FISCAL POLICY UNDER ALTERNATIVE FISCAL DISCIPLINE REGIMES IN A CURRENCY UNION

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Abstract

Following the economic stagnation in Europe due to the global financial crisis, the European Commission allowed member countries to temporarily exceed the limits for the public debt and budget deficit indicated in the stability and growth pact (SGP) but limited the fiscal stimulus plan to a duration of two years. Recently, the European Council advocated for the strengthening of the SGP in order to avoid any persistent violation of the SGP due to the recent fiscal stimulus measures. Accordingly, the present paper uses a two-country overlapping generations framework in order to assess the fiscal policy implications of the strengthening of fiscal discipline in a currency union. The results show that, initially, a fiscal stimulus implemented under the condition of returning to a balanced budget leads to a higher increase in output and consumption in the currency union compared to a fiscal expansion with permanently higher public debt. However, in the medium run, the strict fiscal discipline case leads to an output recession in the currency area despite the increase in private consumption whereas a loosening of the fiscal discipline helps avoid the recession at the cost of higher public debt.

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1 Introduction

Following the economic stagnation in Europe due to the global financial crisis, the European Commission offered in November 2008 a fiscal stimulus strategy for the member countries. While the strategy contained some measures to be implemented at the union level, each country was recommended to react mainly at the national level. In order to facilitate the implementation of national measures, the Commission allowed countries to exceed temporarily the limits for the public debt and budget deficit of 60 and 3 percent of GDP, respectively, as indicated in the Stability and Growth Pact (SGP). However, the member countries were required to return to the norms indicated in the SGP at the end of the fiscal stimulus plan which was limited to a duration of two years.

Such a requirement induces governments to incorporate into their fiscal behavior, a mechanism that would allow to correct the negative effects of fiscal expansion on public finance. However, the extent of this correction seems to be limited to the achievement of a public deficit close to 3 percent and to the stabilization of the public debt at a more or less high level. For example, between 1999 and 2007, bigger countries like France, Germany and Italy as well as smaller countries such as Austria and Portugal have suffered from permanent budget deficits between 1.5 and 4 percent of GDP accompanied by a relatively stable public debt at around 105-115 percent of GDP for Italy and 57-67 percent of GDP for others. By advocating for a stronger SGP in October 2010, the European Council seeks to force governments to take into account the necessity of a balanced budget in the medium run as suggested by the SGP as well as debt stabilization at low levels, when deciding their future fiscal behavior.

The impact of strict application of the SGP on the effect of fiscal policy has been the subject of many debates since its launch in late 1995. On the positive side, economists argued that a strong fiscal discipline would help avoid government solvency problems that occurred in 2008-2009 creating great difficulties for several European countries. On the negative side, economists found the SGP excessively rigid and feared that imposing such fiscal constraints would reduce the use of fiscal policy to stabilize economic activity. The debate is especially important for members of the European monetary union (EMU) that have delegated monetary policy to the European Central Bank (ECB) and are therefore left only with fiscal policy as a stabilization instrument.

Models that analyze the effect of a debt-financed public spending shock generally overlook the possibility of a procedure that allows to improve public finance following a deterioration due to the fiscal expansion. In many of the new open economy macroeconomics models inspired by Obstfeld and Rogoff (1995), the ricardian equivalence assumption implies that the debt burden is met entirely by an increase in taxes. Similarly, dynamic stochastic general equilibrium models consider public spending path generally as an AR(1) process in which increases in public spending and taxes fade away gradually. However, as shown by Favero and Giavazzi (2007) using US data, a simple AR(1) process does not allow to estimate correctly the dynamic effects of a fiscal policy because it neglects the possible feedbacks from public debt towards public spending and taxes.

