2018) calculated on the basis of the nominal debt value following the Mendonca and Pessanha (2014) recommendations, which state that in general the market value of the debt is not available and that it is common practice to use the value nominal value. The results are shown in the table below.

Table 2 **Fiscal Indicator The ratio of market value of debt to GDP**

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
PV/Y	10.87	7.53	67.88	90.74	95.15	99.53	85.98	61.08	45.29	55.96	43.56

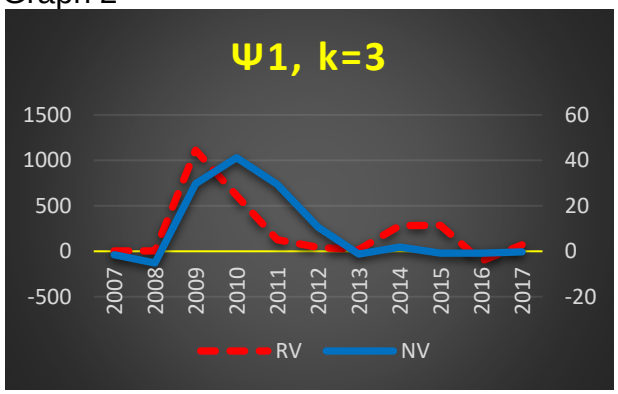
Source: author calculations based on NBR data

3.2 KPIs of the level of public debt management

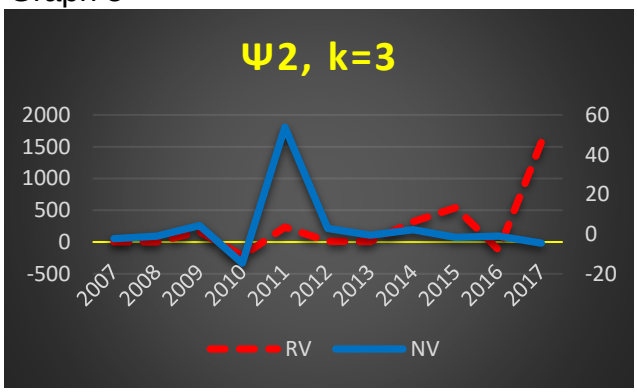
The public debt persistence indicators, which can be considered KPIs (Key Performance Indicators) for the level of public debt management, were proposed by Faraglia, Marcet and Scott (2008). Bodrug (2018) calculated them for the period 2006-2019, using the face value of the public debt. We propose to determine the persistence indicators using the market debt for the period 2007-2017 and then to observe the simultaneous evolution of the performance indicators, calculated both on basis of the nominal value and market value of the public debt.

Performance indicators Ψ1k and Ψ2k are calculated for 3, 6 and 9 lags. The difference between them is that Ψ2k is normalized by the degree of persistence in the primary deficit. From the graphs 2-7 we can deduce that both the values of the simple indicator and of the normalized one registered quite large variations. For details on how persistence indicators are calculated, see Appendices 3 and 4.

