

**Universität Bielefeld**

**Faculty of Business Administration and Economics**

**Working Papers in Economics and Management**

**No. 07-2016  
June 2016**

# **Debt Sustainability Issues in the Central and Eastern European Countries**

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# Debt Sustainability Issues in the CEECs

## *Working Paper*

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### **Abstract**

The aim of this study is to investigate debt sustainability in ten Central and Eastern European countries over 1997-2013. Following Burger (2012), we calculate the stabilized debt using the estimates of a fiscal reaction function for a balanced panel with fixed effects. Comparing the stabilized, the effective debt ratios and the historical averages, we can assess debt sustainability in short and in long run. We find that current debt ratio as of 2015 for Bulgaria and Romania is not sustainable. The debt dynamics of Bulgaria is stable whilst for Romania's case the debt trajectory indicates unstable dynamics. As for historical averages of debt ratios, Bulgaria could encounter debt sustainability issues also in the long run.

JEL: H63, E62

Keywords: Public debt, Fiscal Sustainability, Fiscal Reaction Function, CEECs economies

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# 1 Introduction

Debt sustainability has become central after the sovereign debt crisis in Europe. Since then, there has been observed an increased interest of international bodies such as the European Commission or the International Monetary Fund in developing policy frameworks and recommendations aiming at reducing high debt ratios and/or keeping the budget deficit under control.

We acknowledged the existence of a rich body of research investigating sustainability of fiscal policy in general. We also found several papers indicating fiscal sustainability issues for many of the European Union (EU) countries even before the crisis (i.e. Afonso, 2000; Uctum and Wickens, 2000; Afonso and Rault, 2007). However, the literature studying the fiscal sustainability for Central and Eastern European Countries (CEECs) consists of a small number of studies. For instance, Redžepagić and Llorca (2007) used fiscal reaction function and Ordinary Least Squares to identify the determinants of fiscal sustainability in seven countries of Central and Eastern Europe over 1999-2006. They found a positive reaction of the primary balance to shocks on public debt in several CEECs, except Poland and Czech Republic. In addition, they indicated a relevant influence of the political and partisan cycle on fiscal sustainability only in Poland, but not in the rest of the countries examined. Stoian and Câmpeanu (2010) analyzed fiscal sustainability for ten Central and Eastern European countries estimating individual fiscal reaction functions for the period 2000-2008. The main findings of this study suggest that governments of Bulgaria, Czech Republic, Estonia, Hungary and Lithuania were able to increase the primary surplus as response to shocks on public debt whilst for the cases of Latvia, Poland, Romania and Slovakia the response was opposite indicating difficulties in achieving fiscal sustainability.

Therefore, the aim of our study is to examine debt related sustainability issues for ten CEECs. One main driver of our research was the particularities there have been observed for this group of countries with regard to their debt dynamics. Stoian and Iorgulescu (2016) documented that the former communist countries recorded lower debt ratios, primary deficit and negative flow costs in the sense of higher GDP growth rates than of the interest rates on public debt by comparison with the advanced economies in Europe for which the situation looked opposite. The authors suggested that CEECs might fall into the *debt trap* which implies the increase in the debt ratio as an effect of a negative flow cost. Negative flow cost is consistent with so called *golden rule* of fiscal policy (Escolano, 2010) because it keeps the debt ratio on a stable dynamics and also allows for primary deficit. However, this setting might lead to a significant growth of the debt ratio and as Aizenman and Pasricha (2010) suggested if the flow cost suddenly turns into positive because of deteriorating economic conditions, then the debt burden will largely increase. Making comparison between the debt ratio in 2013 and in 1997, we observed that, except Bulgaria, for which the debt ratio significantly decreased over this period, for the rest of Central and Eastern European countries the debt ratio considerably increased. We noted the largest increase for the Czech Republic and Latvia (3.7), for Slovenia (3.2), and for Lithuania and Romania (2.5). For rest of the countries under investigation, the results showed an increase of 1.7 for Slovakia, 1.4 for Estonia, 1.3 for Poland and 1.2 for Hungary.

Considering this setup, the question which naturally arises is whether the current debt ratio of CEECs is sustainable. In order to provide a relevant answer to this research question, we employ the methodology suggested by Burger (2012), Burger et al. (2011), Burger and Marinkov (2012) and Fincke (2012b) which implies the calculation of a stabilized debt ratio using the coefficient estimates of a fiscal reaction function. We use a dataset consisting of annual data ranges from 1997 to 2013 for ten CEECs. The reminder of this paper is organized

as follows. Section 2 presents in detail the methodology employed within this study. In Section 3, we describe the dataset and report the results of our estimations. The last section comprises the concluding remarks.

