

A Macroeconometrical Model of Sustainable Fiscal Policy. Study Case on Romania

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Abstract—Last years the world economy changed and the sovereign risk default increased dramatically for many countries. Countries like Greece, Iceland or Portugal needs special financial rescue plans. For these countries the main mistake was an imprudent fiscal and budgetary policy last years and also the lack of monetary policy independence. This paper examines the impact of fiscal policy on sovereign default risk on Romanian economy and the dynamic of country risk during global crisis. In order to analyze the sustainability of fiscal policy in Romania last years, we propose a macroeconometrical model in order to study the influence of fiscal policy on sovereign risk default in Romania. We test our results using various sustainability tests and the result was conclusive.

Index Terms—Fiscal policy, macroeconometrical model, sovereign risk, sustainability.

I. INTRODUCTION

Last years the world economy changed and the sovereign risk default increased dramatically for many countries. Countries like Greece, Iceland, Portugal or Spain needs special financial rescue plans. For these countries the main mistake was an imprudent fiscal and budgetary policy last years and also the lack of monetary policy independence. This paper examines the impact of fiscal policy on sovereign default risk on Romanian economy and the dynamic of country risk during global crisis. In Romania, last two years sovereign debt has increased dramatically after the implementation of the IMF conditions. In order to analyze the sustainability of fiscal policy in Romania last years we propose a macroeconometrical model. We start from Buiter [1] and Budina [2] models and analysis and we develop a specific model studying the influence of fiscal policy on sovereign risk default and sustainability of fiscal policy in Romania. We test our results using Quintos [3] and Trehan and Walsh [4] sustainability tests and the result was conclusive.

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II. LITERATURE

The sub-prime credit problems that started in the US during 2007 affected the financial sector in other countries, particularly Europe. Deterioration in the financial sectors of the US and Europe has affected national financial systems in different parts of the world and led to the global financial crisis. In terms of national effects, the contagion from the Greek crisis was spreading across Europe. One of the most prominent explanations is that sovereign risk has been very low over the past few years, as emerging market countries made significant progress in reducing the vulnerability of their public sector balance sheets.

The irresponsible fiscal policy and the decrease of productivity increase the default risk for many European countries. In this context, papers from Blanchard [5], Reinhart and Rogoff [6], Katsimi and Moutos [7] or Leith and Wren-Lewis [8] analyze debt risks and fiscal policies and propose different measures to overcome actual financial crisis.

If the developed countries' fiscal sustainability matter as been consistently analyzed, in the matter of transition economies not many studies have been developed. Especially Buiter [1] and Budina and van Wijnbergen [9] had measured fiscal sustainability for a certain amount of transition economies.

Buiter [1] studied in 12 different countries that are included in external funds programs and whose economies are in transition (of the 6 countries that had been chosen, one is Romania). His studies focus on fiscal performance. It is especially concerned in long and medium-time sized fiscal matters and tries to provide new ideas for designing and implementing future external-financed programs.

Analyzing the data, Buiter considers that Romania has quit communism with a negligible debt rate to GDP. At the end of 1994 the GDP debt rate was 21%, the primary excess was 0.3% (Romania suited the Maastricht Treaty criterion. This fact wasn't one of the worrying reasons considering the solvency. The only question mark was the possibility of a hidden quasifiscal deficit.

Buiter and Budina and van Wijnbergen's studies didn't bring any formal sustainability test. They were considering that fiscal policy was unsustainable if the current or estimated data suggest that the previously mentioned rate will increase compared to the actual level.

Because of its simplicity, this criterion is useful sometimes but requires certain strong suppositions. For example, it is almost unjustifiably conservator in the matter of the current debt/output rate can be under the limit where a fiscal policy becomes unsustainable. Otherwise, the criterion could

suggest the opportunity of a restrictive fiscal policy than necessary.

In 2000, Green [10] evaluated Poland's fiscal policy sustainability at that moment based on intertemporal budget constraint. He uses unit root and cointegration tests and considers seigniorage a source of income of the Government. His conclusion is that the analyzed Polish fiscal policy was sustainable.

Aristovnik and Bercic [11] analyze long and medium time fiscal policy sustainability at country level by three big groups: Central and Eastern Europe, South-Eastern Europe and Independent Estates' Community.

The data concerning the public debt and GDP features the 2001-2004 periods and the increase ration for 2000-2008 (middle-term) and for 2004-2008 (long term).