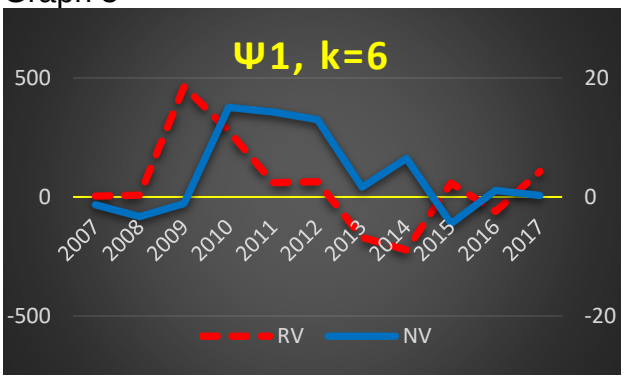
Graph 2



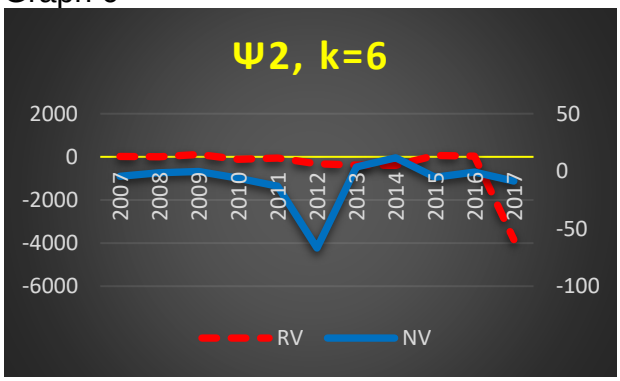
Graph 5



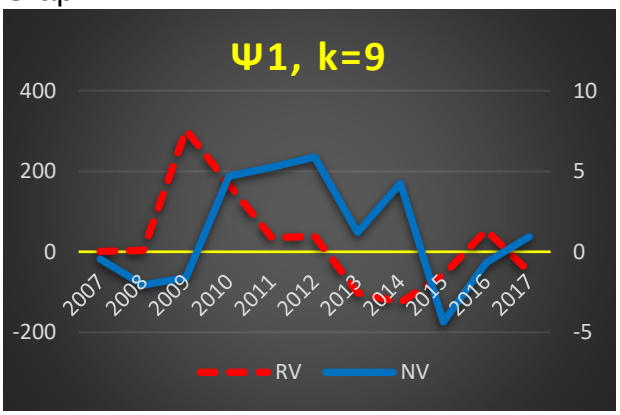
Graph 3



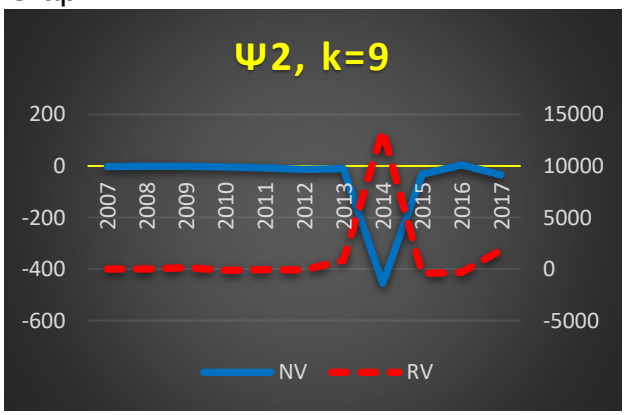
Graph 6



Graph 4



Graph 7



Source: Own processing based on MFP and Eurostat data

In the case of graphs made to capture the evolution of the first indicator, calculated on basis of the nominal value of public debt, we can see higher values of Ψ1k in the period 2009 - 2013, indicating poor performance of debt management. KPI Ψ1k, calculated on basis of the market value of public debt, shows a low level of performance over the period 2008-2011. Thus, in both situations we can notice the effect of the global financial crisis on Romania. The values close to 0, registered in the period 2013-2017 by the indicator calculated on basis of the nominal government debt (Graph 2), suggest an improvement in public debt management, with economic shocks being gradually absorbed through the public debt instrument. Negative values reveal full market outcomes, which means a high level of public debt management efficiency.

If we analyze the evolution of the Ψ2k indicator, which tends to normalize the persistence in the primary deficit, we notice very high or very small values compared to the average. Higher values of the indicator can only be noted in the case of the calculation with 3 lags, between 2010-2012 and 2016-2017. In the other two situations (with 6 and 9 lags), the level of public debt management performance is mostly increasing. Normalization efforts are accentuated in the case of the 6-point indicator, calculated on the basis of the nominal government debt, recording very small values in the year 2012, thus revealing the full market outcomes, more specifically, a strong efficiency of public debt management. Figure 7 shows a paradox. If so far, the trend of those indicators, calculated by the two different methods, were almost the same, the W2 indicator, k = 9, illustrates an opposite trend over the period 2013-2015. So, if at that time we had intended to normalize the persistence in the primary deficit, this would result in a worsening of the level of public debt management.

Considering that KPIs suggest an improvement in public debt management, the shocks in the economy are gradually absorbed through the public debt instrument and that their negative values reveal full market outcomes, resulting in a high level of public debt management, we can adopt the optimistic perspective that Romania can improve its public debt management so that it can have an effect on fiscal insurance, covering the fiscal shocks in the economy.

The persistence of public debt may be reduced by adjusting the primary deficit resulting from changes in the rentability of securities. The effect of this change can be captured by the relative persistence of the market value of the debt to the primary deficit, which may prevent the measurement of debt management performance. Mendonça and Pessanha (2014) assert that the persistence of the indicator takes on remarkable reductions due to the increase in the primary surplus.

3.3 The sensitivity of the performance indicators

Given the high level of public debt management effectiveness noted on basis of KPIs in recent years, we considered important to see if these indicators are sensitive to certain factors. Currency risk may have considerable effects on public debt management. Considering the relatively high weight of the foreign currency denominated government debt, we developed regressions using the OLS method to measure the sensitivity of the persistence indicators to the exposure to currency risk. Regressions are univariate due to the limitation of data related to the calculation of the performance indicators Ψ1k and Ψ2k (analysis period 2006-2019, annual data). In order to ensure a correct equalization of the regression factors, the weights were logarithmed. The results of the econometric model are centralized in Table 3.