## 2 Theoretical background

In order to conduct a profound analysis, some theoretical public finance background may be of avail.<sup>1</sup> A good starting point is the budget identity of the government. Like any other economic agent it is required to balance expenditures and revenues. Public revenues mainly consist of taxes,  $T$ . As regards public expenditures, they are composed of primary spending for goods and services,  $G$ , and interest payments on already outstanding debt  $iB_{t-1}$ . Eventually, if there is a funding gap, it is covered by issuing new bonds/ credit financing. Time is indicated by  $t$ .<sup>2</sup> Reorganization these connections, gives the common textbook notation:

$$DEF_t = \Delta B_t = B_t - B_{t-1} = G_t - T_t + iB_{t-1} \quad (1)$$

With the deficit on the left, given by the change in debt and the primary deficit,  $G-T$ , and the administration's interest payments  $iB$  on the right hand side of the equation. All variables are measured in nominal terms.

Since economic growth is an essential feature of modern economies, it is appropriate to divide (1) by the GDP  $Y$ , with  $Y_t = (1+g)Y_{t-1}$  and  $g$  for the economic growth rate. Such a notation also allows for comparisons between different countries. It is common in the budget context to use ratios to GDP.<sup>3</sup>

$$\frac{B_t}{Y_t} = (1+i)\frac{B_{t-1}}{Y_t} + \frac{G_t - T_t}{Y_t} \quad \Leftrightarrow \quad b_t = \frac{(1+i)}{(1+g)}b_{t-1} + pd_t \quad (2)$$

with small variables notating ratios to GDP and  $pd$  expressing the primary deficit. As (2) shows, the interest rate and the growth rate as well as the initial indebtedness and the primary budget situation influence the size of the current debt ratio of an economy.

Now if it is intended to stabilize the debt ratio at a certain level and kept it constant, as suggested by Stoian (2012), Stoian and Iorgulescu (2016), Buitier (2004), Burger (2012), Burger et al. (2011) for instance, this can be indicated by  $b_t = b_{t-1} = \bar{b} = \text{const.}$ , giving equation (2) as:

$$\bar{b} = \frac{(1+i)}{(1+g)}\bar{b} + pd_s \quad (3)$$

Here  $pd_s$  gives the required primary balance, which can be interpreted as the fiscal policy instrument in order to achieve the stabilized debt ratio  $\bar{b}$ . Making use of the common approximation<sup>4</sup> equation (3) can be stated as

$$-pd_s = (i-g)\bar{b} \quad \Leftrightarrow \quad ps_s = (i-g)\bar{b} \quad (4)$$

<sup>1</sup> These theoretical issues have been pointed out in a similar way by Fincke (2012b).

<sup>2</sup> Cf. for instance Blanchard (2000, Chpt. 27.1) for the subsequent equations. The notation refers to discrete and real variables here. Similar approaches may also be found in or Neck and Sturm (2008, Chpt. 1.5) and Burger (2003) for instance.

<sup>3</sup> Cf. for instance Neck and Sturm (2008), Chpt. 1.5).

<sup>4</sup> See for instance Blanchard (2000, Chpt. 27.1, Appendix 2) for the calculations of the approximations.

The latter part of (4) shows the primary surplus  $ps_t$ , which is influenced by the interest rate - growth rate – differential and the value of the stabilized debt ratio.

For studying debt sustainability a formative approach has been introduced by Bohn (1998): the fiscal response mechanism. It analyses how the government reacts to changes in the public debt ratio with its primary balance relative to GDP. If it runs surpluses (or more general: enhances its balance) as the debt ratio rises, it indicates sustainable behavior. That situation is for instance described in Greiner et al. (2007). It can be indicated as:

$$ps_e = \alpha_0 + c_1 b_{t-1} \quad (5)$$

with  $\alpha_0, c_1$  being constant parameters. The reaction coefficient is  $c_1$ . It expresses the response of the primary surplus to GDP ratio to changes in the public debt to GDP ratio.  $\alpha_0$  captures all other influences on the primary surplus ratio, see Greiner et al. (2005). Equation (5) addresses the empirical access to the approach. It reflects actual responses based on the country's fiscal data, therefore it is labeled by e. Again, the central variables are the primary surplus and the debt ratio, indicating some similarities to the theoretical result in equation (4).