There are a number of papers in the literature which introduce such feedbacks to analyze various policies. For example, Forni et al (2009) consider feedbacks from debt-to-output ratio to distortionary taxes in order to analyze the effects of an increase in various types of public

spending but consider the euro area as a whole and thereby overlook the spillover effects within the euro area. Similarly, Coenen et al (2008) consider feedbacks from debt-to-output ratio to lump sum taxes to analyze the effect of a reduction in labor market distortions caused by euro area tax structures. Corsetti et al. (2010) introduce feedbacks from public debt to both public spending and taxes, into a two-country general equilibrium model with flexible exchange rates to show how expectations of future public spending cuts can modify the impact of an initial increase.

The idea of feedbacks from public debt towards public spending and taxes corresponds well to the conception of fiscal policy in the European Union. Although the extent of these feedbacks differs across periods and countries, efforts to avoid explosive public debt and the related inflationary pressures have been a common feature of fiscal policy in the euro area. Accordingly, the present paper adopts a feedback mechanism similar to that of Corsetti et al. (2010) to assess the impact of a strengthened SGP, as suggested by the Council, on the efficiency of fiscal policy. Namely, the paper compares the multiplier effects of a public spending expansion with efforts of debt stabilization without being concerned about the level at which debt is stabilized to those of a fiscal expansion that is designed to return to a balanced budget in the medium run. In the former case public debt is stable but permanent (weak fiscal discipline) while in the latter public debt is only temporary (strong fiscal discipline).

For this, a two-country overlapping-generations (OLG) model à la Weil (1989) is applied to a currency union with nominal rigidities and imperfect competition where some of the households do not have access to capital markets. One of the advantages of this setup is that, by allowing population growth, the model shows to what extent the future generations will suffer the debt burden decided by the current generations, which forms the basis of a commonly-used argument against public debt. Moreover, the setup allows to identify the spillover effects within the euro area following the fiscal shock.

The results show that an increasing fiscal discipline contributes to the positive effect of fiscal expansion on output and consumption in the short run but causes an output recession in the medium run. In contrast, weak fiscal discipline allows to avoid recession in the medium run but at the cost of higher and permanent public debt. Moreover, the small but positive spillover effects of fiscal expansion on foreign consumption and output are higher under strong fiscal discipline in the short run but again, increasing fiscal discipline leads to output recession abroad in the medium run. Finally, the results suggest that increasing fiscal discipline leads to higher volatility in real interest rates, inflation and taxes.

The paper is organized as follows: section 2 describes the theoretical setup whereas section 3 specifies the equilibrium conditions. Section 4 calibrates the model and gives the dynamics of the fiscal policy impact on main variables as well as a sensitivity analysis for several parameters. Section 5 concludes.

2 The Setup

There are two countries, called home and foreign, inhabited by infinitely lived agents. The two countries form a currency union. Home country population, N_t, has the constant growth rate n implying $N_{t+1} = (1+n)N_t$. Foreign country population, N_t^*, grows at the same constant

rate. Initial world population is normalized to 1. Initially *a* households reside in home country while the foreign population is equal to (1-*a*).

A continuum of goods $z \in [0, a]$ is produced in the home country while foreign goods are indexed on the array (*a*, 1]. Initially, each monopolistically competitive firm produces a single good that is an imperfect substitute of other available goods and the number of goods varieties is equal to the population in each country. The number of households increases in time while the number of goods varieties remains unchanged. Home firms are owned entirely by domestic households and profits are equally distributed among private agents independently of age. The same is true for the foreign country.

2.1 Households

It is assumed that there are two types of households in each country: those who have access to financial markets and those who do not. The first group will be referred to as asset holders while the second group will be called hand-to-mouth households[1]. In addition, following Weil (1989) it is assumed that newborns do not own financial assets regardless of whether they have access to financial markets or not, but they own the present discounted value of their human wealth defined as the labor income and share of profits net of taxes.

2. 1. 1 Asset Holders

Home asset holders have identical preferences over a real consumption index *C*, real money balances M/P and leisure (1-*L*) where *L* is the supply of labor and time endowment is normalized to 1. In any period *t*, household *j*, born in period $\upsilon \in [0, t]$ maximizes the following utility function:

$$U_t^{\upsilon^j} = \sum_{s=t}^{\infty} \beta^{s-t} \left[\log C_s^{\upsilon^j} + \chi \log \frac{M_s^{\upsilon^j}}{P_s} + \eta \log(1 - L_s^{\upsilon^j}) \right] \tag{1}$$

where $0 < \beta < 1$, $\chi > 0$ and $\eta > 0$.