Table 3 **Sensitivity to the exposure to currency risk**

OLS				
Regressor	**c**	**Pd**	**R^2 (%)**	**DW**
Ψ1, k=3	-237,96	62,04	20,83	0,49
Ψ1, k=6	-156,32	40,2	43,88	1,63
Ψ1, k=9	-67,65	17,26	36,65	2
Ψ2, k=3	-118,43	30,72	4,34	2,73
Ψ2, k=6	78,32	-20,92	1,13	1,8
Ψ2, k=9	886,98	-234,03	4,21	2,12

Source: Own processing based on MFP and Eurostat data

From Table 3 we can state that in the case of the econometric models applied for the first four performance indicators, the weight of the public debt denominated in foreign

currency directly influences their evolution, the constant factor being negative, and vice versa for the last two performance indicators: Ψ2, k = 6; Y2, k = 9. It is also important to note that higher values of the determination coefficients R2 occur only in the performance indicators Ψ1, with 3, 6 and 9 lags respectively, so we can say that the variance of the performance indicators is better explained by the share of the public debt denominated in foreign currency for Ψ1, compared to Ψ2.

Since the share of government debt in euro in total foreign currency debt is generally at least 80% in Romania, according to the Government Debt Management Strategy, we wanted to see how the EUR / RON rate influences the evolution performance indicators. The results of the econometric model are centralized in Table 4.

Table 4 **Sensitivity at the EUR / RON exchange rate**

OLS				
Regressor	**c**	**CV**	**R^2 (%)**	**DW**
Ψ1, k=3	23,45	-3,57	0,9	0,79
Ψ1, k=6	4,28	-0,19	0,01	1,14
Ψ1, k=9	-4,65	1,38	3,2	1,51
Ψ2, k=3	11,92	-1,67	0,17	2,5
Ψ2, k=6	62,59	-15,35	8,05	1,79
Ψ2, k=9	211,53	-58,89	3,66	2,14

Source: Own processing based on MFP and Eurostat data

Even if at first sight the relatively high share of foreign currency denominated debt suggests a significant exposure to currency risk, the relatively low volatility of the EUR / RON exchange rate makes the exposure risk more manageable. We can observe extremely low values of the R2 coefficients, so the variance of the performance indicators is explained in a very small proportion by the EUR / RON exchange rate.

In order to see the sensitivity of the performance indicators Ψ1k and Ψ2k to the average maturity of the primary market issues and if a decrease in these may contribute

to improving the way public debt management so as to determine the effect of fiscal insurance, were calculated regressions whose result can be observed in table 5.

Table 5 **Sensitivity to the average maturity of issues in the primary market**

OLS				
Regressor	**c**	**Mat**	**R^2 (%)**	**DW**
Ψ1, k=3	29,51	-6,75	48,4	1,33
Ψ1, k=6	11,43	-2,51	34,16	1,72
Ψ1, k=9	3,03	-0,548	7,53	1,61
Ψ2, k=3	12,62	-2,49	5,51	2,63
Ψ2, k=6	-5,5	0,66	0,22	1,72
Ψ2, k=9	10,4	-16,42	4,24	2,12

Source: Own processing based on MFP and Eurostat data

From Table 5 we can deduce that in all cases, except for the penultimate (Ψ2, k = 6), the average maturity of the primary market issues indirectly influences the evolution of the performance indicators in the sense that an increase in maturity leads to a decrease in the value of the fiscal indicator, highlighting better public debt management. It is also important to note that higher values of the determination coefficients R2 occur only in the performance indicators Ψ1, with 3, 6 and 9 lags respectively, so we can say that the variance of the performance indicators is better explained by the average maturity of primary market issues for Ψ1, compared to Ψ2.

Thus, following the application of the econometric models, based on the values of the obtained coefficients of determination, we can state that both the exposure to the currency risk as evidenced by the share of the public debt denominated in foreign currency and the average maturity of the issues in the primary market have a significant impact on the performance indicators Ψ1, with 3, 6 and 9 lags, respectively. The share of government debt denominated in foreign currency directly influences their evolution, with the constant factor being negative, and vice versa in the case of the average maturity of issues in the primary market. Therefore, a good public debt performance is highlighted when the share of public debt denominated in foreign currency decreases and the average maturity of issues in the primary market increases.

CONCLUSIONS

Applying a debt market valuation model, we obtained an average maturity of government bond issues of approximately 7 years and an average coupon rate of approximately 4%. Next, by estimating the market value of these bonds as the present value of the state's payments at an average coupon rate of 4%, while the benchmark is 4.52% and predicting that the rate the reference value communicated by NBR will be maintained at the same value in the next three years, we obtained a market value of public debt of 137.23 billion lei, this being less than the face value of 139.08 billion lei, due to the fact that the state has a lower loan cost than the actual one on the market.