Burger (2012), Burger et al. (2011), Burger and Marinkov (2012) and Fincke (2012b) elaborate further on the aspect and develop a link between (4) and (5). Burger and his coauthors suggest to calculate the stabilized debt ratio with regard to Bohn's fiscal reaction function. If we assume that the primary surplus is the fiscal policy design variable and that it realizes values that stabilize the debt ratio so that  $b_t = b^* = const.$ , this allows to write (see also Fincke (2012)):

$$ps^* = \alpha_0 + c_1 b^* \quad (6)$$

with the stars indicating the stabilized values. Applying this idea to equation (4) makes it possible to show it in a similar way:

$$ps^* = \theta b^* \quad (7)$$

With  $\theta$  referring to the interest rate – growth rate differential  $\theta=i-g$ . Following Burger by combining these two approaches stated in (6) and (7), enables to determine the stabilized debt ratio according to:

$$b^* = \frac{\alpha_0}{\theta - c_1}. \quad (8)$$

It shows that the stabilized debt ratio  $b^*$  is determined by the individual economy past fiscal behavior. It is expressed in terms of the coefficients estimated with the country's fiscal data ( $\alpha_0, c_1$  coefficients). And it is shaped by the interest rate - growth rate differential  $\theta$ . Equation (8) shows how country-specific stabilized sustainable debt ratio could be calculated based on past fiscal behavior.

### 3 Empirics

We now apply Burgers' concept based on a balanced data set to the CEECs to get some empirical results for the debt sustainability situation in these countries. In a first step, the data set is described, then the estimation set up and the results are presented.

### 3.1 Data set description

Our data set is made up of a few different sources due to data availability because we were seeking for a balanced data set. It consists of data for the ten central and eastern new member states of the EU, i.e. Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia and Slovenia. It is a balanced panel with observations for the time period from 1997 to 2013.

Our central interest is on the relationship between the public debt ratio and the primary balance ratio but in order to enhance the power we added several macro-economic control variables. We also know that fiscal policy does not react solely to shocks on public debt, but there are several other factors which can drive changes in the fiscal balance. The primary balance ratio (*balance*) comes from ECB statistical data warehouse. For Estonia and Czech Republic observations had to be taken from OECD economic outlook statistics and projections in order to get a balanced data set. The other main variable is the debt ratio (*debt*). It is considered as lagged debt, that is, the series run from 1997 to 2012. The observations stem from OECD economic outlook and ECB statistical data warehouse. Due to data availability for Lithuania the series had to be put together with observations from AMECO (2015) macro-economic data base of the European Commission Directorate General for Economics and Financial Affairs (DG ECFIN), ECB (2015) Statistical Data Warehouse and IMF (2014) World Economic Outlook.

We include several control variables in our estimations. For instance, we used squared debt ratio (*qdebt*) in order to test for a potential non-linearity in the primary balance to debt relationship as in Bohn (2005) and to control for the reaction of fiscal policy to high public debt as an effect of the crisis. To measure the influence of the economic conditions, which may differ from country to country, the growth rate of real GDP per capita in constant US Dollar is included (*rgrowthUS*). GDP per capita comes from World Bank (2015) World development indicators. We controlled for the interactions between fiscal and monetary policy measured by inflation rate (*inflation*). Inflation is based on changes in the GDP deflator. Source for the deflator is IMF (2014) World Economic Outlook. We also included a variable in order to incorporate fiscal shocks (*shock*). It is calculated as coefficient of variation of the government spending of each year. The data on government spending stems from AMECO (2015). Following the seminal work of Bayoumi and Eichengreen (1994) who suggested a significant relationship between budget institutions and fiscal outcomes and taking into account the strengthening of fiscal institutions over time across the countries in the European Union, we included a control variable for the (institutional) fiscal situation (*frule*) by the index variable for fiscal rules. It comes from the European Commission (2016). We counted in the influence of the business cycle using the output gap (*ogap*) which comes from AMECO (2015) and is estimated based on potential GDP. As another macro variable the unemployment rate (*unemployment*) is incorporated in the fiscal reaction function to catch possible effects of enterprise restructuring process within the former communist countries on government transfers. It comes from AMECO (2015) database.

Due to data availability we had to extend or replace certain observations in order to get a balanced data set. And for Latvia the primary balance for 2010 to 2012 is based on Central Statistical Bureau of Latvia (2015). The descriptive statistics of the data set are reported in Table 1:

