DE GRUYTER OPEN

DOI 10.2478/sbe-2018-0008

A MODEL TO SIMULATE THE DYNAMICS OF PUBLIC DEBT SUSTAINABILITY IN EU

MARINESCU Ada Cristina
Romanian Academy, Romania

ALBU Lucian-Liviu
Institute for Economic Forecasting, Romanian Academy, Romania

Abstract:

Last decades the public debt increased continuously in all countries of European Union. At present, in many countries this dangerous growth is seriously affecting the general process of economic development. Although in a number of countries the public debt is today larger than 60% of GDP, as the imposed limit by Maastricht Treaty, the problem of its sustainability is varying from country to country. Following old and recent published studies in matter of public debt sustainability, one objective of our study is to analyse the existence of a convergence or a divergence process both at the level of the whole EU and within the two major groups of countries (EU14 – old members of EU, after Brexit, and respectively EU11 – new eastern members adhered to EU after 2000). Other objective is to build a model to simulate the long term dynamics of the public debt as a function of standard variables (such as GDP growth, interest rate, budgetary deficit, etc.). Moreover, by using recent data from Eurostat, IMF, and World Bank, we try to estimate few essential parameters in order to control the public debt sustainability in each country of EU. Finally, countries are grouped in a number of classes for which certain policy measures could be evaluated.

Key words: *public debt, budget deficit, interest rate, behaviour regimes, convergence*

1. Introduction

At present and for next years, the problem of stopping the dangerous increasing in public debt is becoming one of the main goals of governments in EU. In the same time, especially after the so called Greece's debt crisis, a number of studies tried to analyse main factors influencing dynamics of public debt, to model the mechanism of its increasing, to simulate its future trend and to find some optimising possible trajectories. First, our study is focusing on analysing the convergence in EU in mater of public debt and its main factors. Secondly, based on the standard equation of public debt dynamics and using few usual conditions, we present a model in which dynamics of main factors (variables) of public debt would be simulated together.

2. Dynamics of public debt in UE and convergence

Last decades in EU it was a strong process of convergence between the two major conventional groups of countries: EU11 (all former communist countries from east-central part of Europe adhered to EU after 2000) and EU14 (old members, excepting Cyprus and Malta, and UK after the Brexit). The process is illustrated for the period 2002-2016 (depicted as t from 2 to 16 on the horizontal axis) by the graphical representation in Figure 1, where y%EU11 and y%EU14 mean the average value of GDP per capita (expressed as dollar PPP) in EU11 and EU14 as proportion in the average value of EU27 (EU after Brexit). As absolute values, GDP per capita increased in 2002-2016 from 12.7 to 26.9 thousand dollars PPP in EU11 and from 30.0 to 42.5 thousand dollars PPP in EU14.

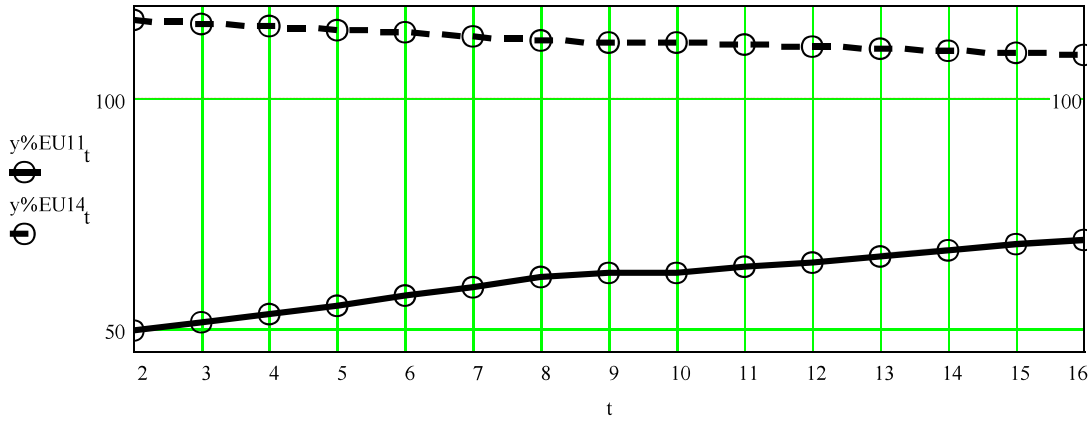

Figure 1.

