Spoor A4:

ASSESING FISCAL RULES AND SUSTAINABILITY: BEYOND THE THRESHOLD

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Steunpunt Fiscaliteit en Begroting

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Samenvatting "Assessing Fiscal Rules and Sustainability: Beyond the Threshold"

Gegeven de consensus over de noodzaak voor effectieve budgettaire maatregelen om de houdbaarheid van de openbare financiën te vrijwaren, lijkt een voldoende strikt budgettair beleid gepast om problemen zoals die in de jaren 1970 en 1980 te voorkomen. Een vaak voorgestelde manier om dat doel te bereiken is het implementeren van begrotingsnormen. Recent werden in het Fiscal Compact bijvoorbeeld de vereisten voor de structurele begrotingssaldi op middellange termijn verder verstrengd.

De literatuur omtrent begrotingsnormen heeft zich tot dusver voornamelijk gefocust op de budgettaire uitkomsten en bijgevolg de algemene evenwichtseffecten van de restricties links laten liggen. Desondanks vereist de Gouden Regel, bijvoorbeeld, een begrotingsevenwicht met uitzondering van de schuldfinanciering van publieke investeringen. Om de wenselijkheid van dergelijke begrotingsnormen te beoordelen moeten dan ook hun impact op de houdbaarheid én de algemene staat van de economie in rekening worden genomen.

In deze paper wordt een **overlappend generatiemodel** gebruikt om op basis van een sterk gestileerde economie met een inkomensbelasting, pensioenuitkeringen en publieke investeringen zowel de budgettaire houdbaarheid te beoordelen als de evenwichtseffecten van verscheidene begrotingsnormen te bestuderen. Daaruit blijkt dat de Belgische vertrekpositie, onder de beschreven voorwaarden, niet zal leiden tot een houdbaar evenwicht als gevolg van crowding out in de kapitaalmarkt.

Uit de kalibratie van het model blijkt ook dat het opleggen van **begrotingsnormen** in de gestileerde economie leidt tot hogere houdbare, initiële schuldniveaus. Het expansieve effect van de uitzondering van publieke investeringen onder een Gouden Regel blijkt evenwel niet op te wegen tegen haar budgettaire kost. Bijgevolg lijkt een gewone balans in het model de voorkeur te hebben boven een dergelijke regel.

Indien de overheid echter verondersteld wordt een **budgettaire reactiefunctie** te volgen zoals verwacht op basis van de historische data, resulteert dit in een houdbaar, initieel schuldniveau dat de psychologische grens van de honderd procent van het BBP overschrijdt. Desalniettemin wordt de voorgestelde reactiefunctie gekenmerkt door enkele belangrijke beperkingen. Zo is er cyclische convergentie naar en rond een schuldgraad van nul procent en zou die gepaard gaan met een lagere economische groei.

Assessing Fiscal Rules and Sustainability: Beyond the Threshold

(Preliminary version, do not cite)

Wouter van der Wielen*

Abstract

This paper develops an overlapping generations model including income taxation, pension benefits and public investment in order to assess fiscal sustainability. In addition, the model is used to study the effects of fiscal rules in this respect. In particular, the model simulates the effects of adhering to borrowing constraints and following a fiscal reaction function. I found that the Belgian conditions will not lead to a sustainable equilibrium under the proposed conditions due to crowding out in the capital market. The assessed fiscal rules are preferred to the current policy even if the initial debt would be relatively low.

Keywords: Fiscal sustainability, fiscal rules, fiscal reaction function, overlapping generations model

JEL codes: H63, H68, E62

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1. Introduction

Drawing upon a consensus with respect to the necessity of effective fiscal measures to safeguard the sustainability of public finances and the validation of this thesis by the recent debt crisis, a sufficiently stringent fiscal policy seems appropriate to avert lapses like those in the mid-1970s and 1980s. A frequently proposed way of achieving this goal is to implement fiscal rules or budgetary constraints. Debrun et al. (2008), for instance, argue that the domestic rules in the EU provide a solution to the deficit bias problem caused by the common pool problem and the governments' myopia. More recently, the Fiscal Compact, expected to enter into force in early 2013, further strengthened the structural balance requirements of the medium-term objectives imposed on EMU Member States.

The design of efficient and effective fiscal rules, however, has been the center of debate for several decades, with the contrast between stringent neoclassical principles and Keynesian macroeconomic stabilization as a common thread. So far, the fiscal rule literature has mainly focused on the budgetary outcomes, while neglecting the general equilibrium effects of budgetary constraints. Yet, the golden rule of public finance adopted in Germany and the UK, for example, required running an overall balanced budget while allowing debt-financed investments. Therefore, to assess the desirability of such rules, both the fiscal rules' effect on the general state of the economy as well as the sustainability of the proposed policy need to be considered.