Assuming the average reference rate 5% in 2019 and 6% in 2020, the present value of state payments at an average coupon rate of 4% is 134.86 billion lei, also below the face value of 139.08 billion lei, due to the fact that the average coupon rate is lower than the expected reference rates. For primary market issues, average maturities and average coupon rates for each year in the 2007-2017 period could be calculated, noting the effects of the crisis on their values.

The public debt market value, estimated using both a constant reference rate and variable reference rates for 10 years starting from 2007, follows the nominal value trend and is mostly lower than this, because the coupon rate is lower than the benchmark rate of 4.52%, resulting that the state has borrowed cheaper. Exceptions are the years 2007 and 2008, when the Government of Romania had to borrow at high coupon rates (6.39% and 8.1% respectively) due to the financial crisis.

Considering that KPIs suggest an improvement in public debt management, the shocks in the economy are gradually absorbed through the public debt instrument and that their negative values reveal full market outcomes, meaning a high level of public debt management, we can adopt the optimistic outlook that Romania can improve its public debt management so that it can have an effect on fiscal insurance, covering shocks in the economy.

The econometric models used to determine the sensitivity of the performance indicators to the main risk factors affecting public debt helped us conclude that both the exposure to foreign exchange risk as evidenced by the share of the foreign currency denominated government debt and the average maturity of the issues in the primary market have a significant impact on the persistence indicators Ψ1, with 3, 6 and 9 lags. The share of government debt denominated in foreign currency directly influences the evolution of performance indicators, and vice versa in the case of the average maturity of issues in the primary market. Therefore, a better management of public debt is highlighted when the share of public debt denominated in foreign currency decreases and the average maturity of issues in the primary market increases.

Recommendations

In the last part of the paper, we gave some recommendations that would improve the management of public debt. Thus, some of the most important solutions would be:

* Decreasing primary deficits and / or generating primary surpluses. One solution would be that the interest rates on the loans made by the state are lower than Romania's economic growth rate.
* Minimizing debt fluctuations, thus offsetting the impact of the primary deficit on the market value of the debt.
* Increase (decrease) in the interest rate as result of a shock in the economy to be offset by a decrease (increase) in the market value of government debt.
* Reducing the persistence of public debt by adjusting the primary deficit resulting from changes in the yields of securities.
* Decrease of the share of public debt denominated in foreign currency
* Debt financing from internal resources and savings. (for example, Japan has a debt of more than 200% of GDP, being financed almost exclusively by money saved by Japanese)
* Choosing a higher maturity for loans, as the annual coupon rate is lower in this case.

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APPENDICES

Appendix 1 Issuance of treasury certificates in circulation

Nr. crt.	ISIN	Total nominal value adjudicated (million lei)	Issue date	Due date	Discount rate (% p.a.)	Maturity (years)
1	**RO1718CTN0C3**	1007,97	26.Jul.17	25.Jul.18	0,78	1
2	**RO1718CTN0D1**	806,36	16.Aug.17	15.Aug.18	0,78	1
3	**RO1818CTN060**	171,11	11.Jun.18	10.Dec.18	2,89	0,5
4	**RO1819CTN027**	512,24	14.Feb.18	13.Feb.19	2,36	1
5	**RO1819CTN035**	512,02	07.Mar.18	06.Mar.19	2,32	1
6	**RO1819CTN050**	190,65	14.May.18	13.May.19	2,81	1