A deeper analysis inside each group of countries demonstrates for the whole period a trend of convergence in EU11 and one of divergence in EU14, as it is shown in Figure 2 (where □%y is the coefficient of variation as a measure of the concentration degree).

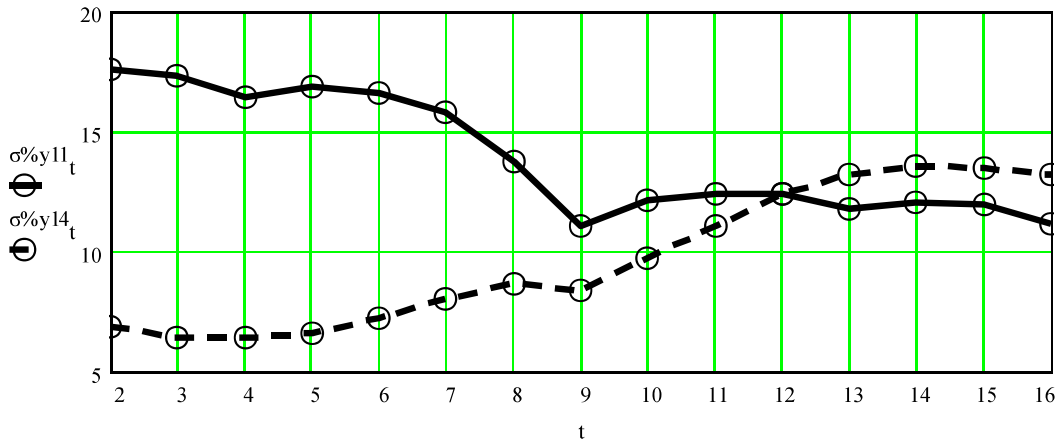

Figure 2.

Moreover, by putting together dynamics in the two groups of countries on the same graphical imagine it can be highlighted two different behavioural regimes in mater of GDP per capita, as they are shown in Figure 3 (where yMT is the average level of GDP per capita for the whole period 2002-2016). First regime, characterising dynamics in EU11, is located on the left side of the graphic representation and the second one, characterising dynamics in EU14, on its right side.

At this point of our analysis, we can imagine a transitional regime between the two distinct regimes (one characterising dynamics in the group EU11 and respectively that characterising dynamics in the group EU14), corresponding between approximatively 26.8 and 30 thousand dollars per capita. Thus, by changing from a time scale to an economic development scale, in EU, in a continuum space of GDP per capita, the growth of economic development level (beyond 30 thousand dollars per capita) will be followed by a dramatic change from an era of convergence to one of divergence.

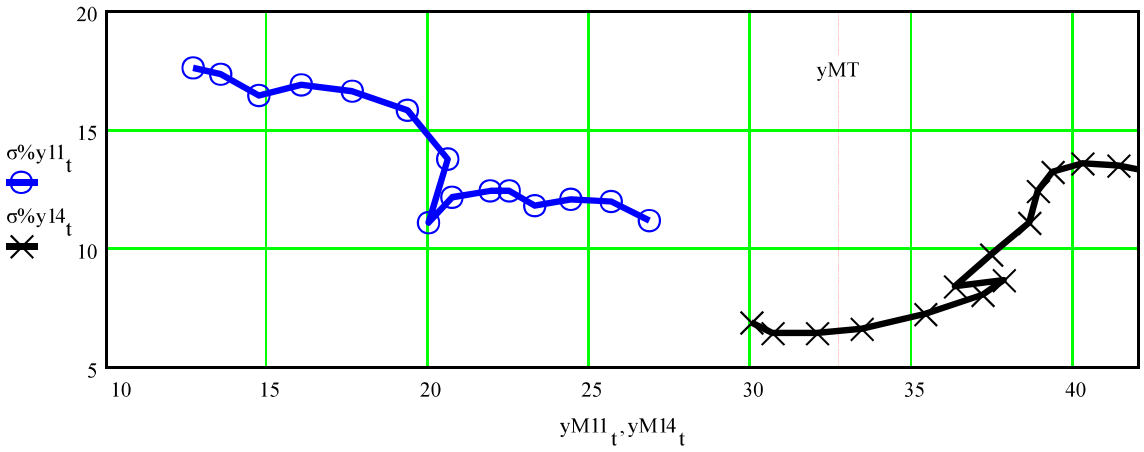

Figure 3.