They are using the primary fiscal spacing theory (suggested by Buiter [1] and by Blanchard [5]), based on the solvability criterion we consider sustainability a policy that doesn't lead towards an increasing public debt rate to GDP. Their results will point fiscal sustainability problems at the Eastern-Central level (especially Czechs Republic, Hungary and Poland) and at the South-Eastern level (especially Croatia and Albania). Based on these results, Romania's fiscal policy is sustainable at long and middle term also.

The first tests set studies the governmental debt stationarity and is due to Hamilton and Flavin's [12] contributions.

The second test set examines the incomes' and fiscal costs' cointegration proprieties. The most important later contributions to these approaches were Trehan and Walsh's [4], Trehan and Walsh's [13] and Quintos's [3].

This approach starts directly from the current budget constraint and examines the budgetary process's sustainability using cointegration tool. When the government fiscal policy is restricted by current budget deficit then the current public debt value must be equal with the actualized sum of the future expected surpluses. If this rule is broken, this fact indicates that the fiscal policy is unsustainable, because the debt would go off at a rate that's higher than the economy's growth rate.

Roman *et all* [14] study analyze the relationship between political cycles and economic growth and they conclude that in Romanian economy there exists strong relationship between variables included in the model.

III. THE MODEL

Our model derives from Buiter and Budina [1], [2], intertemporal budget equilibrium model.

First relationship describes budget inter-temporal constraint. This relationship is:

$$GB_t = GD_t + (1+i_t) \cdot GB_{t-1} \quad (1)$$

where: GB_t represent nominal government debt, GD_t is nominal government deficit and i_t is nominal interest rate.

Rewriting (1) in real terms we obtain:

$$B_t = D_t + (1+r_t) \cdot B_{t-1} \quad (2)$$

where: B_t represent real government debt, D_t is real government deficit and r_t is real interest rate.

If we define government deficit as difference between government expenses (G) and government revenues (T) we obtain:

$$B_t - B_{t-1} = G_t - T_t + r_t \cdot B_{t-1} \quad (3)$$

If real interest rate had a stationary behavior around mean value r we have (4):

$$B_t(1+r) \cdot B_{t-1} = G'_t - T_t \quad (4)$$

$$\text{where } G'_t = G_t + (r_t - r) \cdot B_{t-1} \quad (5)$$

Budget intertemporal constraint will be:

$$B_t = \sum_{j=0}^{\infty} \frac{T_{t+j} - G'_{t+j}}{(1+r)^{j+1}} + \lim_{j \rightarrow \infty} \frac{B_{t+j+1}}{(1+r)^{j+1}} \quad (6)$$

The intertemporal equilibrium condition is:

$$\lim_{j \rightarrow \infty} E_t \left(\frac{1}{1+r} \right)^{j+1} B_{t+j+1} = 0 \quad (7)$$

In respect with this transversality restriction, budgetary inter-temporal constraint shows that current value of public debt equals expected value of budget surpluses.

Previous condition is equivalent with the fact that public debt increasing ratio must be smaller like real interest rate increase.

Starting on these conditions many authors develop cointegration tests.

By differentiating (6) we obtain:

$$\Delta B_t = \sum_{j=0}^{\infty} (1+r)^{-(j+1)} (\Delta T_{t+j} - \Delta G'_{t+j}) + \lim_{j \rightarrow \infty} (1+r)^{-(j+1)} \Delta B_{t+j+1} \quad (8)$$

or

$$EXP_t - T_t = \sum_{j=0}^{\infty} (1+r)^{-(j+1)} (\Delta T_{t+j} - \Delta G'_{t+j}) + \lim_{j \rightarrow \infty} (1+r)^{-(j+1)} \Delta B_{t+j+1} \quad (9)$$

where EXP_t represent total government expenses (including interest amounts).

To obtain equilibrium condition right terms must be stationary and also left term must be stationary.

Hamilton and Flavin [12] propose as necessary condition for sustainability, stationarity condition for first difference order government debt.

But public debt first difference order evolution is explained essentially by public deficit, so this test is not different from total deficit stationarity test.

Remark. Fiscal policy may be sustainable even public debt is not stationary.

Quintos [3] sustainability test

Starting on (8) Quintos associates sustainability with condition (10):

$$\lim_{j \rightarrow \infty} E_t \left(\frac{1}{1+r} \right)^{j+1} \Delta B_{t+j+1} = 0 \quad (10)$$

This condition differs from transversality condition by the presence of debt difference operator.

That means if ΔB_t is stationary then we obtain a „strong” sustainability and if ΔB_t is not stationary then we have a “week” sustainability.