Table 1 Descriptive statistics

| Country        | Statistics | balance | debt  | qdebt   | rgrowthus | ogap  | shock | inflation | unemployment | frule |
|----------------|------------|---------|-------|---------|-----------|-------|-------|-----------|--------------|-------|
| Bulgaria       | average    | 1.67    | 40.53 | 2336.87 | 3.91      | 0.37  | 1.11  | 5.80      | 12.09        | 0.62  |
|                | median     | 2.02    | 31.58 | 1017.17 | 5.45      | -0.01 | 1.36  | 4.66      | 12.10        | 1.08  |
|                | stdev      | 2.33    | 20.94 | 1801.91 | 3.38      | 1.81  | 5.65  | 2.41      | 3.90         | 1.02  |
|                | min        | -3.44   | 13.30 | 176.86  | -3.67     | -1.76 | -8.95 | -0.82     | 3.90         | -1.01 |
|                | max        | 3.67    | 63.96 | 4091.14 | 9.41      | 4.51  | 6.49  | 8.79      | 18.20        | 2.07  |
| Czech Republic | average    | -2.97   | 27.17 | 824.07  | 2.18      | 0.32  | 0.14  | 2.10      | 7.18         | -0.24 |
|                | median     | -2.87   | 27.96 | 789.22  | 2.08      | -0.16 | 0.15  | 1.91      | 7.24         | -0.05 |
|                | stdev      | 1.79    | 7.82  | 480.49  | 2.98      | 2.51  | 4.90  | 1.66      | 1.08         | 0.40  |
|                | min        | -5.96   | 7.82  | 289.27  | -5.53     | -2.91 | -5.84 | -1.59     | 1.08         | -1.01 |
|                | max        | 1.79    | 45.50 | 2070.25 | 6.38      | 5.79  | 14.33 | 3.95      | 8.30         | 0.40  |
| Estonia        | average    | -0.38   | 5.76  | 35.09   | 4.26      | 1.70  | 0.01  | 5.00      | 10.30        | 0.96  |
|                | median     | -0.23   | 5.69  | 32.33   | 6.59      | 1.73  | -1.50 | 4.79      | 10.30        | 0.95  |
|                | stdev      | 1.48    | 1.41  | 18.80   | 6.57      | 5.84  | 8.52  | 2.51      | 3.32         | 0.08  |
|                | min        | -4.17   | 1.41  | 13.29   | -15.75    | -8.98 | 10.42 | 0.43      | 3.32         | 0.08  |
|                | max        | 1.56    | 9.71  | 94.19   | 10.50     | 14.90 | 22.91 | 10.74     | 16.70        | 1.08  |
| Hungary        | average    | -0.83   | 65.20 | 4341.59 | 2.32      | -0.11 | -0.02 | 5.58      | 8.02         | -0.24 |
|                | median     | -0.62   | 62.89 | 3959.84 | 2.89      | -0.19 | 0.08  | 5.12      | 7.45         | -0.51 |
|                | stdev      | 2.39    | 9.71  | 1315.07 | 2.90      | 2.54  | 2.39  | 2.51      | 2.03         | 0.65  |
|                | min        | -5.48   | 9.71  | 1315.07 | -6.62     | -4.49 | -4.44 | 2.35      | 2.03         | -0.79 |
|                | max        | 2.39    | 81.04 | 6568.13 | 4.90      | 4.36  | 4.52  | 8.12      | 11.20        | 0.95  |
| Latvia         | average    | -1.68   | 19.67 | 557.06  | 5.30      | -0.24 | 0.34  | 5.40      | 12.66        | 0.16  |
|                | median     | -1.29   | 13.95 | 194.53  | 7.21      | -0.53 | -0.67 | 3.80      | 12.58        | 0.01  |
|                | stdev      | 2.37    | 13.03 | 717.87  | 7.31      | 5.89  | 8.53  | 5.09      | 3.66         | 0.61  |
|                | min        | -7.38   | 8.40  | 70.63   | -18.14    | 11.92 | 10.06 | -1.27     | 3.66         | 0.01  |
|                | max        | 2.37    | 46.77 | 2187.53 | 12.46     | 10.83 | 20.15 | 18.47     | 19.50        | 2.45  |
| Lithuania      | average    | -2.03   | 23.40 | 607.83  | 5.24      | -0.46 | -1.91 | 2.68      | 12.19        | 0.25  |
|                | median     | -1.26   | 22.36 | 499.93  | 6.29      | -1.00 | -4.94 | 2.39      | 12.90        | 0.04  |
|                | stdev      | 2.54    | 7.50  | 420.68  | 5.91      | 5.18  | 8.80  | 3.43      | 4.12         | 0.34  |
|                | min        | -8.06   | 7.50  | 236.88  | -14.84    | 10.25 | 12.80 | -3.49     | 4.12         | -0.02 |
|                | max        | 2.54    | 39.93 | 1594.48 | 10.57     | 9.08  | 16.57 | 9.16      | 17.80        | 0.71  |
| Poland         | average    | -1.71   | 45.41 | 2093.37 | 3.72      | -0.17 | -0.37 | 3.49      | 13.33        | 1.39  |
|                | median     | -1.62   | 46.00 | 2131.91 | 3.64      | 0.24  | -0.03 | 3.11      | 13.37        | 1.24  |
|                | stdev      | 1.47    | 5.43  | 500.59  | 1.65      | 2.40  | 2.61  | 1.54      | 4.46         | 0.35  |
|                | min        | -5.13   | 5.43  | 500.59  | 1.23      | -4.39 | -4.27 | 0.39      | 4.46         | 0.35  |
|                | max        | 1.47    | 54.80 | 3003.48 | 7.01      | 3.10  | 3.16  | 4.01      | 20.00        | 1.94  |
| Romania        | average    | -1.57   | 21.53 | 516.97  | 3.72      | -0.29 | 0.37  | 17.35     | 7.08         | -0.60 |
|                | median     | -0.97   | 21.56 | 483.26  | 4.27      | -1.11 | 0.03  | 13.44     | 7.10         | -0.59 |
|                | stdev      | 2.30    | 7.20  | 350.11  | 4.12      | 4.18  | 6.35  | 9.78      | 0.64         | 0.00  |
|                | min        | -7.37   | 7.20  | 150.60  | -6.50     | -4.79 | -9.13 | 3.42      | 0.64         | -0.60 |
|                | max        | 2.30    | 37.34 | 1394.20 | 9.79      | 7.38  | 11.02 | 21.03     | 8.30         | 0.00  |
| Slovakia       | average    | -2.86   | 39.49 | 1612.42 | 3.58      | -0.09 | -0.90 | 3.28      | 15.11        | 0.20  |
|                | median     | -2.46   | 40.83 | 1667.16 | 4.10      | -1.01 | -3.73 | 2.86      | 14.80        | 0.23  |