The real consumption index $C_t^{\upsilon^j}$ is a CES type function defined as:

$$C^{\upsilon^j} = \left[a^{\frac{1}{\theta}} (C_H^{\upsilon^j})^{\frac{\theta-1}{\theta}} + (1-a)^{\frac{1}{\theta}} (C_F^{\upsilon^j})^{\frac{\theta-1}{\theta}} \right]^{\frac{\theta}{\theta-1}} \tag{2a}$$

where $C_H^{\upsilon^j}$ and $C_F^{\upsilon^j}$ denote respectively the consumption indexes over the continuum of differentiated goods, produced at home and abroad, consumed by home household *j* from generation υ. The parameter θ gives the elasticity of substitution between home and foreign goods and is assumed to be greater than one.

The sub-indexes of home and foreign goods consumption are given as follows:

$$C_H^{\upsilon^j} = \left[(\tfrac{1}{a})^{\frac{1}{\sigma}} \int_0^a c^{\upsilon^j}(h)^{\frac{\sigma-1}{\sigma}} dh \right]^{\frac{\sigma}{\sigma-1}} \tag{2b}$$

$$C_F^{\upsilon^j} = \left[(\tfrac{1}{1-a})^{\frac{1}{\sigma}} \int_a^{1-a} c^{\upsilon^j}(f)^{\frac{\sigma-1}{\sigma}} df \right]^{\frac{\sigma}{\sigma-1}} \tag{2c}$$

In the above equations, σ is the elasticity of substitution between goods produced within a country. It is assumed to be equal across countries and greater than one.

[1] The second group is also referred to as rule-of-thumb consumers in the literature.

Households consume each good equally regardless of the origin of the good. In other words, agents do not have biased preferences toward the goods produced in their country.

The overall price index P_t, given below, is defined as the minimum expenditure needed to purchase one unit of the composite consumption good, C_t :

$$P_t = \left[aP_{H,t}^{1-\theta} + (1-a)P_{F,t}^{1-\theta} \right]^{\frac{1}{1-\theta}} \tag{3a}$$

where $P_{H,t}$ and $P_{F,t}$ denote respectively the price indexes corresponding to home consumption sub-index of home and foreign goods given above. The price sub-indexes are defined as:

$$P_{H,t} = \left[\frac{1}{a} \int_0^a p_t(h)^{1-\sigma} dh \right]^{\frac{1}{1-\sigma}} \tag{3b}$$

$$P_{F,t} = \left[\frac{1}{1-a} \int_a^1 p_t(f)^{1-\sigma} df \right]^{\frac{1}{1-\sigma}} \tag{3c}$$

The preferences of foreign households are similar with asterisks denoting foreign variables so that the foreign price index, corresponding to the foreign consumption index, is given by:

$$P_t^* = \left[aP_{H,t}^{*1-\theta} + (1-a)P_{F,t}^{*1-\theta} \right]^{\frac{1}{1-\theta}} \tag{4}$$

Since this is a monetary union setup, all prices are expressed in the same currency. Identical preferences and the law of one price, together with the currency union assumption, imply that overall price indexes are equal across countries. In addition, the terms of trade S_t are defined as $P_{F,t} / P_{H,t}$.

