

## Fiscal stimulus in times of high debt An empirical model for the European Union

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In this paper, I show the results of recent research examining the effectiveness of fiscal policy at different levels of the debt-to-GDP ratio for a panel of fifteen EU-countries from 1977 to 2012. I use a specific type of econometric model that allows analyzing the mechanisms by which higher debt may change the expansionary effects of a spending shock. At low public debt levels, I show that an increase in government consumption has a positive effect on private consumption, private investment and real GDP. However, at higher debt ratios, private consumption increasingly exhibits U-shaped responses and the economy increasingly shows features of crowding out of private investment. This results in negative fiscal multipliers if the pre-shock level of public debt exceeds 78,5 percent of GDP. Moreover, at these high debt levels, the accumulation of public debt in the years after the shock is considerable. Overall, my results indicate that policy makers should diligently scrutinize the public debt situation before increasing public spending, since this type of policy may be ineffective and even counterproductive.

**JEL Classification Code:** E62, H31, C33, C11

**Keywords:** fiscal policy, debt dynamics, economic growth, panel VAR, European Union

(\*) This paper is a summary of my Master's thesis, 'Fiscal stimulus in times of high debt. Ricardian equivalence and the effects of monetary policy in the European Union' (Master's thesis to obtain the degree of Master of Advanced Studies in Economics, KU Leuven). Therefore, I would like to thank my supervisor, Frank Smets, for his continuous assistance.





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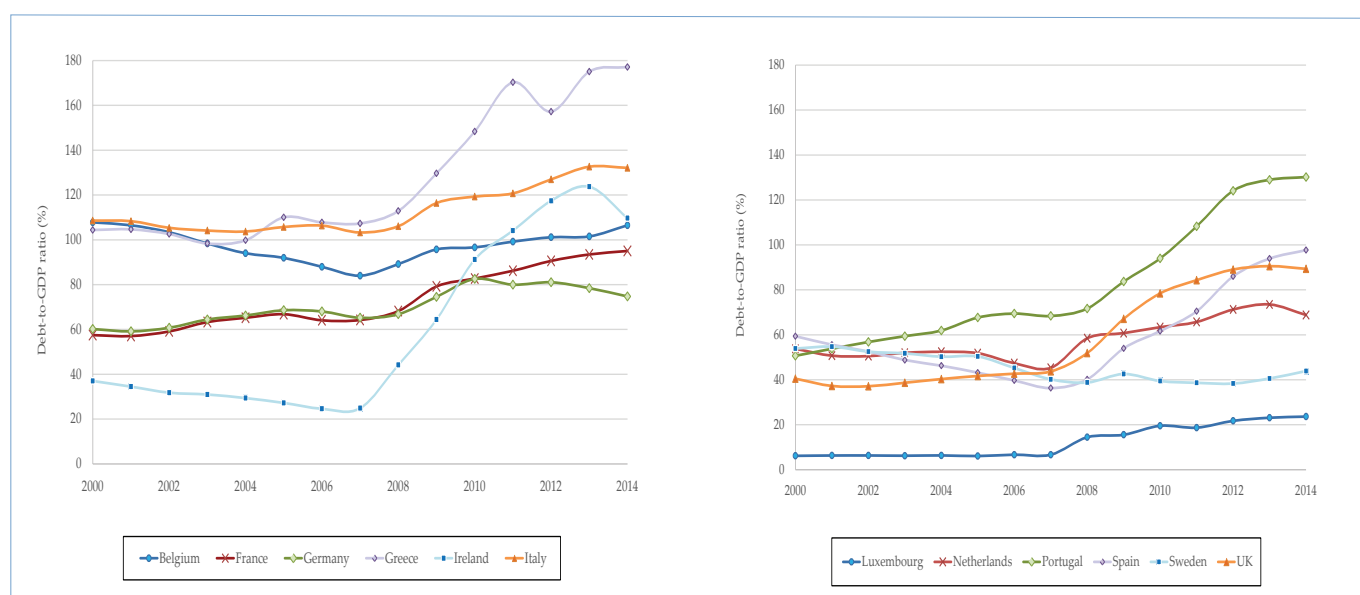
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# 1 Introduction

High public debt levels are by no means historical abnormalities. However, the extent to which EU-countries have recently been jointly exposed is remarkable (figure 1). Given the recent economic slowdown, policy makers face a complex trade-off between stimulating the economy and reducing public debt. Therefore, providing insight into how fiscal policy, real output and public debt interact may be very important.