|          |         |        |       |         |       |       |       |       |       |       |
|----------|---------|--------|-------|---------|-------|-------|-------|-------|-------|-------|
|          | stdev   | 2.39   | 7.14  | 569.01  | 3.45  | 3.22  | 9.09  | 2.46  | 2.92  | 0.93  |
|          | min     | -6.50  | 7.14  | 569.01  | -5.57 | -3.44 | 14.64 | -1.19 | 2.92  | -1.01 |
|          | max     | 2.39   | 52.11 | 2715.87 | 10.12 | 7.22  | 9.09  | 5.68  | 18.80 | 2.47  |
| Slovenia | average | -1.98  | 29.37 | 940.70  | 1.99  | 0.17  | 0.36  | 3.78  | 6.82  | 0.08  |
|          | median  | -1.01  | 26.50 | 702.22  | 2.92  | 0.15  | -1.86 | 3.54  | 6.60  | 0.36  |
|          | stdev   | 3.12   | 8.78  | 651.48  | 3.68  | 3.29  | 8.64  | 2.49  | 1.40  | 0.40  |
|          | min     | -12.02 | 8.78  | 468.68  | -9.02 | -4.78 | -9.96 | -1.07 | 1.40  | -0.81 |
|          | max     | 3.12   | 53.39 | 2850.60 | 6.15  | 6.79  | 28.62 | 7.31  | 10.10 | 0.49  |

### 3.2 Estimations

Starting to apply Burgers' concept introduced above to the CEECs required to first set up a regression to estimate the coefficients. To implement Bohn (1998)'s fiscal response mechanism our approach utilized a panel as the data series are rather short. We also employed the fixed effects model to capture the country-specific. The fixed effects model also helped us to make distinct estimates for the debt stabilizing ratio. Equation (9) presents the model design:

$$ps_t^i = \alpha_0^i + c_1 b_{t-1}^i + Z_t^i \delta + \epsilon_t^i \quad (9)$$

For each individual economy  $i = 1 \dots 10$ , with control variables reflected in  $Z$ .

We estimated equation (9) in several forms, firstly with all the control variables included, and then, removing the variables which were statistically not significant. Table 2 reports the results.