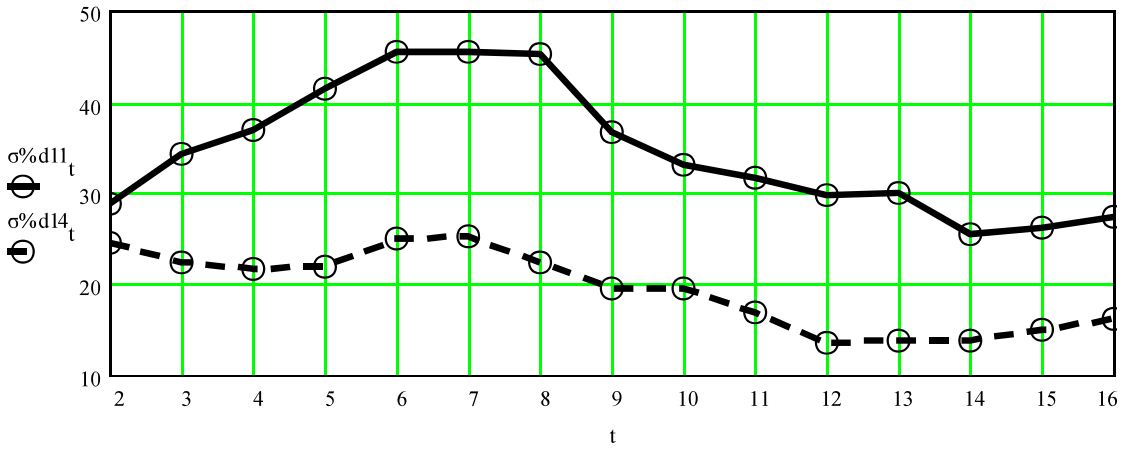

Figure 4.

Regarding dynamics in matter of public debt, during the analysed period, in EU11 it was a divergence trend before crisis, emerged in 2007-2008, and followed by a

convergence trend after that. Comparatively, inside of EU14, it was demonstrated a quasi-continuous trend of convergence, as it is shown in Figure 4, with a maximum value of the coefficient of variation (noted as σ%d) in 2007, the year when crisis started.

Applying a similar methodology, as we used above to analyse general economic development, in case of public debt, the behavioural regimes seem to evolve in an opposite manner, as it is shown in Figure 5.

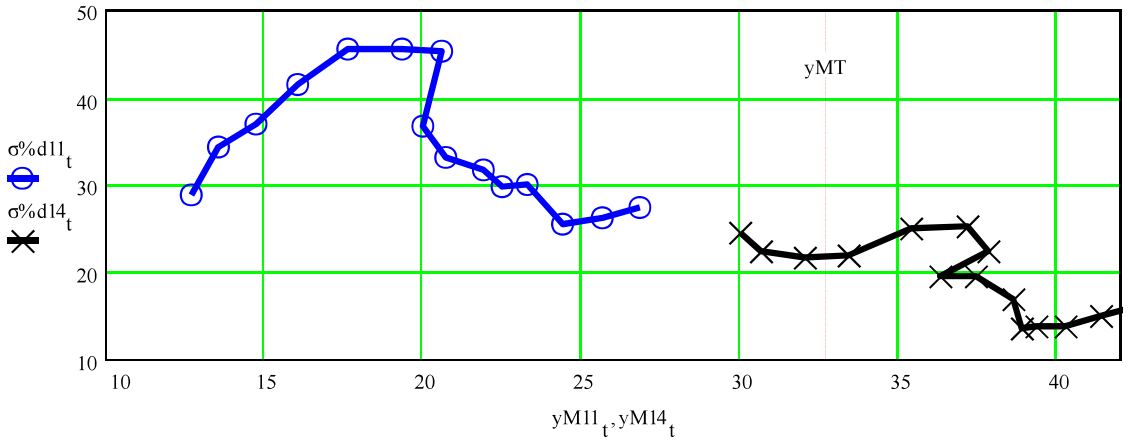

Figure 5.