Figure 1: the public debt-to-GDP ratio in EU-countries



Note: Public debt measured as general government consolidated gross debt (percentage of GDP at market prices).

Source: AMECO (2014).

Various papers have already investigated the effect of public debt on output growth (Checherita & Rother, 2010; Cecchetti, Mohanty & Zampolli, 2011). In addition, the literature has also devoted considerable attention to determining the specific impact of fiscal policy on real output (i.e. fiscal multiplier analysis). However, a large body of this literature has not provided a link to public debt (Blanchard & Perotti, 2002; Woodford, 2011; Christiano, Eichenbaum & Rebelo, 2011).

Several papers have explicitly focussed on debt dynamics when examining the effectiveness of fiscal policy (Favero & Giavazzi, 2007; Corsetti, Meier & Muller, 2012; Nickel & Tudyka, 2013). More specifically, Nickel and Tudyka (2013) examine the effectiveness of fiscal policy under different debt-to-GDP ratios for a panel of seventeen European countries. They find that the responses to fiscal stimuli exhibit strong nonlinearities: the effect of fiscal policy on the economy substantially decreases with growing debt-to-GDP ratios. At higher debt levels, the fiscal multiplier becomes insignificant and eventually changes sign. The au-

thors attribute these nonlinearities to two underlying phenomena: crowding out of private investment and Ricardian equivalence <sup>(1)</sup>. Their results suggest that policy makers should be discouraged to increase spending if public debt is high, since these programmes will be ineffective or even counterproductive.

The paper of Nickel and Tudyka (2013) provides a very interesting methodology (interacted panel vector autoregression, to which I turn in the next section) to examine these types of nonlinearities. However, their model may be further refined by explicitly modelling the private consumption channel <sup>(2)</sup>. In this way, I can assess whether or not the private sector increasingly displays features of Ricardian equivalence if the pre-shock debt-to-GDP ratio is higher. Using both private consumption and private investment may result in more realistic fiscal multipliers over the entire range of debt-to-GDP ratios and thus allows an assessment of the extent to which the effectiveness of fiscal policy depends on the specific debt environment in which the shock takes place. I test this for a panel of fifteen EU-countries.

In the next section, I briefly introduce the methodology used in this study.

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1 The Ricardian equivalence proposition states that households are rational and forward-looking and so consider the government budget constraint when making their consumption-saving decisions. If this hypothesis holds, households expect that higher fiscal deficits now without coincident taxation will be reverted in the future by higher surpluses. Therefore, since households would want to smooth consumption, they decide to lower private consumption (i.e. increase precautionary saving) immediately after a spending shock (Barro, 1989; Sorensen & Whitta-Jacobsen, 2010; De Bruyne, 2013). Also, the higher the pre-shock debt-to-GDP ratio, the stronger the expected fiscal consolidation and the larger the drop in private consumption may be. Therefore, households may behave increasingly 'Ricardian' at higher debt-to-GDP ratios.

2 Nickel and Tudyka (2013) use private investment, but not private consumption.

## 2 Methodology

From a methodological point of view, I closely follow Nickel and Tudyka (2013) and Towbin and Weber (2011), and construct an interacted panel VAR model. I use this framework to examine nonlinearities in the fiscal multiplier with respect to the pre-shock debt-to-GDP ratio. In the baseline case, the model contains the following variables: real government consumption <sup>(3)</sup>, real private consumption, real private investment, real GDP and the general government debt-to-GDP ratio.

I use annual data on fifteen EU-countries for the period 1977-2012. These countries are Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden and the United Kingdom. The data are taken from the European Commission's AMECO database (AMECO, 2014).

An 'interacted' model allows that each endogenous variable interacts with the pre-shock debt-to-GDP ratio. In this way, the responses of each endogenous variable depend on the debt environment in which the shock takes place. I also allow the debt-to-GDP ratio and government consumption to change endogenously following the spending shock.