Besides money balances, households can hold two types of financial assets in terms of real composite consumption good: a public and a private bond. The private bond can be traded internationally while the public bond is held only by domestic agents. Home agents also supply labor in the perfectly competitive labor market, receive profits from domestic firms and pay lump sum taxes. Then the budget constraint of a home asset-holder agent j of generation υ can be given as:

$$P_t B_{t+1}^{\upsilon^j} + M_t^{\upsilon^j} = P_t(1+r_t)B_t^{\upsilon^j} + M_{t-1}^{\upsilon^j} + W_t^j L_t^{\upsilon^j} + \int_0^a \Pi_t^i di - P_t C_t^{\upsilon^j} - P_t T_t^j \tag{5}$$

In the equation above, r_t denotes the real rate of return on both bonds between periods t and t-1. Total private and public bonds are represented by $B_t^{\upsilon^j}$ while Π_t^i denotes firm profits. In addition, W_t^j and T_t^j represent, respectively, the wages and the share of lump sum taxes paid by the agent both of which are independent of age. Assets are denoted according to their due date. For example, $B_{t+1}^{\upsilon^j}$ corresponds to assets purchased at the beginning of period t and held during this period, arriving at maturity at the beginning of period t+1. In contrast, money balances are denoted according to the current date so that $M_t^{\upsilon^j}$ denotes the period-t money holdings of agent j while $M_{t-1}^{\upsilon^j}$ represents the money balances that are carried over from period t-1.

A similar budget constraint holds for the foreign household.

Home consumer maximizes equation (2a) and the corresponding sub-indexes under the nominal expenditures constraint for consumption which gives the individual demand of a representative agent born in period $\upsilon \leq t$ for a typical home and foreign good as follows:

$$c_t^{\upsilon^j}(h) = \left[\frac{p_t(h)}{P_{H,t}}\right]^{-\sigma}\left[\frac{P_{H,t}}{P_t}\right]^{-\theta} C_t^{\upsilon^j} \tag{6a}$$

$$c_t^{\upsilon^j}(f) = \left[\frac{p_t(f)}{P_{F,t}}\right]^{-\sigma}\left[\frac{P_{F,t}}{P_t^*}\right]^{-\theta} C_t^{\upsilon^j} \tag{6b}$$

Home asset holder *j*, born in period υ, maximizes utility given in equation (1) under the budget constraint given in equation (5) with respect to $C_t^{\upsilon^j}, B_{t+1}^{\upsilon^j}, M_t^{\upsilon^j}$ and $L_t^{\upsilon^j}$. The first order conditions imply the following equations:

$$C_{t+1}^{\upsilon^j} = \beta(1+r_{t+1})C_t^{\upsilon^j} \tag{7}$$

$$\frac{M_t^{\upsilon^j}}{P_t} = \chi C_t^{\upsilon^j}\left(\frac{1+i_{t+1}}{i_{t+1}}\right) \tag{8}$$

$$L_t^{\upsilon^j} = 1 - \frac{\eta P_t C_t^{\upsilon^j}}{W_t} \tag{9}$$

The first equation above gives the intertemporal consumption path expressing the consumption smoothing behavior. Equation (9) gives the optimal labor supply which equates the marginal disutility of extra work effort to the marginal utility of consumption due to the increase in labor income. Equation (8) is the usual money demand equation where home nominal interest rate i_{t+1} is defined by the following relation:

$$1 + i_{t+1} = \frac{P_{t+1}}{P_t}(1+r_{t+1})$$

The first order conditions for foreign agents are similar with asterisks denoting foreign variables.

2.1.2 Hand-to-mouth Households

Hand-to-mouth households, or non-asset holders, do not have access to financial markets by definition and they consume their entire disposable income at each period. Therefore, consumption of a hand-to-mouth consumer *j* born in period υ is given as follows:

$$C_t^{\upsilon^j} = \frac{W_t}{P_t} L_t^{\upsilon^j} - T_t^{\upsilon^j} \tag{10}$$

Labor supply of non-asset holders is similar to that of asset holders. In addition, equations (2a)-(4) and (6a) and (6b) hold also for hand-to-mouth households.

The assumption of hand-to-mouth households is widely used in the literature on debt-financed fiscal policy as a way of eliminating ricardian behavior in infinite-horizon representative agent models. In the present setup, this assumption is not necessary to deviate from ricardian behavior since population growth already eliminates ricardian equivalence. Hand-to-mouth households are introduced in this setup because this type of consumer behavior is empirically observed in various industrialized countries as pointed out by Campbell and Mankiw (1989). Moreover, this assumption allows to isolate total private

demand from the negative wealth effect resulting from higher current and future taxes and relates total private consumption more tightly to current disposable income.