Source: Table created by author based on NBR data

Appendix 2 Issuance of government bonds in circulation

Nr. crt.	ISIN	Total nominal value adjudicated (million lei)	Issue date	Due date	Coupon rate (% p.a.)	Maturity (years)
1	**RO1318DBN034**	8083,66	08.Apr.13	28 nov.18	5,6	5,7
2	**RO1419DBE013**	4318,269	27.Jan.14	21.Jan.19	3,4	5
3	**RO1619DBN035**	5939	31.Oct.16	25.Feb.19	1,35	2,3
4	**RO1519DBN037**	8386,57	28.Sep.15	29.Apr.19	2,5	3,6
5	**RO1419DBN014**	8657,22	26.Feb.14	24.Jun.19	4,75	5,3
6	**RO1220DBN057**	417,18	28.May.12	27.Jan.20	5,85	7,7
7	**RO1620DBN017**	8860,37	21.Mar.16	26.Feb.20	2,25	3,9
8	**RO0520DBN0L3**	50	18.Apr.05	18.Apr.20	7,25	15
9	**RO1320DBN022**	9220,75	20.Mar.13	29.Apr.20	5,75	7,1
10	**RO0520DBN0Y6**	50	20.Jun.05	20.Jun.20	7,3	15
11	**RO1720DBN072**	4157,63	07.Aug.17	26.Oct.20	2,3	3,2
12	**RO1621DBE048**	6354,597	26.Feb.16	26.Feb.21	1,25	5
13	**RO1521DBN041**	8804,35	26.Oct.15	22.Mar.21	3,25	5,4
14	**RO1121DBN032**	8809,24	30.May.11	11.Jun.21	5,95	10,1
15	**RO1821DBN052**	2704,44	17.Jan.18	27.Oct.21	4	3,8
16	**RO1722DBN045**	6693,33	08.Mar.17	08.Mar.22	3,4	5
17	**RO1522DBN056**	9103,35	4 nov.2015	19.Dec.22	3,5	7,1
18	**RO1323DBN018**	9274,62	28.Jan.13	26.Apr.23	5,85	10,3
19	**RO1823DBN025**	2820,61	22.Jan.18	28.Jun.23	4,25	5,4
20	**RO1624DBN027**	6669,73	29.Aug.16	29.Apr.24	3,25	7,7
21	**RO1425DBN029**	9101,15	30.Jul.14	24.Feb.25	4,75	10,6
22	**RO1227DBN011**	9795,62	27.Feb.12	26.Jul.27	5,8	15,5
23	**RO1631DBN055**	812,42	10.Oct.16	24.Sep.31	3,65	15

Source: Table created by author based on NBR data

Appendix 3 KPIs based on nominal value of public debt

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Ps, k=3	0.66	4.80	6.91	-2.81	0.55	3.81	2.58	0.89	0.53	0.88	0.05
Ps, k=6	0.28	2.45	4.23	-2.46	-1.11	-0.19	0.45	0.56	0.84	-1.52	-0.03
Ps, k=9	0.26	1.67	2.53	-1.54	-0.76	-0.44	-0.12	-0.01	0.14	-0.16	-0.03
Pd, k=3	-0.91	-0.36	36.63	38.37	30.01	14.41	1.32	2.79	-0.31	0.02	-0.16
Pd, k=6	-1.00	-0.83	3.12	12.59	13.19	12.81	2.11	7.06	-3.63	-0.39	0.21
Pd, k=9	-0.20	-0.40	0.93	3.16	4.49	5.44	1.07	4.25	-4.22	-0.84	0.91
Ψ1, k=3	-1.57	-5.16	29.72	41.18	29.46	10.60	-1.26	1.91	-0.84	-0.86	-0.21
Ψ1, k=6	-1.28	-3.28	-1.11	15.05	14.30	13.00	1.66	6.50	-4.47	1.13	0.23
Ψ1, k=9	-0.46	-2.07	-1.60	4.70	5.24	5.88	1.20	4.26	-4.36	-0.68	0.94
Ψ2, k=3	-2.37	-1.08	4.30	-14.64	53.81	2.78	-0.49	2.15	-1.60	-0.98	-4.50
Ψ2, k=6	-4.51	-1.34	-0.26	-6.12	-12.91	-66.80	3.70	11.66	-5.33	-0.74	-8.45
Ψ2, k=9	-1.79	-1.24	-0.63	-3.05	-6.92	-13.32	-9.80	-455.94	-31.98	4.26	-34.65

Source: author calculations based on MFP and Eurostat data

Appendix 4 KPIs based on market value of public debt

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Ps, k=3	0.66	4.80	6.91	-2.81	0.55	3.81	2.58	0.89	0.53	0.88	0.05
Ps, k=6	0.28	2.45	4.23	-2.46	-1.11	-0.19	0.45	0.56	0.84	-1.52	-0.03
Ps, k=9	0.26	1.67	2.53	-1.54	-0.76	-0.44	-0.12	-0.01	0.14	-0.16	-0.03
Pd, k=3	3.64	9.12	1118.92	608.62	128.68	46.20	21.52	282.76	285.53	-106.81	72.45
Pd, k=6	3.46	9.60	468.15	274.72	58.33	63.69	-169.62	-222.24	59.48	-61.88	106.66
Pd, k=9	0.91	5.22	305.21	165.29	34.46	38.04	-101.38	-125.53	-57.93	53.49	-49.66
Ψ1, k=3	2.97	4.32	1112.00	611.43	128.13	42.39	18.94	281.87	285.01	-107.69	72.40
Ψ1, k=6	3.18	7.15	463.93	277.17	59.44	63.89	-170.07	-222.80	58.64	-60.36	106.68
Ψ1, k=9	0.65	3.55	302.68	166.83	35.21	38.49	-101.26	-125.52	-58.07	53.65	-49.64
Ψ2, k=3	4.48	0.90	160.85	-217.36	234.02	11.13	7.34	317.47	541.49	-122.19	1571.45
Ψ2, k=6	11.20	2.92	109.76	-112.69	-53.68	-328.20	-379.69	-399.89	69.97	39.70	-3838.37
Ψ2, k=9	2.53	2.13	119.63	-108.43	-46.48	-87.17	829.89	13444.79	-426.13	-335.27	1826.72