I impose a recursive structure to the model, such that all endogenous variables react contemporaneously to government consumption, but the latter does not react contemporaneously to any other variable. I order private consumption and private investment second and third respectively, such that real GDP (ordered fourth) reacts to government consumption both directly and indirectly (i.e. via private consumption and private investment). The debt-to-GDP ratio is ordered last and reacts to all other variables contemporaneously. This ordering is subjective. Therefore, as a check of robustness of the results, I will change the order of the variables, such that government consumption reacts to real GDP contemporaneously, as in Blanchard and Perotti (2002).

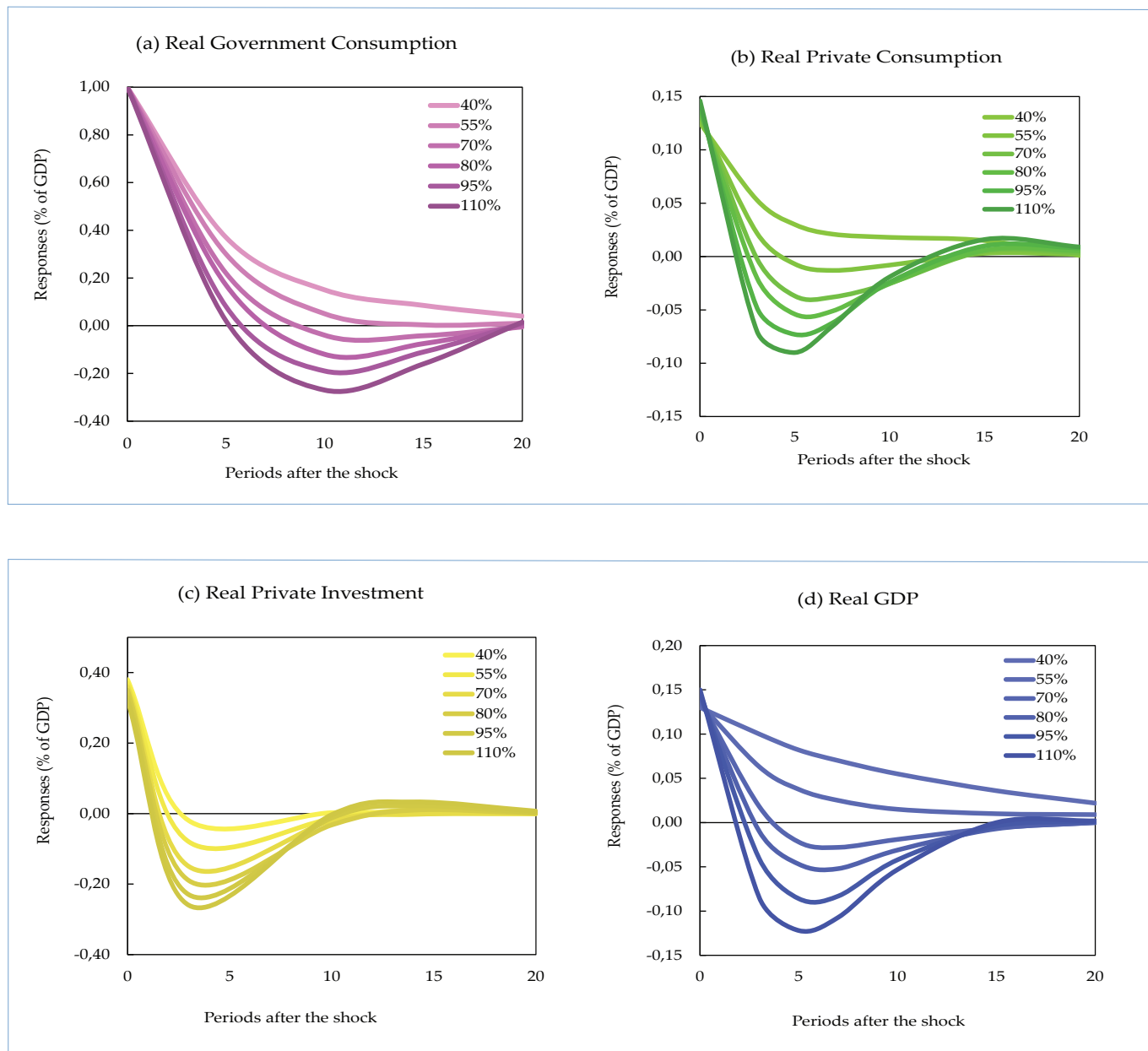
I estimate <sup>(4)</sup> the model using Bayesian methods, following Lynch (2007), Canova and Ciccarelli (2009), Koop (2011) and Nickel and Tudyka (2013).