The purpose of this paper is to present an overlapping generations (OLG) model for an economy under the authority of fiscal rules. This allows for making inferences about the corresponding fiscal sustainability while controlling for endogenous macroeconomic effects. Consequently, a sound answer can be provided to the question whether current fiscal policy is sustainable and, if not, whether fiscal rules provide any solace.

In order to achieve this goal, the next section will first present some basic principles, as well as the framework of analysis. Section 3 continues with the overlapping generations model used to assess fiscal sustainability. It will also present the fiscal rules used in the subsequent analysis. Section 4 comprises the analysis of fiscal sustainability and welfare when the current policy is maintained or when fiscal rules are in force. Finally, section 5 will provide some concluding remarks.

2. Fiscal Rules and Sustainability

2.1 Sustainability of Public Finances

It is often taken for granted that fiscal sustainability refers to fiscal policies which can be maintained indefinitely without risking a government's ability to continue to spend in order to achieve public purposes. Nevertheless, the definition of fiscal sustainability employed by different assessments in the economic literature varies, as is illustrated in this subsection.[1] In general, the following

[1] Moreover, note that some authors (e.g., IMF 2002) draw a distinction between a government's solvency and sustainability. The government is judged solvent if it satisfies the no-Ponzi scheme condition (i.e., if it is able to service its outstanding debt using future primary surpluses over an infinite horizon). Whereas sustainability refers to the capability of the government to attain the same budget constraint given historical data generated under current policies in a finite horizon. In order to keep the overview of the methods at

transversality condition (i.e., the no-Ponzi scheme condition) should be adhered to in an economy with a finite number of utility maximizing agents (O'Connell and Zeldes 1988):

$$\lim_{T\to\infty}\left[b_T\left(\frac{1+r}{1+y}\right)^{-T}\right] \leq 0. \tag{1}$$

where b_t is the public debt as a percentage of GDP at time T, r is the real interest rate, and y represents the real GDP growth rate. Consequently, one may argue that this is complied with if the economy is dynamically efficient ($r > y$). Denoting the primary deficit relative to GDP as d_t, the accompanying intertemporal budget constraint (IBC) for the government can be denoted as follows:

$$\lim_{T\to\infty}\left[\sum_{t=1}^{T} d_t\left(\frac{1+r}{1+y}\right)^{-t}\right] = -b_0. \tag{2}$$

A straightforward sustainability test based on the former is to analyze whether primary public expenditures and government revenues may continue to display their historical growth rates in the future. As suggested by Hamilton and Flavin (1986), public expenditures and revenues have to be cointegrated in order to satisfy the IBC. Stationarity of the public debt series in differences, too, should be sufficient to conclude that a country's fiscal policy is sustainable, as it implies that the no-Ponzi scheme condition is satisfied. In the same vein, Trehan and Walsch (1988) suggested to test for cointegration between the series of a government's primary balance and its public debt. Bohn (1998), however, raised the concern that such tests may be misleading to test sustainability in accordance with the IBC due to sensitivity to the discount rates. Testing for the reaction of the fiscal balance to changes in the debt stock would overcome this problem.

Blanchard (1990) took a different approach by introducing the primary gap and tax gap indicator of sustainability, based on the permanent primary deficit and the fiscal revenues as a percentage of GDP imperative to stabilize the debt level, respectively.[2] Building on this, an adjusted primary gap indicator can be calculated to quantify the amount by which the primary surplus has to increase such that the IBC holds, as done by the European Commission's S2 sustainability indicator.

Lastly, given the aging population, a valuable approach is offered by the method of generational accounting. Auerbach et al. (1991, 1994) added an intergenerational perspective to the sustainability analysis by measuring the redistribution of lifetime tax burdens across generations. Instead of using the conventional fiscal deficit and the level of public debt as a measure of sustainability, generational accounting analysis proposes the use of the fiscal gap, a measure of the additional burden that will need to be imposed on future generations to satisfy the government's budget constraint. The OECD method of assessing the sustainability was found to show a large parallel with the one offered by generational accounting (Benz and Fetzer 2006). Nonetheless, a possible drawback of a generational accounting analysis is the strong data requirements posed by it.

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hand comprehensive, both idioms will be used interchangeably. Nonetheless, the reader is advised to keep the slight difference of definition in mind.

[2] Buiter (1985) already focused on stabilizing the ratio of public sector net worth to output instead of the level of public debt. Yet, due to measurement problems the idea did not gain ground in practice.

A benefit of the aforementioned methods of assessing fiscal sustainability is that they explicitly emphasize the constraints imposed on fiscal policies. In spite of that, they overlook the simultaneity between budgetary variables and the general economic conditions. In reality, taxes, public expenditures, budget deficits and public debt do have an impact on macroeconomic variables such as factor prices and the growth rate. Consequently, despite the greater ease of empirical testing of the methods, more complex general equilibrium models are necessary for a robust sustainability analyses.