Appendix 5 Sensitivity to exposure to currency risk

Dependent Variable: FI1__K_3
Method: Least Squares
Date: 06/27/18 Time: 12:22
Sample: 2006 2017
Included observations: 12

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-237.9631	152.5237	-1.560171	0.1498
PD	62.04279	38.24496	1.622248	0.1358

R-squared	0.208340	Mean dependent var	9.375810
Adjusted R-squared	0.129174	S.D. dependent var	15.46715
S.E. of regression	14.43364	Akaike info criterion	8.328012
Sum squared resid	2083.301	Schwarz criterion	8.408830
Log likelihood	-47.96807	Hannan-Quinn criter.	8.298091
F-statistic	2.631687	Durbin-Watson stat	0.494224
Prob(F-statistic)	0.135816		

Dependent Variable: FI2__K_3
Method: Least Squares
Date: 06/27/18 Time: 12:31
Sample: 2006 2017
Included observations: 12

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-118.4296	182.0230	-0.650630	0.5299
PD	30.72479	45.64183	0.673172	0.5161

R-squared	0.043352	Mean dependent var	4.057425
Adjusted R-squared	-0.052313	S.D. dependent var	16.79161
S.E. of regression	17.22522	Akaike info criterion	8.681638
Sum squared resid	2967.082	Schwarz criterion	8.762456
Log likelihood	-50.08983	Hannan-Quinn criter.	8.651716
F-statistic	0.453160	Durbin-Watson stat	2.725137
Prob(F-statistic)	0.516093		

Dependent Variable: FI1__K_6
Method: Least Squares
Date: 06/27/18 Time: 12:29
Sample: 2006 2017
Included observations: 12

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-156.3223	57.33092	-2.726667	0.0213
PD	40.20158	14.37559	2.796517	0.0189

R-squared	0.438849	Mean dependent var	3.944721
Adjusted R-squared	0.382734	S.D. dependent var	6.905437
S.E. of regression	5.425347	Akaike info criterion	6.371053
Sum squared resid	294.3439	Schwarz criterion	6.451870
Log likelihood	-36.22632	Hannan-Quinn criter.	6.341131
F-statistic	7.820505	Durbin-Watson stat	1.625083
Prob(F-statistic)	0.018907		

Dependent Variable: FI2__K_6
Method: Least Squares
Date: 06/27/18 Time: 12:33
Sample: 2006 2017
Included observations: 12

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	78.32475	247.2505	0.316783	0.7579
PD	-20.92151	61.99748	-0.337457	0.7427

R-squared	0.011260	Mean dependent var	-5.080628
Adjusted R-squared	-0.087615	S.D. dependent var	22.43563
S.E. of regression	23.39784	Akaike info criterion	9.294176
Sum squared resid	5474.590	Schwarz criterion	9.374994
Log likelihood	-53.76506	Hannan-Quinn criter.	9.264255
F-statistic	0.113877	Durbin-Watson stat	1.797442
Prob(F-statistic)	0.742748		

Dependent Variable: FI1__K_9
Method: Least Squares
Date: 06/27/18 Time: 12:30
Sample: 2006 2017
Included observations: 12

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-67.64906	28.61650	-2.363988	0.0397
PD	17.25820	7.175521	2.405149	0.0370

R-squared	0.366477	Mean dependent var	1.152214
Adjusted R-squared	0.303125	S.D. dependent var	3.243976
S.E. of regression	2.708041	Akaike info criterion	4.981340
Sum squared resid	73.33484	Schwarz criterion	5.062157
Log likelihood	-27.88804	Hannan-Quinn criter.	4.951418
F-statistic	5.784743	Durbin-Watson stat	2.003263
Prob(F-statistic)	0.036989		

Dependent Variable: FI2__K_9
Method: Least Squares
Date: 06/27/18 Time: 12:33
Sample: 2006 2017
Included observations: 12

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	886.9778	1407.005	0.630401	0.5426
PD	-234.0272	352.8032	-0.663336	0.5221