Table 2 Estimates of fiscal reaction function

| Explanatory variables   | Model (1)     | Model (2)    | Model (3)    | Model (4)    | Model (5)    |
|-------------------------|---------------|--------------|--------------|--------------|--------------|
| debt                    | 0.0779724*    | 0.078480*    | 0.080385*    | 0.085341*    | 0.057852***  |
| qdebt                   | -0.0244215    | -0.025491    | -0.026175    | -0.033225    |              |
| rgrowthUS               | 0.0225522     | 0.020974     |              |              |              |
| ogap                    | 0.0364843     | 0.032279     |              | 0.050473     |              |
| shock                   | -0.2244680*** | -0.227296*** | -0.241706*** | -0.231689*** | -0.240735*** |
| inflation               | 0.1024177***  | 0.100083***  | 0.102799***  | 0.102518***  | 0.098993***  |
| unemployment            | 0.1312356     | 0.125263     | 0.102953*    | 0.140209*    | 0.102231***  |
| frule                   | 0.0008333     |              |              |              |              |
| factor (country)        |               |              |              |              |              |
| Bulgaria                | 0.0008333*    | -0.028480**  | -0.025452*   | -0.03060**   | -0.022137**  |
| Czech Republic          | -0.0605635*** | -0.060287*** | -0.058622*** | -0.062232*** | -0.054525*** |
| Estonia                 | -0.0291604**  | -0.027514**  | -0.024015*** | -0.028959*** | -0.022545*** |
| Hungary                 | -0.0650490*** | -0.064477*** | -0.063337*** | -0.066421*** | -0.059739*** |
| Latvia                  | -0.0534452*** | -0.052383*** | -0.048956*** | -0.054156*** | -0.045688*** |
| Lithuania               | -0.0613449*** | -0.060387*** | -0.057469*** | -0.062310*** | -0.053580*** |
| Poland                  | -0.0711880*** | -0.069120*** | -0.066291*** | -0.071900*** | -0.061304*** |
| Romania                 | -0.0576738*** | -0.057340*** | -0.055867*** | -0.059050*** | -0.051660*** |
| Slovakia                | -0.0815885*** | -0.080447*** | -0.077217*** | -0.083519*** | -0.072297*** |
| Slovenia                | -0.0529946*** | -0.052434*** | -0.050987*** | -0.054429*** | -0.046643*** |
| Residual standard error | 0.01517       | 0.01513      | 0.0151       | 0.01509      | 0.01507      |
| Adjusted R-squared      | 0.7426        | 0.7442       | 0.7452       | 0.7455       | 0.7461       |
| F-statistic             | 26.64         | 28.38        | 32.19        | 30.29        | 34.58        |

Significance codes: 0 '\*\*\*'; 0.001 '\*\*'; 0.01 '\*'; 0.05 '.'; 0.1 ' '; 1



Based on Theil' s Information Criterion of minimizing the standard errors, we selected model (5) for further estimations and discussions. We observed that fiscal policy reaction among the CEECs is positive, in the sense that a shock on public debt will lead to an increase in the primary balance by 0.05 percent of GDP. The delay of government response is of one year implying that the adjustment takes place one year after the shock occurs. One year delayed reaction function is consistent with fiscal sustainability for the reason that the interest payments on public debt occur later in time (Greiner, Koeller and Semmler, 2005). Thus, we can state that the conditions for running a sustainable fiscal policy within the CEECs are met. Additionally, we observed that the country-specific factors,  $\alpha_0^i$ , are negative, suggesting that on average the primary balance of these countries was a deficit. These results are consistent with Stoian and Iorgulescu (2016) finding that Central and Eastern European countries mostly run primary deficits by comparison with the advanced economies in the European Union. They are also in accordance with the average values for the primary balance reported in Table 1. The only exception was Bulgaria, which introduced on July1, 1997 the currency board in order to stabilize the national economy. As an effect, large primary surplus were generated in order to reduce the public debt which in 1996 recorded the highest level of 111.8 percent of GDP (Roussanova, 2002). Fiscal shocks have a negative effect on primary balance and lead to an adjustment of 0.22 percent of GDP. The correlation between inflation rate and primary balance is a positive one and significant and suggests tight fiscal policy in relationship with the monetary policy. There are papers which documented the continuous concern of the governments in Central and Eastern Europe for price stability (Svejnar, 2006; Nath and Tochkov, 2010). They introduced restrictive fiscal and monetary policies along with wage control, currency devaluation and in some cases fixed exchange rates as to control for the galloping inflation in the early period of transition. Joining the European Union and the prospect of accession to the Eurozone also brought the responsibility of achieving low inflation rates in absolute terms, but also relative to the benchmark established by the Maastricht Treaty. Keeping the budget balance under control and avoiding large deficits represent key issues of completing macroeconomic objectives. The positive and significant relationship between unemployment and primary balance can reveal highly discretionary fiscal policy which did not allow for unemployment compensations to lead to large budget deficits although unemployment still represents a major problem in the post-communist countries (Münich and Svejnar, 2007). We found no significant impact of the squared debt, which suggests the existence of a linear relationship between government debt and primary balance across the countries in Central and Eastern Europe. Also, the GDP per capita growth rate and the fiscal index have no relevant impact on the primary balance.

Using the estimates of coefficients  $\alpha_0^i$  and  $c_1$  for model (5), we calculate the stabilized debt,  $b^*$  as described in equation (8). We used the implicit interest rate on public debt ( $i$ ) and the GDP growth rate ( $g$ ) over 1998-2013 from Ameco (2016) in order to compute the differential,  $\theta$ . The results are reported in Table 3.