2.2 A General Equilibrium Approach

Considering a non-Ricardian setup, a special type of dynamic general equilibrium models of interest are the so-called overlapping generations (OLG) models.[3] By introducing overlapping generations and non-altruistic households, the Ricardian equivalence breaks down. Therefore, OLG models allow for intergenerational considerations. In particular, the famous neutrality result fails to hold in the OLG models considered below due to the presence of (unborn) future generations whose interests are not or only partially taken into account by present generations. Such a turnover in generations causes a redistribution of wealth between different generations. For instance, part of the future tax burden accompanying the issue of new government bonds is borne by individuals who are not yet born at the moment of the issue. For that reason, a bond issue represents net wealth to those who are alive at the moment of the issue and affects their decisions.

Diamond (1965) pioneered the OLG models including public debt to analyze the effects of the debt stock on the long run steady state of a closed economy. He found that an increase in internal or external public debt per capita will decrease the consumer's utility in case of an efficient economy, but may increase it in the inefficient state. Using this framework, several other notable results have been established. For example, Rankin and Roffia (2003) used a Diamond OLG model to assess the theoretical determinants of maximum sustainable debt. They showed that for both an open as a closed economy there is almost always a maximum sustainable level of debt. More specifically, the maximum occurs where variables are such that an infinitesimal increase in debt causes the economy to embark on a path of uncontrolled capital decumulation.

Furthermore, Chalk (2000) also used a Diamond OLG setting to assess the sustainability of bond-financed deficits and accompanying limits to government borrowing if the steady-state interest rate falls short of the growth rate ($r < y$). Although that under these conditions permanent deficits are sustainable according to the IBC, his findings proved that $r < y$ is a necessary, yet, not sufficient condition for permanent deficits. In addition, it is required that the deficits and stock of debt are not excessive.

Finally, de la Croix and Michel (2002) showed that there is no restriction on government borrowing when policymakers can freely tax all generations. While fiscal instruments are limited by the fact that the life-cycle income of the agents must be kept positive, there is no specific constraint on debt policy.

[3] The well-known Ricardian equivalence hypothesis has been up for debate for a long time. The most important issue being the failure of the permanent-income hypothesis (PIH). If the PIH fails in quantitatively important ways, the equivalence result fails too. Thus, the resulting burden of public expenditures financed by current taxes or bonds (and accompanying increased future taxation) would turn out not be the same.

There thus appears to be no theoretical reason to oblige the government to satisfy its IBC in overlapping generations models. Hence, in combination with the possibly counterintuitive results of the IBC (see e.g., Chalk 2000), this provides evidence that a dynamic OLG approach is a valuable road to explore in order to achieve the main objective of this paper.

2.3 Effective Fiscal Measures

The overlapping generations approach has more recently been applied as an instrument for the analysis of fiscal policy rules. This was mainly done in combination with the analysis of macroeconomic stabilization and fiscal sustainability. For example, Yakita (2008) used the OLG approach to analyze the sustainability of budget deficits if a golden rule is in force. He proved the existence of a threshold level of initial public debt for a given stock of public capital. When that threshold is surpassed, the government is judged unable to sustain the budget deficits intended by the prevailing rule.

Related research with regard to the European setting has also been conducted. Marín (2002), for instance, showed that a close to balance or in surplus fiscal rule such as the one entailed in the Stability and Growth Pact can guarantee the global stability of the equilibrium and make fiscal sustainability compatible with automatic stabilization. Allowing for a fiscal rule that adjusts the primary balance (as a percentage of GDP) as a function of the deviation from the European target debt level, Annicchiarico and Giammarioli (2004) found that a fiscal rule characterized by time invariant parameters may result in non-linear adjustments of the former fiscal variables. Moreover, they found that the adjustment of the transfer instead of the tax rate in order to satisfy the rule positively influences growth and the speed of convergence of the public debt to its target level.

More evidence rationalizing fiscal rules was brought to the table by Fernández-Huertas Moraga and Vidal (2010). They formulated an OLG model for sustainability analysis including human capital formation through educational spending. That way, they found that in the absence of fiscal rules which stabilize government debt, the economic equilibrium is in general unstable and a debt trap may render fiscal policy unsustainable.

Nevertheless, de la Croix and Michel (2002) provide some counterbalance. They distinguished between the effects of constant deficit policies and constant debt policies on capital accumulation and debt dynamics. A level of debt such that the golden rule capital stock is a steady state always exists. However, a constant debt policy may be unable to lead the economy to the golden rule, as it can only implement the golden rule for a specific level of the initial debt. The authors conclude that none of the policies considered is stable per se. Nonetheless, two policies were generally found unsustainable: to maintain a constant deficit with a too high initial debt and to maintain a constant debt with a too low initial capital.