R-squared	0.042147	Mean dependent var	-45.99147
Adjusted R-squared	-0.053638	S.D. dependent var	129.7145
S.E. of regression	133.1479	Akaike info criterion	12.77181
Sum squared resid	177283.6	Schwarz criterion	12.85263
Log likelihood	-74.63086	Hannan-Quinn criter.	12.74189
F-statistic	0.440015	Durbin-Watson stat	2.116528
Prob(F-statistic)	0.522112		

Appendix 6 Sensitivity to exposure to the EUR / RON exchange rate

Dependent Variable: FI1__K_3
Method: Least Squares
Date: 06/27/18 Time: 00:03
Sample: 1 14
Included observations: 14

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	23.45411	46.48802	0.504519	0.6230
CV	-3.570223	10.77083	-0.331472	0.7460

R-squared	0.009073	Mean dependent var	8.102994
Adjusted R-squared	-0.073504	S.D. dependent var	14.59454
S.E. of regression	15.12141	Akaike info criterion	8.401664
Sum squared resid	2743.885	Schwarz criterion	8.492958
Log likelihood	-56.81165	Hannan-Quinn criter.	8.393213
F-statistic	0.109873	Durbin-Watson stat	0.786147
Prob(F-statistic)	0.746005		

Dependent Variable: FI2__K_3
Method: Least Squares
Date: 06/27/18 Time: 00:14
Sample: 1 14
Included observations: 14

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	11.92252	50.99921	0.233779	0.8191
CV	-1.673763	11.81603	-0.141652	0.8897

R-squared	0.001669	Mean dependent var	4.725734
Adjusted R-squared	-0.081525	S.D. dependent var	15.95131
S.E. of regression	16.58879	Akaike info criterion	8.586895
Sum squared resid	3302.255	Schwarz criterion	8.678189
Log likelihood	-58.10827	Hannan-Quinn criter.	8.578444
F-statistic	0.020065	Durbin-Watson stat	2.496023
Prob(F-statistic)	0.889705		

Dependent Variable: FI2__K_3
Method: Least Squares
Date: 06/27/18 Time: 00:14
Sample: 1 14
Included observations: 14

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	11.92252	50.99921	0.233779	0.8191
CV	-1.673763	11.81603	-0.141652	0.8897

R-squared	0.001669	Mean dependent var	4.725734
Adjusted R-squared	-0.081525	S.D. dependent var	15.95131
S.E. of regression	16.58879	Akaike info criterion	8.586895
Sum squared resid	3302.255	Schwarz criterion	8.678189
Log likelihood	-58.10827	Hannan-Quinn criter.	8.578444
F-statistic	0.020065	Durbin-Watson stat	2.496023
Prob(F-statistic)	0.889705		

Prob(F-statistic)	0.968462

Dependent Variable: FI2__K_6
Method: Least Squares
Date: 06/27/18 Time: 00:18
Sample: 1 14
Included observations: 14

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	62.59384	64.65048	0.968188	0.3521
CV	-15.35221	14.97890	-1.024923	0.3256

R-squared	0.080493	Mean dependent var	-3.417048
Adjusted R-squared	0.003867	S.D. dependent var	21.06999
S.E. of regression	21.02921	Akaike info criterion	9.061266
Sum squared resid	5306.733	Schwarz criterion	9.152560
Log likelihood	-61.42886	Hannan-Quinn criter.	9.052815
F-statistic	1.050467	Durbin-Watson stat	1.793966
Prob(F-statistic)	0.325617		

Dependent Variable: FI1__K_9
Method: Least Squares
Date: 06/27/18 Time: 00:22
Sample: 1 14
Included observations: 14

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-4.648897	9.468416	-0.490990	0.6323
CV	1.380758	2.193741	0.629408	0.5409

R-squared	0.031958	Mean dependent var	1.288036
Adjusted R-squared	-0.048712	S.D. dependent var	3.007464
S.E. of regression	3.079843	Akaike info criterion	5.219198
Sum squared resid	113.8252	Schwarz criterion	5.310492
Log likelihood	-34.53439	Hannan-Quinn criter.	5.210747
F-statistic	0.396154	Durbin-Watson stat	1.511294
Prob(F-statistic)	0.540880		

Dependent Variable: FI2__K_9
Method: Least Squares
Date: 06/27/18 Time: 00:16
Sample: 1 14
Included observations: 14

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	211.5256	376.5655	0.561723	0.5846
CV	-58.88640	87.24662	-0.674942	0.5125

R-squared	0.036574	Mean dependent var	-41.67208
Adjusted R-squared	-0.043712	S.D. dependent var	119.8951
S.E. of regression	122.4875	Akaike info criterion	12.58546
Sum squared resid	180038.3	Schwarz criterion	12.67675
Log likelihood	-86.09821	Hannan-Quinn criter.	12.57701
F-statistic	0.455547	Durbin-Watson stat	2.143198
Prob(F-statistic)	0.512508		