In EU, in a continuum space of GDP per capita, growth of economic development level (beyond 30 thousand dollars per capita) will be followed by a dramatic change on the side of public debt dynamics, namely from an era of divergence to one of convergence. However, this positive trend of convergence will be obtained only by increasing the burden of public debt in GDP (denoted as average value in a group of countries by dM%) as it is shown in Figure 6.

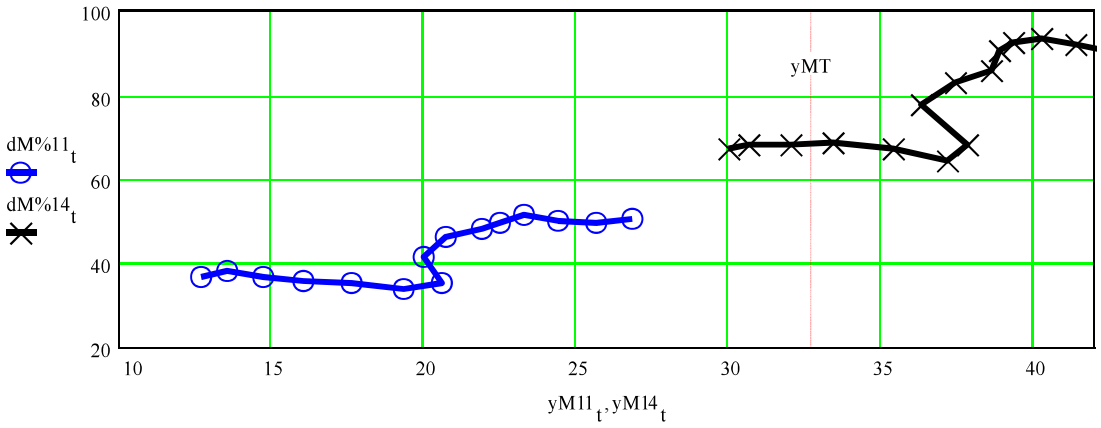

Figure 6.

Thus, in case of the transition from the fist behavioural regime to the second one, growth of GDP per capita will be followed by an impressive jump in the level of ratio between public debt and GDP, namely from around 50% to 67%.

3. Mechanism of public debt and its factors

In specialised literature regarding trends in public debt, there are investigated many causes, as main factors being usually considered the initial level of public debt, budget deficit, and interest paid on the public debt. A simple equation expressing the relation among them is as follows:

$$d\%1 = (D0 + Db1 + \Pi 1) / Y1$$

where d%1 is the value of ratio between public debt and GDP in current year, D0 – absolute value of public debt in the previous year, Db1 – absolute value of paid (or payable) interest on public debt in current year, $\Pi 1$ – absolute value of budget deficit in current year, and Y1 – absolute value of GDP in current year.
Finally, after a number of algebraic operations, the stability condition for public debt as a share of GDP is given by the following equation:

$$g\% = (i\%1 * d\%0 / \pi\%1) – 1$$

where g% is growth of GDP (thus Y1/Y0), i%1 – interest rate on public debt in current year, d%0 – ratio between public debt and GDP in previous year, and π%1 – ratio between budget deficit and GDP in current year.

4. Simulation model and estimations

In this section of the study, we are investigating the behaviour regimes in case of main factors of public debt, corresponding to the two groups of countries in EU. The behavioural regimes are graphically presented in case of interest rate value, i%, in Figure 7, for the share of interest in GDP, db%, in Figure 8, and for deficit budget, π%, in Figure 9.

In case of the average value of interest rate, iM%, transition from the first behaviour regime, functioning in UE11 (left side of the graphical representation) to the second one, operating in EU14, starts by a jump then followed by a quasi-continuous decreasing. For the value of interest as share of GDP, db%YM, it is a huge jump from the first regime to the second one, followed by a decreasing in its level for higher

values of GDP per capita. Trajectories for budget deficit, as share of GDP, π%, are very fluctuating in each case of the two regimes.