Defining regression model (11) we have the relationship between fiscal revenues and total government expenses:

$$T_t = \alpha + \beta EXP_t + \varepsilon_t \quad (11)$$

Depending on estimation results we have:

- a) A strong budgetary sustainability if T_t and EXP_t are both $I(1)$ and cointegrated, that means $\varepsilon_t \sim I(0)$ and $\beta=1$.
- b) A week budgetary sustainability if T_t and EXP_t are both $I(1)$ and cointegrated, that means and $0 < \beta < 1$.
- c) A unsustainable budgetary deficit if $\beta \leq 0$.

Quintos sustains that cointegration is not a necessary condition for week sustainability. If we don't have cointegration, then (11) is not satisfied.

When strong sustainability condition is accomplished then also budget intertemporal constraint is respected and public deficit follows an $I(1)$ process. If sustainability condition is week, then public deficit follows an $I(2)$ process and budget constraint is respected and public debt increase rate is smaller like GDP rate.

Trehan and Walsh [13] proposed two sustainability tests that differ on interest rate in constant approach and in time variation approach. They supposed if budgetary intertemporal constraint is accomplish, then government debt and deficits are integrated (and nonstationary) and interest rates are constants ($r_t = r$). In this context the necessary and sufficient condition for sustainability is that budgetary debts and budgetary deficits are cointegrated. To verify this condition we rewrite (2) as:

$$B_t - B_{t-1} = D_t + r \cdot B_{t-1} \quad (12)$$

If B_t is $I(1)$ then $B_t - B_{t-1}$ are stationary by definition. Then also $D_t + r \cdot B_{t-1}$ is stationary. If interest rate is constant then B_t and D_t are cointegrated.

So, if fiscal policy is sustainable, then a public debt increase would lead towards interest expenses increase and budgetary deficit decrease.

A second sustainability test proposed by Trehan and Walsh [15] does not impose a constant interest rate in (12). Whatever, it is necessary to test if only total budgetary deficit is stationary so that inter-temporal constraint is accomplished.

A. Bohn Sustainability Test

Bohn [15] approach shows if a government take necessary measures to respect budgetary constraint analyzing

relationship between fiscal surplus rate and public debt ratio. His hypothesis is that GDP fiscal surplus rate is positively related with public debt ratio, and then the government take necessary measures to obtain a sustainable fiscal policy.

Equation that indicates this relationship is:

$$\left(\frac{S}{Y} \right)_t = \beta_0 + \beta_1 \left(\frac{D}{Y} \right)_{t-1} + \beta_2 GVAR_t + \beta_3 YVAR_t + \varepsilon_t \quad (13)$$

where:

S/Y is fiscal revenue ratio and D/Y is public debt ratio;

$GVAR = \frac{g_t - g_t^*}{y_t}$ is a variable that indicates government

expenses variation from long term equilibrium line (g represent current government expenses and g^* is long term government expenses);

$YVAR = \left(1 - \frac{y_t}{y_t^*} \right) * \left(\frac{g_t^*}{y_t} \right)$ is a variable that indicates GDP

variance corrected with debt ratio (y is GDP rate and y^* is potential GDP rate);

B. Remark

Models' variables correspond to Barro [16] model.

From (13), if β_1 is positive then fiscal policy respect inter-temporal constraint and β_2 and β_3 must be negatives. This will indicate that fiscal surplus decreases if government expenses are greater like optimum level or we have an economy contraction.

Another sustainability test suggested by Bohn [15] is done by debt dynamics analysis. Equation 14 indicates necessary relationship:

$$\left(\Delta \frac{D}{Y} \right)_t = \alpha_0 + \alpha_1 \left(\frac{D}{Y} \right)_{t-1} + \alpha_2 GVAR_t + \alpha_3 YVAR_t + \varepsilon_t \quad (14)$$

This equation shows if debt ratio changes influences long term values of debt ratio.

As a consequences, α_1 must be negative and α_2 respectively α_3 must be positives.

IV. STUDY CASE ON ROMANIA

Reference [17] gives as a good description of Romanian economy especially in crisis period.

We use the previous models to analyze Romanian fiscal policy sustainability. Our dataset consist in quarterly information on specified variables from National Institute of Statistics [18] for 1990-2010 periods.

In our study case we use as variables:

y_t – is quarter to quarter GDP rate;

y_t^{bd} – is quarterly total debt / GDP ratio;

y_t^r – is quarterly total revenues / GDP ratio;

S/Y - is quarterly fiscal revenue ratio and D/Y is public debt ratio;

$GVAR = \frac{g_t - g_t^*}{y_t}$ - is a variable that indicates government

expenses variation from long term equilibrium line (g

represent current government expenses and g^* is long term government expenses);

$$YVAR = \left(1 - \frac{y_t}{y_t^*}\right) * \left(\frac{g_t}{y_t}\right) - \text{is a variable that indicates GDP}$$

variance corrected with debt ratio (y^* is potential GDP rate, estimated using Hodrick – Prescott filter on GDP real rate);

A. Trehan and Walsh Test

For Romania Trehan and Walsh test indicates that budgetary inter-temporal constraint is satisfied and the process is stationary.