Appendix 7 Sensitivity to the average maturity of primary market issues

Dependent Variable: FI1__K_3
Method: Least Squares
Date: 06/27/18 Time: 12:57
Sample: 1 14
Included observations: 14

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	29.50789	7.015502	4.206098	0.0012
MAT	-6.748208	2.011571	-3.354695	0.0057

R-squared	0.483959	Mean dependent var	8.102994
Adjusted R-squared	0.440956	S.D. dependent var	14.59454
S.E. of regression	10.91223	Akaike info criterion	7.749209
Sum squared resid	1428.921	Schwarz criterion	7.840503
Log likelihood	-52.24446	Hannan-Quinn criter.	7.740758
F-statistic	11.25398	Durbin-Watson stat	1.334710
Prob(F-statistic)	0.005730		

Dependent Variable: FI2__K_3
Method: Least Squares
Date: 06/27/18 Time: 02:54
Sample: 1 14
Included observations: 14

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	12.61793	10.37579	1.216094	0.2473
MAT	-2.488131	2.975074	-0.836326	0.4193

R-squared	0.055077	Mean dependent var	4.725734
Adjusted R-squared	-0.023667	S.D. dependent var	15.95131
S.E. of regression	16.13897	Akaike info criterion	8.531914
Sum squared resid	3125.596	Schwarz criterion	8.623208
Log likelihood	-57.72340	Hannan-Quinn criter.	8.523463
F-statistic	0.699441	Durbin-Watson stat	2.631952
Prob(F-statistic)	0.419314		

Dependent Variable: FI2__K_6
Method: Least Squares
Date: 06/27/18 Time: 02:56
Sample: 1 14
Included observations: 14

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-5.497447	14.08361	-0.390344	0.7031
MAT	0.655876	4.038225	0.162417	0.8737

R-squared	0.002193	Mean dependent var	-3.417048
Adjusted R-squared	-0.080957	S.D. dependent var	21.06999
S.E. of regression	21.90628	Akaike info criterion	9.142987
Sum squared resid	5758.620	Schwarz criterion	9.234281
Log likelihood	-62.00091	Hannan-Quinn criter.	9.134536
F-statistic	0.026379	Durbin-Watson stat	1.721722
Prob(F-statistic)	0.873680		

Dependent Variable: FI1__K_6
Method: Least Squares
Date: 06/27/18 Time: 02:51
Sample: 1 14
Included observations: 14

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	11.42698	3.517915	3.248227	0.0070
MAT	-2.517299	1.008700	-2.495588	0.0281

R-squared	0.341671	Mean dependent var	3.442268
Adjusted R-squared	0.286810	S.D. dependent var	6.479438
S.E. of regression	5.471924	Akaike info criterion	6.368701
Sum squared resid	359.3034	Schwarz criterion	6.459995
Log likelihood	-42.58091	Hannan-Quinn criter.	6.360250
F-statistic	6.227959	Durbin-Watson stat	1.720586
Prob(F-statistic)	0.028142		

Dependent Variable: FI1__K_9
Method: Least Squares
Date: 06/27/18 Time: 02:52
Sample: 1 14
Included observations: 14

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3.027548	1.935238	1.564432	0.1437
MAT	-0.548407	0.554895	-0.988307	0.3425

R-squared	0.075269	Mean dependent var	1.288036
Adjusted R-squared	-0.001792	S.D. dependent var	3.007464
S.E. of regression	3.010157	Akaike info criterion	5.173425
Sum squared resid	108.7325	Schwarz criterion	5.264719
Log likelihood	-34.21397	Hannan-Quinn criter.	5.164974
F-statistic	0.976750	Durbin-Watson stat	1.606269
Prob(F-statistic)	0.342512		

Dependent Variable: FI2__K_9
Method: Least Squares
Date: 06/27/18 Time: 02:57
Sample: 1 14
Included observations: 14

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	10.40317	78.50726	0.132512	0.8968
MAT	-16.41749	22.51057	-0.729324	0.4798

R-squared	0.042445	Mean dependent var	-41.67208
Adjusted R-squared	-0.037352	S.D. dependent var	119.8951
S.E. of regression	122.1137	Akaike info criterion	12.57935
Sum squared resid	178941.2	Schwarz criterion	12.67064
Log likelihood	-86.05543	Hannan-Quinn criter.	12.57090
F-statistic	0.531913	Durbin-Watson stat	2.121302
Prob(F-statistic)	0.479798		