For completeness, a series of recent studies using standard growth models to map the economic impact of fiscal rules have to be mentioned. These endogenous growth models comprise a significant portion of the debate concerning fiscal rules, especially with respect to the golden rule. The various growth models, however, do not entirely agree upon the impact of the golden rule on economic growth and welfare. For instance, Kellermann (2007), Groneck (2010), and Agénor and Yilmaz (2011) found that the golden rule or other primary surplus rules that exclude productive spending result in a higher growth in comparison to a balanced budget or a fixed deficit benchmark. Minea and Villieu (2009), on the other hand, found that the golden rule would lead to lower growth in both the short and long run. The resulting welfare effects were found to depend on the form of the utility function, in particular the intertemporal elasticity of substitution of consumption. For instance, Ghosh and Mourmouras (2011) stated that the golden rule may actually result in a higher steady-state welfare in comparison to a rule for which there are no constraints on the objectives for borrowing. Finally, both the growth and welfare effect Groneck (2011) attributed a crucial role to the composition of government expenditures in adhering to the rule.

In brief, as there is much debate on the impact of fiscal rules the main purpose of this paper is to analyze three frequent proposals from both an economic as a sustainability perspective. Using a non-Ricardian framework, it is found that the current Belgian debt stock is unsustainable and budgetary constraints offer an insufficient solution. Nonetheless, even in case of a lower initial debt stock, the proposed rules are expected to be preferred to the current policy due to their expansionary impact.

3. THE MODEL

3.1 HOUSEHOLDS

The discrete time model employed in this paper is a two-period overlapping generations model based on that of Diamond (1965). The consumption side of the model consists of N consumers who each live two periods. They earn a living by supplying labor to firms when young, while they are assumed to retire in the second phase of their lives and enjoy transfers from a pension scheme. Each agent chooses its consumption plans to maximize his or her discounted lifetime utility function taking the return on savings from one period to another as given. The superscripts denote the stage of life of the private agents (i.e., young and working vs. old and retired). In this context, the representative consumer born in period t solves the following problem:

$$\max_{\{c_t^Y, c_{t+1}^O\}} u(c_t^Y) + \beta u\left(c_{t+1}^O\right) \tag{3}$$

where u(•) is the instantaneous utility function, c_t^Y is the consumption by the young generation during period t, c_{t+1}^O is the consumption by the same generation when old during period t+1, and β entails a notion of discounting as it is the inverse of the rate of time preference. Accordingly, the representative consumer derives utility only from his own consumption during both stages of life and is assumed not to have any bequest motive.

Furthermore, the consumer problem is subject to the following budget constraints:

$$c_t^Y = (1 - \tau_t)w_t - s_t^Y \tag{4}$$

$$c_{t+1}^O = [1 + E_t(R_{t+1})]s_t^Y + E_t(\pi_{t+1})w_t \tag{5}$$

with w_t being the wage rate at time t (i.e., per unit of labor provided when young), τ_t denoting the distortionary tax rate levied by the government on the young agents living at time t (with $0 < \tau_t < 1$), s_t^Y denoting the savings by the young at time t, $E_t(R_{t+1})$ representing the expected return earned on these savings, and $E_t(\pi_{t+1})$ being the expected pension rate received by the representative consumer born in period t when old (with $\pi_{t+1} > 0$). The taxes and retirement benefits are assumed to be proportional to the labor income earned by the generation when young. These simplifying assumptions do, however, imply there is no redistribution among income classes or between different generations. The focus of the system is on the intertemporal redistribution for an agent within the same generation. Nonetheless, it does show some resemblance to, for instance, the Belgian social security system since it is a repartition system.

Finally, note that the population is assumed to grow at the exogenous rate n each generation, implying that the labor force grows at rate n as each agent is supposed to supply his or her endowments of labor inelastically during the first phase of their lives.

3.2 Firms

The production side of the model is characterized by a neoclassical production function depending on both capital and labor. Each firm i at time t its production function can be expressed as:

$$Y_{it} = F(K_{it}, K_t^P L_{it}^D) \tag{6}$$

where K_{it} denotes the private capital rented by firm i, L_{it}^D is the individual labor demand of each firm i, and K_t^P represents the public capital stock available in period t Following Futagami et al. (1995) and Yakita (2008), the public capital stock is assumed to multiplicatively enhance output through labor input. Note that the producer problem can be simplified by normalizing the number of firms to one single firm which takes prices as given. That profit maximizing firm's problem then is

$$\max_{\{K_t, L_t^D\}} [F(K_t, K_t^P L_t^D) - r_t K_t - w_t L_t^D]. \tag{7}$$

Note that $R_t = r_t - \delta$ has to hold, with δ denoting the rate of depreciation. In other words, the return on savings has to equal the return on capital after depreciation, which implies a loss in value.