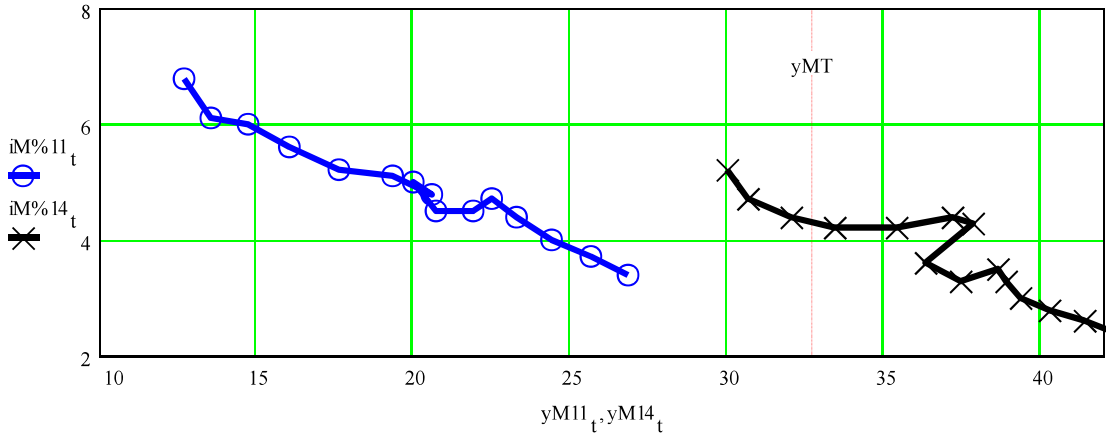

Figure 7.

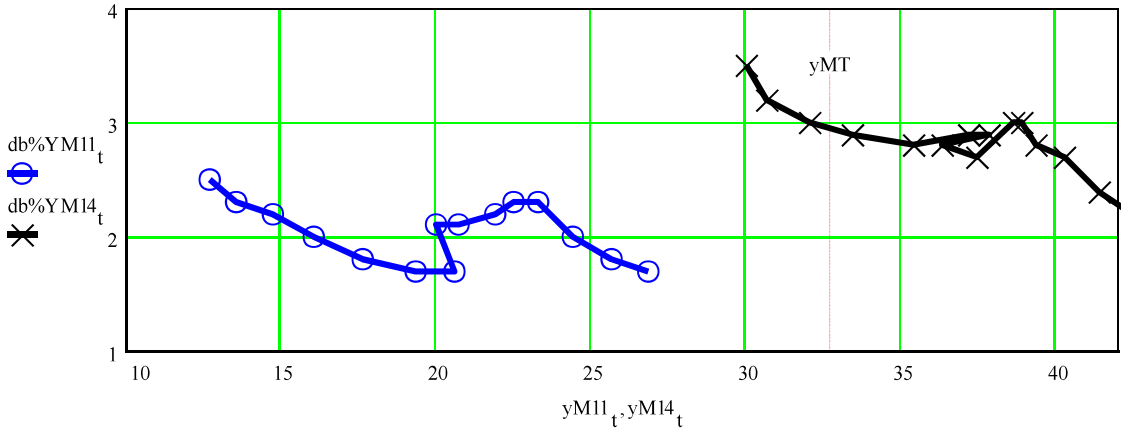

Figure 8.