Table 3 Stabilized debt ratio vs. current debt ratio

| Country        | $\theta = (i-g)$ | $c_1$  | $\alpha_0$ | $b^* = \frac{\alpha_0}{\theta - c_1}$ | $b_{2015}$ | $gap = (b_{2015} - b^*)$ |
|----------------|------------------|--------|------------|---------------------------------------|------------|--------------------------|
| Bulgaria       | -0.04738         | 0.0579 | -0.0221    | 21.0                                  | 26.7       | 5.7                      |
| Czech Republic | -0.00047         | 0.0579 | -0.0545    | 93.4                                  | 41.1       | -52.3                    |
| Estonia        | -0.05272         | 0.0579 | -0.0225    | 20.3                                  | 9.7        | -10.6                    |
| Hungary        | -0.00169         | 0.0579 | -0.0597    | 100.2                                 | 75.3       | -24.9                    |
| Latvia         | -0.04363         | 0.0579 | -0.0457    | 45.0                                  | 36.4       | -8.6                     |
| Lithuania      | -0.0137          | 0.0579 | -0.0536    | 74.9                                  | 42.7       | -32.2                    |
| Poland         | -0.00904         | 0.0579 | -0.0613    | 91.6                                  | 51.3       | -40.3                    |
| Romania        | -0.0936          | 0.0579 | -0.0517    | 34.1                                  | 38.4       | 4.3                      |

|          |          |        |         |       |      |       |
|----------|----------|--------|---------|-------|------|-------|
| Slovenia | 0.007959 | 0.0579 | -0.0466 | 93.3  | 83.2 | -10.1 |
| Slovakia | -0.01277 | 0.0579 | -0.0723 | 102.3 | 52.9 | -49.4 |

We can compare the current debt ratio as of 2015 with the stabilized debt ratio in order to detect debt sustainability issues on short term. We found positive gaps only for Bulgaria and Romania which suggest debt sustainability issues. For the rest of countries, the results show negative gaps which indicate sustainable debt. If we analyze the evolution of debt ratio over the last 20 year, including the forecasts for 2016 and 2017 as provided by Ameco (2016) and consider a linear trend, we can establish unstable trajectories (see Figure 1).