In view of a constant returns to scale production function it is convenient to rewrite production as a fraction of efficiency units of labor (i.e. in its intensive form). Using lower case letters to indicate variables as a fraction of efficiency units of labor, solving the producer's maximization problem in case of a Cobb-Douglas production function, $Y_t=(K_t)^\alpha(K_t^P L_t^D)^{1-\alpha}$, results in the following factor prices:[4]

$$r_t = \alpha k_t^{\alpha-1} \tag{8}$$

$$\overline{w}_t = (1-\alpha) k_t^\alpha. \tag{9}$$

where $\overline{w}_t$ is the wage per efficiency unit of labor.

3.3 Government

[4] The Cobb-Douglas function used clearly satisfies the constant returns to scale property necessary for rewriting the problem in its intensive form (i.e., the function is homogeneous of degree one in its arguments), as well as the Inada conditions and prerequisite of positive (but decreasing) marginal products in effective units of labor of a neoclassical production function.

Considering the stock of public debt at the beginning of each period, the government has to obey the following law of motion of debt:

$$B_{t+1} = (1 + R_t)B_t + D_t \tag{10}$$

with B_{t+1} denoting the public debt stock at the beginning of period t+1 and D_t being the primary deficit incurred during period t. The latter is assumed to consist of, on the one hand, the amount by which the transfers to retired agents exceed the tax revenues during the same period. And, on the other hand, the government is also assumed to provide public capital. In particular, the investment in public capital, I_t^P (= K_{t+1}^P-K_t^P), is assumed to amount to a fixed rate of output, θY_t. Formally, in period t this is:

$$D_t = \pi_t w_{t-1} L_{t-1} - \tau_t w_t L_t + \theta Y_t. \tag{11}$$

Public policymakers their choices are described by the sequences of D_t and B_t, which in turn are implied by the choice of the tax and benefit rates. The specific regulations to which these choices are subjected, will be discussed in the next subsection.

3.4 Fiscal Policy Rules

Using the above described model the rest of this paper will aim to test how both a country's real economy and fiscal position react to different fiscal policies. The various fiscal policies will be formulated as fiscal rules to which the government has to obey, say constitutionally.

3.4.1 Current Fiscal Policy

A self-evident first scenario to be assessed is a continuation of current fiscal policy. How sustainable is the current policy if it would be carried on in the future and, in particular, what long term effects would it have on the real economy? By not only keeping the proportion of public capital investment fixed, but also fixing the tax rate and benefit rate to their initial level the model gives an indication.

3.4.2 A Balanced Budget or Golden Rule

Another intriguing case in light of current European developments, is that of a balanced (primary) budget. More specific, setting D_t=0 in equation (11) implies $\tau_t w_t L_t = \pi_t w_{t-1} L_{t-1} + \theta Y_t$.

Similarly, a permanent deficit policy is considered. The deficit level is chosen such that the primary deficit accrued can amount to a level equal to that of the public capital investments. All the rest of the government's expenditures should balance with her fiscal revenues. Consequently, the deficit rule largely corresponds to the historical golden rule of public finances. This can be formally expressed as $D_t = \theta Y_t$.

3.4.3 A Fiscal Reaction Function

Finally, a fiscal policy reaction function, as found for the U.S. by Bohn (1998), is incorporated in order to assess its impact on sustainability in this setting. In particular, the original econometric reasoning from which the fiscal reaction idea resulted, is extended to a forward looking setting that allows inferring on its value in practice. The fiscal reaction function is specified as follows:

$$d_t - d_{t-1} = \chi - \gamma b_{t-1} - \kappa(d_{t-1} + R_{t-1} b_{t-1}). \tag{12}$$

According to the respective literature a policy is sustainable if the coefficients of reaction are sufficiently large. Following a recent application by Collignon (2012), Belgian policy makers' reaction function is characterized by a parameter for adjustment to the debt level, γ, of 0.160 and a parameter for adjustment to the budget balance, κ, as large as 0.026. The historic tendency of the primary deficit to increase, χ, was found to be 0.036. Based on this, the Belgian fiscal policy during the last decades was judged sustainable (Collignon 2012). Nonetheless, in what follows the coefficients are evaluated in a non-customary setup.

4. A Case for Fiscal Rules and Sustainability?

4.1 A Debt Threshold

In the model under consideration crowding out in the capital market may eventually result in a negative private capital stock. In particular, the requirement to satisfy

$$s_t^Y L_t = K_{t+1} + B_{t+1} \tag{13}$$

implies that an excessive public debt stock may crowd out private capital investments.[5] Given the complete depreciation of capital during one 30-year period, this implies that the private capital stock becomes negative if a country's current private savings fall short of the amount necessary to finance next period's public debt certificates. In addition, a negative private capital stock yields it impossible to determine a real valued rate of return and wage. Moreover, a negative private capital stock is rather unthinkable in practice. Consequently, a minimum criterion for the basic continuity of a policy emerging in this context is provided in Proposition 1.