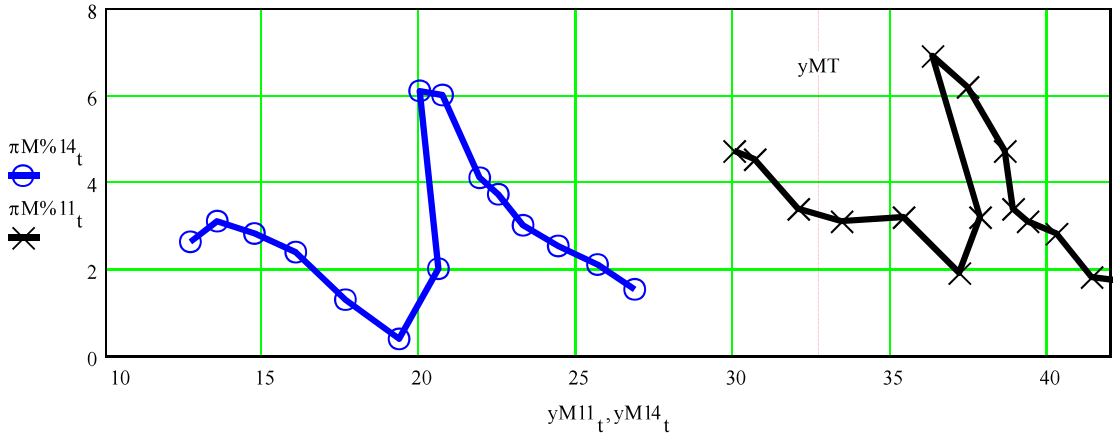

Figure 9.

5. Conclusion

In this paper it was empirically demonstrated that there are at least two regimes of behaviour in EU, in mater of dynamics of public debt, depending essentially on the general level of economic development, expressed by GDP per capita. Transition from the first regime, existing in EU11, to the second one, operating in EU14, is generating a significant convergence in mater of public debt per capita and an important decreasing in interest rate, but also it will be followed by an impressive growth in the level of public debt reported to the GDP (close to 100%).

References

Albu, L.-L. (2002): "Sustainability Function", *Romanian Jornal for Economic Forecasting*, 2, 5-14.

Albu, L.-L. (2008): "A simulation model of public debt sustainability", *MPRA Paper* 11713, University Library of Munich, Germany.

Barro, R. (1988): "The Ricardian Approach to Budget Deficits", NBER, *Working Paper*, no. 2685.

Blanchard, O. J. (1990): "Suggestion for a New Set of Fiscal Indicators", *OECD Working Paper*, 79.

Coricelli, F. (1997): "Fiscal Policy a Long Term View", *Economic Policy Initiative*, 3, Forum Report of the Economic Policy Initiative.

Elmendorf, D.W. and Mankiw, G. (1998): "Government Debt", *Handbook of Macroeconomics*, January.

Dornbusch, R. (1987): *Debts and Deficits*, Leuven and MIT University Press.

Fry, M. (1992): "Some Stabilizing and Destabilizing Effects of Foreign Debt Accumulation in Developing Countries", *Economics Letters*, 39, 315-321.

Garcia, F. (1998): "Public Debt Sustainability and Demand for Monetary Base", *Working Papers IMF*.

Krejdl, A. (2006): "Fiscal Sustainability – Definition, Indicators and Assessment of Czech
Public Finance Sustainability", *CNB Working Paper Series*, 3, Czech National Bank.

Langenus, G. (2006): "Fiscal Sustainability Indicators and Policy Design in the Face of Ageing", *NBB Working Papers - Research Series*, 102, National Bank of Belgium.

Mello, L. and Hussein, K. (2001): "Is Foreign Debt Portfolio Management Efficient in Emerging Economies?", August, Working Paper, IMF.

Monokroussos, P. (2010): "Assessing fiscal policy with the use of sustainability indicators: The case of Greece", *Economy and Markets*, Vol. V, Issue VI, December, Eurobank EFG Economic Research.

Mundell, R.A. (1990): "Debts and Deficits in Alternative Macroeconomic Models", *Revista di Politica Economica*, VII-VIII, 5-130.

Rocha, R.R. and Saldanha, F. (1992): "Fiscal and Quasi Fiscal Deficits, Nominal and Real Measurement and Policy Issues", *Working Paper*, *WPS*.

Roubini, N. and Sachs, J. (1989): "Government spending and budget deficits in the industrial countries", *Economic Policy*, April.

Stournaras, Y. (1990): "Public Sector Debt and Deficits in Greece", *Revista di Politica Economica*, VII-VIII, 405-440.

*** European Commission (2006): "The long-term sustainability of public finances in the European Union", *European Economy*, 4, Brussels.