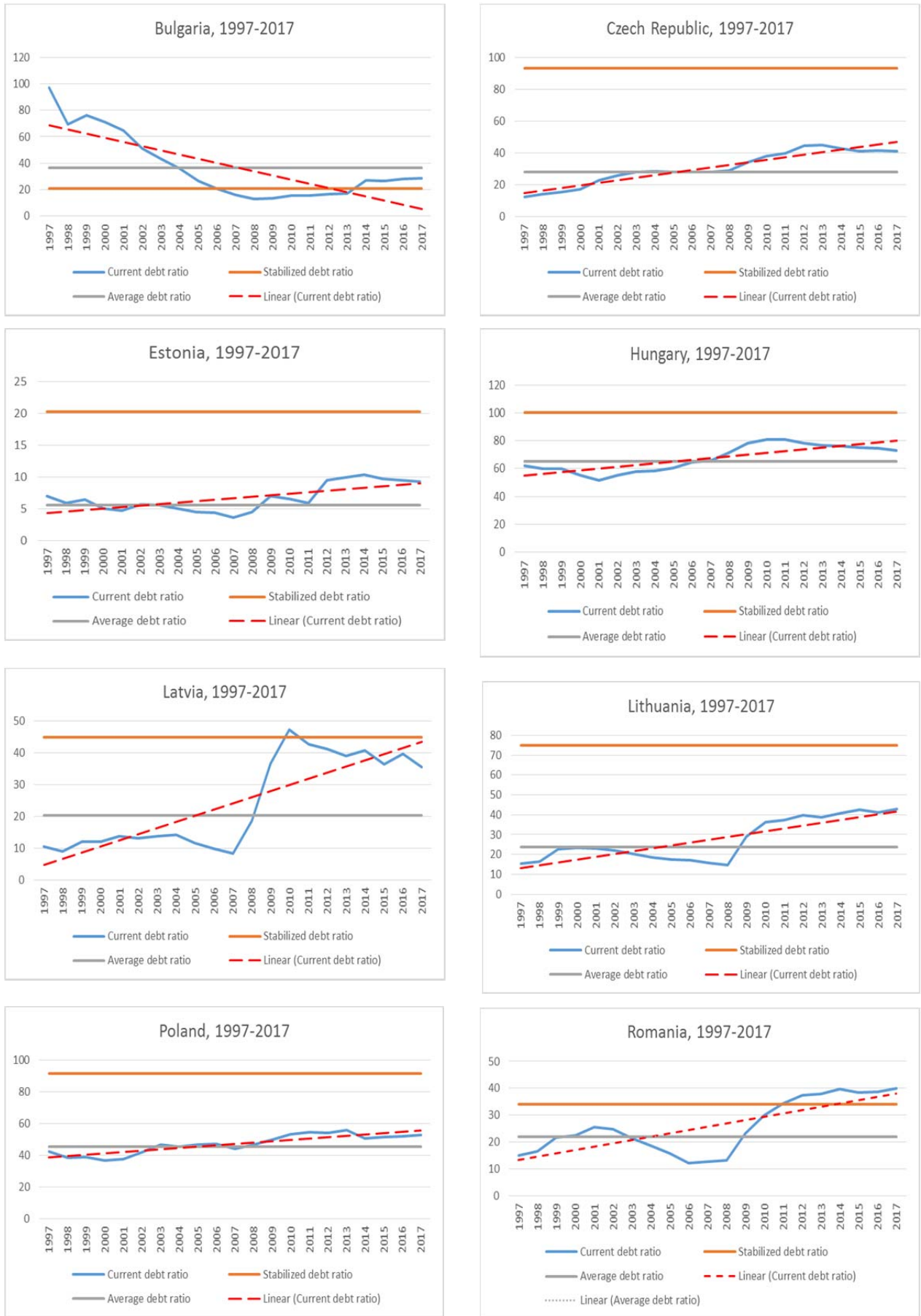


Figure 1 Debt dynamics, stabilized and average debt ratio



Figure 1 Debt dynamics, stabilized and average debt ratio

For Bulgaria, the stabilized debt ratio corresponds to the debt ratio in year 2005. Bulgaria has continuously decreased the debt ratio since 1997 and the debt dynamics over the past 2 years has been a stable one. Analyzing the historical average of debt ratio, we can observe that the stabilized ratio is below the average. If we consider the historical average as a benchmark for the long term debt sustainability, we can state that Bulgaria could confront some debt sustainability issues in the future. Latvia exceeded the stabilized debt ratio by almost 5 percent of GDP in 2010 and then reduced the debt ratio close to the stabilized ratio in 2011. However, the debt dynamics indicate an unstable path over the last 20 years. The average debt ratio is below the stabilized one which might indicate debt sustainability in the future. As for Romania, the stabilized debt ratio roughly corresponds to the debt ratio in years 2013 and 2015. The linear trend suggests an unstable debt dynamics and in between 2013 and 2015 the effective debt ratio was close or exceeded the stabilized ratio. These results indicate current debt sustainability issues although the historical average suggests debt sustainability in the long run. There is a group of countries consisting of the Czech Republic, Hungary, Poland, Slovakia and Slovenia for which we calculated stabilized debt ratios close to 100 percent of GDP. Examining the historical data for debt ratio and also the average, we found no evidence of large debt ratios within this group of countries, except for Hungary for which the descriptive statistics indicate the greatest average, to suggest such high stabilized debt ratio. These results might indicate some limits of the model employed. We must note that in the case of negative differential between the implicit interest rate on public debt and the GDP growth rate,  $\theta$ , and of a positive response of government,  $c_1$ , the country specific coefficients  $\alpha_0^i$ , should have been negative in order to calculate a relevant stabilized debt ratio. When  $\theta$  approaches to zero and becomes positive and exceeds the response coefficient,  $c_1$ , the country specific coefficients should be positive in order to calculate a non-distorted stabilized debt ratio. This is consistent with achieving primary surplus in order to stabilize the public debt. For these countries, the difference  $(\theta - c_1)$  is lower and closes to zero suggesting that the interest rate roughly equals the GDP growth rate. Around these settings, the results might be distorted. For Estonia and Lithuania, the current debt ratio is sustainable, the linear trend indicates a stable debt dynamics over the past twenty years and the historical average also suggest debt sustainability in the long run.

#### 4 Conclusion

The aim of this study was to examine debt sustainability for ten Central and Eastern European Countries. The reasons which drove our research were the limited number of papers with this regard and some debt dynamics particularities which have been observed for this group of countries. For this purpose, we employed a methodology consisting in calculating the stabilized debt ratio based on estimates of a fiscal reaction function. The dataset used ranged a period from 1997-2013. Comparing the stabilized debt ratio with the current debt ratio as of 2015, we found debt sustainability issues in the sort run for Bulgaria and Romania. For rest of

the countries, the results suggest debt sustainability. Analyzing the linear trend of the debt ratios over the past 20 years from 1997 to 2017, we found unstable debt dynamics for Romania and also for Latvia. The comparison between the stabilized debt ratio and the historical average indicate debt sustainability in the long run for all of the countries, excepting Bulgaria. We also found distorted results for five countries (the Czech Republic, Hungary, Poland, Slovakia and Slovenia) which indicated some limits of the model employed.

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