3 I concentrate on real government consumption for a variety of reasons. First of all, a large part of the theoretical and empirical literature has devoted more attention to the spending side. Second, a comparison of my results with those of Nickel and Tudyka (2013) becomes easier. Third, government consumption is known as the component of spending that reacts least to changes in real GDP (Nickel & Tudyka, 2013).

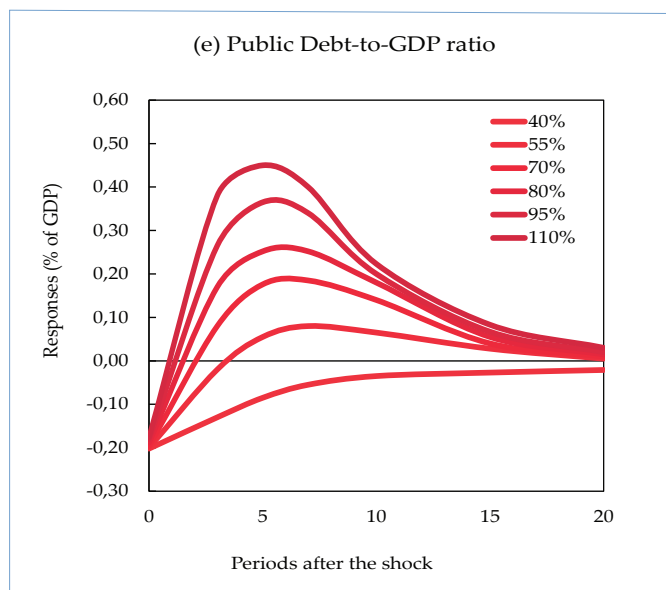
4 For detailed information regarding the data, the construction of the model and the estimation procedure, I would like to refer to Van Rymenant (2014).

### 3 Results

Figure 2: median responses to a spending shock at various debt-to-GDP ratios







Source: Calculations in Matlab<sup>®</sup>, data from AMECO (2014).

Figure 2 shows the median responses of real government consumption (panel a), real private consumption (panel b), real private investment (panel c), real GDP (panel d) and the public debt-to-GDP ratio (panel e) to a 1 %-point of GDP increase in government consumption. For each variable, I trace the responses<sup>(5)</sup> over a 20-year period for debt ratios ranging from 40 % to 110 % of GDP.

The figure shows that the economy exhibits strong non-linear effects with respect to the initial debt-to-GDP ratio. At lower debt-to-GDP ratios, the responses of private consumption, private investment and real GDP are positive across all horizons, resulting in high fiscal multipliers<sup>(6)</sup>. By contrast, the higher the pre-shock debt-to-GDP ratio, the earlier the responses turn negative and the more outspoken negative responses at later horizons: private consumption, private investment and real GDP increasingly exhibit U-shaped responses, resulting in lower fiscal multipliers. I show this in table 1. My results indicate that the debt ratio at which the fiscal multiplier turns negative is equal to 78,5 % of GDP.

Table 1: fiscal multipliers across various debt-to-GDP ratios

Debt-to-GDP ratio	20 %	30 %	40 %	50 %	60 %	70 %	80 %	90 %	100 %	110 %	120 %	130 %
Fiscal Multiplier	0,93	0,60	0,38	0,24	0,13	0,05	-0,01	-0,15	-0,29	-0,40	-0,51	-0,63

Source: Calculations in Matlab<sup>®</sup>, data from AMECO (2014).