Using an $AR(7)$ model, total budgetary deficit rate equation is:

$$\Delta y_t^{bd} = 5,34 - 1,57y_{t-1} + 1,04\Delta y_{t-1}^{bd} + 1,49\Delta y_{t-2}^{bd} + 1,27\Delta y_{t-3}^{bd} + 0,54\Delta y_{t-4}^{bd} + 0,56\Delta y_{t-5}^{bd} + 0,67\Delta y_{t-6}^{bd} + 0,20\Delta y_{t-7}^{bd} + \varepsilon_t \quad (14)$$

We observe that the recent deficit rates are the most important and after 3 periods deficit rate influence decrease. Also an important contribution on budgetary deficit rate is from previous year GDP rate (a negative contribution, economically correct).

Using Dickey Fuller Augmented test for Romanian economy in this model we obtain stationarity, so on short term budgetary deficit is sustainable.

B. Testing Revenue Stationarity

We use again an $AR(7)$ model to test the revenue ratio stationarity. Estimated equation is:

$$\Delta y_t^r = 79,21 - 2,65y_{t-1} + 1,35\Delta y_{t-1}^r + 1,26\Delta y_{t-2}^r - 0,42\Delta y_{t-6}^r + 0,20\Delta y_{t-7}^r + \varepsilon_t \quad (15)$$

We can observe that order 1 difference revenue ratio is influenced by previous year revenues and order I and II difference revenue ratio.

C. Bohn Sustainability Tests

Bohn approach better explain emergent economies evolution (like Romanian economy) due on the fact this is more flexible like inter-temporal standard analysis. Bohn suggests that model information can be used to analyze better fiscal sustainability without using any interest rate.

There are no supplementary conditions on interest rates. Also Bohn tests include cyclical fluctuations and GVAR and YVAR improve econometric analysis quality.

For Romanian economy, in 1990-2010 periods, estimated equation is:

$$\left(\frac{S}{Y}\right)_t = -4,85 + 0,7\left(\frac{D}{Y}\right)_{t-1} - 24,8GVAR_t - 8,7YVAR_t + \varepsilon_t \quad (16)$$

Barro rules are respected and fiscal revenues ratio had a positive reaction to debt ratio increase and a negative reaction to economy contraction or to debt ratio variation.

These estimators indicate that Romanian government fiscal policy was a sustainable one in analyzed periods.

We model also the debt dynamics in order to improve

sustainability analysis.

Second Bohn equation is:

$$\left(\Delta \frac{D}{Y}\right)_t = 8,5 - 0,33\left(\frac{D}{Y}\right)_{t-1} + 62,85GVAR_t - 62,87YVAR_t + \varepsilon_t \quad (17)$$

In this case two estimators respect theoretical conditions, respectively α_1 and α_2 estimators, that indicates a responsible fiscal policy. The third estimator does not respect non-negativity constraint, which indicates government reaction to economy contraction (or expansion) is not an appropriate one. For the future this government reaction function will negatively influence public debt.

On short term the Romanian fiscal policy was sustainable between 1990 and 20010 (with default short periods). Starting on 2008 year, the sustainability of fiscal and budgetary policy decrease and influences the sovereign default risk. On the long term it is possible to maintain the sustainability of fiscal policy only if Romanian economy will have growth rates around 5% and reduced (below 3%) budgetary deficits.

V. CONCLUSION

Our analysis shows that both expenses ratio and revenue ratio are stationary. In this case there are not cointegration relationships between these two variables. How integration order for expenses ratio and revenue ratio are zero it's been shown that in analyzed period government priority was to maintain short term budgetary deficit balanced. Long term budgetary deficit was neglected.

Barro model indicates that Romanian government fiscal policy was a sustainable one in analyzed periods.

Using Hamilton-Flavin sustainability criteria (first order cointegration series) we obtain that Romania's public debt in 1990-2010 period was sustainable. Also using Trehan and Walsh criteria we obtain for budgetary deficit sustainability.

Both budgetary expenses and revenues are stationary, so there are no cointegration. For analyzed periods the government tried to achieve short time budgetary equilibrium instead medium time and long time budgetary equilibrium.

Using Bohn reaction function we show that primary surpluss had a positive reaction on public debt increase and a negative reaction on crisis or expenses shocks.

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