Proposition 1 The (upper) threshold level of the initial public debt, $\widetilde{B_t}$, necessary to assure a positive capital stock in period T, keeping fixed all other initial variables, is

$$\widetilde{B_t} = \frac{\frac{\beta}{1+\beta}\left[1-\tau_{T-1}-\frac{\pi_T}{\beta(1+R_T)}\right]w_{T-1}L_t(1+n)^{T-1-t}-\sum_{j=t}^{T-1}\left[D_j\prod_{i=j+1}^{T-1}(1+R_i)\right]}{\prod_{i=t}^{T-1}(1+R_i)}. \tag{14}$$

Proof. It suffices to set $K_T \geqq 0$ in equation (13), insert the savings function $s_{T-1}(\tau_{T-1}, \pi_T, w_{T-1}, r_T)$ from the model, and solve backwards using the debt dynamics of equation (10). ■

The threshold level introduced above does not represent the variable levels for which the IBC holds. Although it represents a relationship among the current debt and future primary balances, it also takes into account private savings as a function of the wages, taxes, pensions, and interest rates. In what follows, this alternative to the IBC is used for assessing the different policies. The requirement will be specified such that the private capital stock remains strictly positive for at least the next 150 years. Once continuity is guaranteed, one can test sustainability in a stricter sense.

4.2 Continuing Current Fiscal Policy

[5] In accordance with Auerbach and Kotlikoff (1987), crowding out in the long run is found. Nevertheless, due to the time horizon of the model the crowding in they found in the short run is hard to reestablish here.

Belgium's current fiscal policy is characterized by a tax rate on labor of approximately 38.3 per cent. The pension benefit as a percentage of the individual gross earnings averaged over all households (i.e., the gross replacement rate) in 2008 in Belgium amounted to 42.0 per cent (OECD 2011). For an individual's net earnings it was 64.1 per cent. Lastly, the Belgian public investments as a proportion of GDP are kept fixed at their 2008 value according to the OECD StatExtracts database, 1.66 per cent of GDP. An overview of the exogenous parameters and the rescaled initial values for simulation is presented in the appendix. Except for those rescaled variables, all monetary values that follow will be expressed in billions of Euros.

4.2.1 Failing to Meet the Threshold

Solving the model numerically using the aforementioned parameters and initial values shows that the Belgian fiscal starting position is unsustainable. The rising public debt will crowd out private investments from the third period onwards. Given that current fiscal policy is maintained, the current debt rate should not exceed 11.82 per cent to preserve continuity over the next 150 years. In all other cases, current private savings will be insufficient to finance both next period's public debt certificates and a positive private capital stock. From a different point of view, if the current public debt stock, however, does prevail, the government should run an average annual primary surplus during the next thirty years that is over four times higher than the average during the last decade.

The specification of a restricted number of parameters may make the results sensitive to changes in the assumptions concerning their values. An overview of the individual sensitivity of each of the parameters characterizing current fiscal policy, while the other parameters are kept constant at their prespecified level, are included in Figure 1. The three panels portray the threshold level of initial debt to ensure the existence of an equilibrium for each parameter value. The shapes of the graphs are according to expectations. For example, a low rate of taxation on labor leaves little room for maneuver as it restricts the governments revenues. A high rate, on the other hand, may limit the acceptable initial debt level as well, since it limits agents' ability to save and invest. Higher pension transfers put a burden on the government. Public investments may lighten such a burden up to some satiation point by enhancing growth. From the figure it immediately becomes clear that the initial Belgian debt level will not likely result in an equilibrium, not even in extremis.