5 Van Rymenant (2014) shows each impulse-response function separately, together with the associated probability bands.

6 The fiscal multiplier is defined as the cumulative percentage point change in real GDP, divided by the cumulative percentage point change in real government consumption (i.e. the sum of the initial exogenous shock to government consumption and all subsequent endogenous responses of government consumption), over a horizon of 30 years.

The immediate responses in private consumption and private investment amount to +0,15 %-points and +0,40 %-points of GDP respectively, whereas the effect on real GDP is rather modest (given the responses in its components), +0,15 %-points of GDP. Therefore, the trade balance must become more negative after the spending shock. This result is consistent with Nickel and Tudyka (2013), where the trade balance is an endogenous variable.

Panel (e) of figure 2 shows that at lower pre-shock debt-to-GDP ratios, the spending shock results in a gradual decline in public indebtedness. By contrast, at higher debt-to-GDP ratios, the responses in public debt become increasingly hump-shaped: the accumulation of debt becomes more outspoken and more persistent.

The (theoretical) explanation for these nonlinear responses in the debt-to-GDP ratio is manifold. First, if, at higher debt ratios, countries delay fiscal consolidation and allow a period-after-period accumulation of debt, uncertainty rises about whether or not markets will continue to finance the debt at affordable rates and hence markets become more unpredictable (Asmussen, 2013). Moreover, since higher debt tends to increase (longer-term) interest rates, the likelihood of default rises in a nonlinear fashion with the debt ratio (Cecchetti, 2013). Also, the proportion of a country's debt in foreign hands is an important element for assessing the risk for non-residents, such that higher debt generally discourages foreign investment (Callow, 2013). Last but not least, the changes in the debt-to-GDP ratio may also be attributed to changes in GDP following the spending shock, which I explicitly do in this model.

Unfortunately, my model does not contain the (long-term) interest rate <sup>(7)</sup>. Nevertheless, the theoretical relationship between the observed debt dynamics and the long-term interest rates is important in two ways. First, a rise in the long-term interest rates may explain why private investment increasingly exhibits U-shaped responses to the spending shock (i.e. crowding out of private investment). Second, and more important from a policy perspective, higher interest rates raise the interest payments on the outstanding debt, which makes public debt even more challenging (more unsustainable).

Panel (a) of figure 2 shows that policy makers react to the accumulation of public debt by cutting back government consumption: the worse the initial debt situation, the faster governments switch to debt-stabilizing decisions. In addition, the stronger the accumulation of debt in the first years after the shock, the more pronounced the declines in government consumption at later horizons. These results are consistent with Chung and Leeper (2007), Corsetti et al. (2012) and Nickel and Tudyka (2013).

7 As I will show later, extending the model is too ambitious from an econometric point of view, given the available data.

In order to attribute the observed nonlinearities in private consumption to Ricardian equivalence <sup>(8)</sup>, the responses in private consumption should have turned negative immediately after the spending shock at higher debt-to-GDP ratios. However, this is clearly not the case. Panel (b) of figure 2 shows that the immediate effect of the spending shock on private consumption is very similar across all debt-to-GDP ratios (i.e. an increase in private consumption of 0,15 %-points of GDP). At higher debt-to-GDP ratios, the responses in private consumption only turn negative two years after the shock. Consequently, I reject the Ricardian equivalence proposition for the European Union.

Rather, panel (b) and (d) show that the responses in private consumption exhibit very similar nonlinearities as the responses in real GDP. Therefore, I conclude that households use a 'rule of thumb' to determine their consumption and saving: private consumption closely follows disposable income, which in turn is determined by real output.

These results are robust across different specifications, i.e. I observe very similar nonlinearities in the fiscal multiplier and in the debt dynamics if I change the ordering <sup>(9)</sup> of the variables or if I omit real private investment as an endogenous variable.

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8 I provide a definition of 'Ricardian equivalence' in footnote 2.

9 Following Blanchard and Perotti (2002) to some extent (cfr. supra).

## 4 General conclusion

In this paper, I examine under which circumstances governments should be discouraged to increase public spending. In particular, I employ the interacted panel VAR framework to a panel of fifteen EU-countries for the period 1977-2012, using Bayesian methods to estimate the model. Within this model, I explicitly focus on debt dynamics.