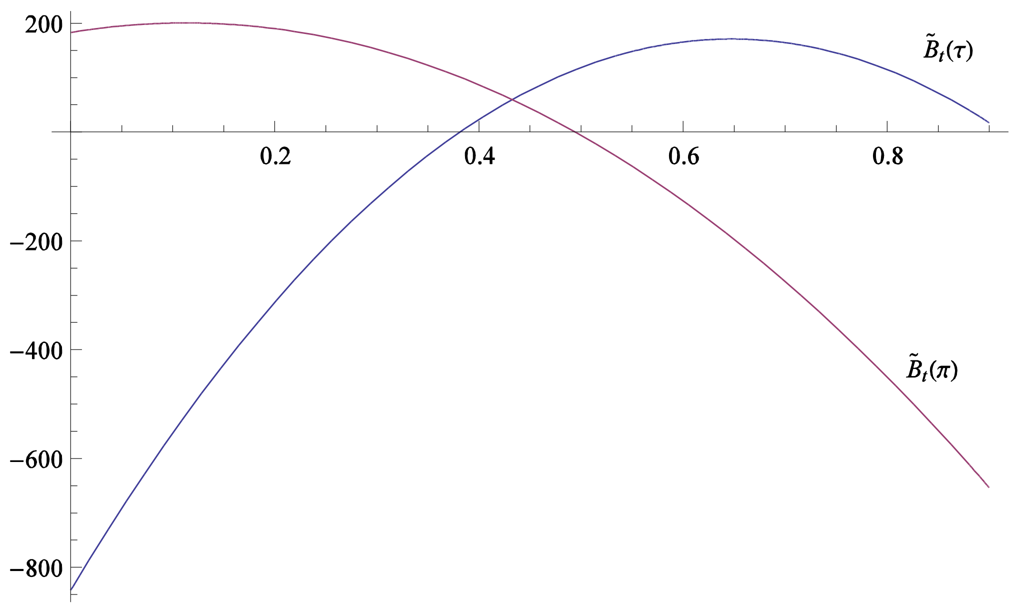

Figure 1a

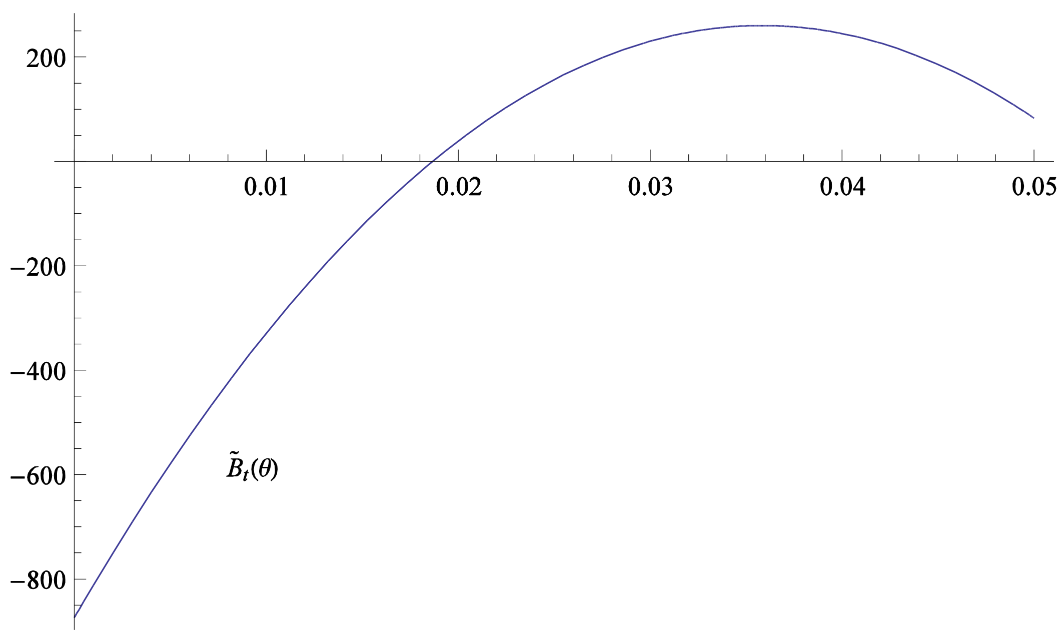

Figure 1b

4.3 Power to the Austere?

4.3.1 Fiscal Rules

Given that current fiscal policy is judged undesirable, does the implementation of fiscal rules offer solace? In any case introducing a balanced primary budget requirement results in higher threshold levels of the initial debt stock. In particular, when the tax rate is freely chosen by policymakers, the initial debt stock may not surpass 25.44 per cent of GDP. On the other hand, when the pension rate is endogenous the threshold level of public debt is 25.59 per cent of GDP. A golden rule allows for a more expansionary policy via public investment. Hence, a lower threshold level of initial debt to ensure the existence of an equilibrium corresponds with the expected result. In particular, the initial debt level may not exceed 21.40 and 20.84 per cent of GDP, respectively. In spite of that, the respective threshold levels also imply that even these would not provide a sufficient answer to the high initial Belgian debt level. Nevertheless, the consolidation required now will be smaller if a fiscal rule is implemented afterwards. For instance, the primary balance could be approximately 146 billion Euros less over the next thirty years if the primary balance is balanced afterwards.

To be able to provide further insights into the different fiscal rules, all scenarios are simulated again with an initial debt level of 35 billion Euros in order to prevent crowding. In this way a lower primary budget balance is found to have an expansionary impulse. In particular, while the current policy would be characterized by large primary surpluses in the long run, the fiscal rules presented would require a relatively more expansionary fiscal stance. As a result, the economic growth, consumption and capital stock would be higher under imposition of the rule. Moreover, a higher capital stock would in its turn lower a country's interest rate. It is this lower interest burden, although combined with a lower primary balance, which would cause the public debt stock to be lower in the long run.

Yet, a limit to the advantageous expansionary influences becomes apparent. The budgetary cost of an expansionary policy will at some point exceed the beneficial impact, which results in the higher debt stock diminishing further expansionary effects. Although running a primary deficit as large as the public investments is generally considered to be more expansionary, both the output and the capital stock are found to increase less than they would under the balanced budget rule. In addition, the public debt is expected to remain at a higher level. As a consequence of this restriction, the balanced budget rule is preferred to the golden rule in the case under consideration.

Hence, even if the initial Belgian debt stock would be relatively low, the proposed fiscal rules would be preferred to current fiscal policy. Nevertheless, if the debt level is much higher, the debt will not necessarily become negative after 30 years. In that case, running a primary balance would make the public debt stock grow (instead of decline) steadily at the rate of return on government bonds. Although the rule might have a more expansionary effect, a definite answer could not be given whether this expansionary effect (with the resulting lower interest burden) would be more sustainable than continuing the less expansionary current policy with primary surpluses. For this the boundary deficit level where both effects equal out should be calculated. Unfortunately, as no equilibrium exists for the actual Belgian debt stock, a definite answer to the latter issue is not possible in this setup.

4.3.2 Fiscal Reaction

If the government strictly follows the fiscal reaction function found in the historic data this results in the upper threshold of public debt surpassing the psychological boundary of 100 per cent of GDP. The Belgian threshold rises to 104 per cent of GDP and the current Belgian debt becomes sustainable. Consequently, if policy makers continue the behavior portrayed in the historic data, no major actions are called for.

Nonetheless, the suggested fiscal reaction function is characterized by some important limitations. Firstly, as a fiscal rule the fiscal reaction is specified such that in the long run the resulting dynamics cause convergence towards a zero debt rate. Yet, the convergence comes about cyclically around the zero debt rate. This cyclicality clearly creates a large variation in the public debt rate unless the defined path of adjustment is broken as soon as the future point of convergence is crossed. From a practical point of view this property seems undesirable. Secondly, in addition to the upper threshold for public debt a lower threshold arises as a result of these dynamics. If this lower threshold is nevertheless passed, the swings in the debt rate from the reaction function will eventually cause the debt rate to pass its upper threshold. Owing to such adverse dynamics the debt level may thus neither be too high or too low.

Corollary 1 As a result of the cyclical convergence, a fiscal policy reaction function rule also poses a lower bound on the public debt level.

Lastly, following the historic tendencies results in slower economic growth. Hence, the advantageous effects on fiscal sustainability are only one side of the medal.

5. Concluding Remarks

Fiscal rules are regularly cited to be a solution to possible unsustainability of public finances in the long run. Given that past indicators and tests for assessing fiscal sustainability solely use historical data, may give counterintuitive results if the economy is dynamically inefficient or lack to take into account the dynamic interactions in the economy, a more elaborate framework for analyzing a country's fiscal sustainability was proposed. To overcome those drawbacks a general equilibrium model was employed as a means of testing fiscal rules and sustainability. In particular, a two-period OLG model was used in order to derive a threshold level for the public debt stock.

Using this setup, the current Belgian public debt stock was found to be unsustainable. Even if the tax rate, pension rate, or public investments would be adjusted to take on extreme values, the current debt level was judged too high. As suggested by the threshold debt levels, two possibly more sustainable fiscal policies would be to adhere to a balanced primary budget rule or a primary golden rule. Nevertheless, the respective threshold levels also imply that even these would offer too little solace for the high initial Belgian debt level. On the other hand, it was found that even in case of a relatively low initial Belgian debt stock, the proposed fiscal rules are expected to be preferred to the current policy due to their expansionary impact.

Extending the framework proposed by Bohn (1998) from an empirical test to a dynamic theoretic setting shows the impact of fiscal reaction by policy makers in turbulent times. In particular, it was found that the high current debt level does not pose a threat in view of the theoretical sustainability measure under consideration if Belgian policy makers keep on adjusting their fiscal policy as they did on average in the past. Nonetheless, such policy is not without limitations. Limitations which call for further investigation.

Finally, other criteria may be interesting to explore in the future too. For instance, one could impose stronger requirements, such as a minimum level of capital higher than zero. One could also express the criterion as the primary deficit level required, ceteris paribus, to ensure a positive private capital stock. That way, it would provide in a clear policy directive. The rate of the pension transfers or labor taxes required to have a positive private capital stock would extend the indicator proposed by Blanchard (1990) to the current setting.

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APPENDIX

Table 1

Exogenous Parameter Values for Simulation			
Parameter	Model Value		Source
α	0.250		Chalk (2000)
β	0.299		de la Croix and Michel (2002)
δ	1.000		de la Croix and Michel (2002)
η	0.558		Eurostat
Initial Variable Values for Simulation			
Variable	Initial Value	Scaled Initial Value	Source
K	1,422 (€bn)	14.216	BelgoStat
K^P	200 (€bn)	2.003	BelgoStat
D	-8.779 (€bn)	-2.634	BelgoStat
B	326 (€bn)	3.264	BelgoStat
Y	335 (€bn)	123.333	BelgoStat & Own extrapolation
r	4.896 (%)	3.195	Eurostat
w		1.000	Normalization
L		77.908	Model closure

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