In summary, my results show that the responses in both private consumption and private investment exhibit strong nonlinearities with respect to the pre-shock debt-to-GDP ratio, which result in negative fiscal multipliers if the initial debt ratio exceeds 78,5 % of GDP. Moreover, the accumulation of debt becomes more outspoken and more persistent at higher pre-shock debt-to-GDP ratios.

From a policy perspective, my results highlight the importance of keeping the debt-to-GDP ratio below a certain threshold level, which was also postulated in the Maastricht Treaty (European Union, 1992). Once governments allow debt to rise beyond the threshold level, increased public spending will become counterproductive and public debt will further accumulate. The only possible escape route would then be austerity (a negative spending shock).

Keeping the above results in mind, a negative (1 %-point of GDP) shock to government consumption would result in exactly opposite impulse-response functions, exhibiting the same degree of nonlinearities. The higher public debt, the more outspoken the positive responses of private consumption, private investment and real GDP and the more public debt will decline at later horizons.

Then, why are governments in high debt so reluctant to strict austerity? The reason is that in case of a negative spending shock, the economy will go into a two-year recession before the responses in real GDP turn positive (mirror image of figure 2, panel (d)). Moreover, the stronger the austerity, the deeper this recession will be.

Nevertheless, in the longer run, austerity seems the only reasonable option for highly indebted countries. After all, I show that increased spending may be ineffective and even counterproductive and that the accumulation of public debt following the spending shock is remarkable in these situations.

## 5 Further research

In this paper, I examine under which circumstances governments should be discouraged to increase public spending and I explicitly focus on the effect of the debt-to-GDP ratio on the fiscal multiplier.

However, the literature has repeatedly suggested that the effectiveness of fiscal policy is also related to the behaviour of monetary policy. Friedman (1948) and Leeper (2010) state that the distinct impacts of fiscal and monetary policy are difficult to disentangle. More specifically, if monetary policy is governed by a Taylor rule <sup>(10)</sup>, the size of the fiscal multiplier will be limited (Sorensen & Whitta-Jacobsen, 2010; Christiano, Eichenbaum & Rebelo, 2011). Under forward guidance <sup>(11)</sup> by contrast, the Taylor rule becomes trivial and the fiscal multiplier may be higher (Erceg & Lindé, 2010; Del Negro, Giannoni & Patterson, 2013; De Graeve, Ilbas & Wouters, 2014).

In many EU-countries, the central bank has indeed implemented forward guidance. The previous paragraph suggests that the limiting effect of high debt on the fiscal multiplier may be partially or entirely offset by the effect of monetary policy (i.e. the central bank that implements forward guidance).

Unfortunately, constructing an interacted panel VAR model in which each endogenous variable interacts with both the pre-shock debt-to-GDP ratio and with a variable that represents monetary policy may be too ambitious <sup>(12)</sup> from an econometric point of view, given the available data (Van Rymenant, 2014).

However, in the future more data will become available and constructing a model that simultaneously considers the debt-to-GDP ratio and monetary policy may be feasible.

Second, my model does not contain the long-term interest rate. However, the endogenous response of the long-term interest rate may be important to explain crowding out of private investment (and private consumption) and to model the endogenous debt dynamics more explicitly. Therefore, it may be interesting to include the long-term interest rate as an endogenous variable in the model.

<sup>10</sup> A Taylor rule prescribes that the central bank will raise the nominal policy interest rate whenever output or inflation accelerates beyond its natural level. In particular, every one-percentage point increase in the inflation gap should result in a more than one-percentage point increase in the policy rate. This is known as the ‘Taylor principle’, which guarantees that the real interest rate falls (Sorensen & Whitta-Jacobsen, 2010; De Bruyne, 2013).

<sup>11</sup> Under forward guidance, the central bank commits itself to keep the nominal policy interest rate at a predetermined (very low) level for a defined period and it clearly communicates this commitment to the public. This implies that the central bank will no longer react to output- and inflation gaps by adjusting its policy interest rate (ECB, 2013; De Graeve, Ilbas & Wouters, 2014).

<sup>12</sup> For detailed information regarding this extended model, I would like to refer to Van Rymenant (2014).

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