2.1.3 Aggregate per capita values

As it is traditional in OLG models, one needs to express all variables in per capita terms which consists in aggregating the relevant variables across all generations and then dividing by the number of households. In what follows, a variable without any reference to a specific generation will denote the aggregate level.

Aggregating equation (7) across all generations alive at period t gives[2]:

$$\beta(1+r_{t+1})a\left[C_t^0 + nC_t^1 + ... + n(1+n)^{t-1}C_t^t\right] = a\left[C_{t+1}^0 + nC_{t+1}^1 + ... + n(1+n)^{t-1}C_{t+1}^t\right]$$

Since the consumption of asset holders will be different from that of hand-to-mouth households, it will be convenient, at this point, to add a superscript A denoting asset holders in order to avoid any confusion.

Note that the left-hand side of the expression above gives the total consumption of all asset holders alive at date t (C_t^A) while the right-hand side is different from C_{t+1}^A since it does not include the period t+1 consumption of agents born in t+1 ($C_{t+1}^{A,t+1}$). However, this equation can be rewritten as follows so as to include $C_{t+1}^{A,t+1}$:

$$\beta(1+r_{t+1})C_t^A = a\left[C_{t+1}^{A,0} + nC_{t+1}^{A,1} + ... + n(1+n)^{t-1}C_{t+1}^{A,t} + n(1+n)^t C_{t+1}^{A,t+1} - n(1+n)^t C_{t+1}^{A,t+1}\right]$$

From which one gets:

$$\beta(1+r_{t+1})C_t^A = a\left[C_{t+1}^A - n(1+n)^t C_{t+1}^{A,t+1}\right] \quad (11)$$

Dividing both sides by the number of households alive at period t yields the per capita consumption Euler equation as follows:

$$\beta(1+r_{t+1})C_t^{A,PC} = C_{t+1}^{A,PC} + n\left(C_{t+1}^{A,PC} - C_{t+1}^{A,PC,t+1}\right) \quad (12)$$

where the superscript PC indicates per capita values.

The consumption Euler equation includes the period t+1 consumption of the new-borns $C_{t+1}^{A,PC,t+1}$, which is one of the fundamental differences with respect to the representative agent models. The arrival of new generations tilts the intertemporal consumption path. Thus, asset holders are no longer indifferent to the timing of taxes and the ricardian equivalence no longer holds.

Since all asset holders have identical labor income and new-borns do not have financial wealth, the difference $C_{t+1}^{A,PC} - C_{t+1}^{A,PC,t+1}$ in equation (12) must be equal to (1-β) of the financial wealth of agents belonging to earlier generations (see appendix). Then equation (12) takes the following form which is the aggregate per capita consumption Euler equation:

$$\beta(1+r_{t+1})C_t^{A,PC} = C_{t+1}^{A,PC} + \frac{n(1-\beta)(1+r_{t+1})}{1+\eta}B_{t+1}^{PC} \quad (13)$$

The per capita money demand derived from (8) is given as follows:

$$\frac{M_t^{A,PC}}{P_t} = \chi\left(\frac{1+i_{t+1}}{i_{t+1}}\right)C_t^{A,PC} \quad (14)$$

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[2] If the population grows at rate n and initial population is equal to a, the generation υ=1 has an members, generation υ=2 has $a(1+n)^2 - a(1+n) = an(1+n)$ members, generation 3 has $a(1+n)^3 - a(1+n)^2 = an(1+n)^2$ members and so on.

From equation (9) and its counterpart for non-asset holders, it is possible to get the optimal aggregate per capita labor supply for asset holders and hand-to-mouth households as follows:

$$L_t^{A,PC} = 1 - \frac{\eta P_t C_t^{A,PC}}{W_t} \text{ and } L_t^{HM,PC} = 1 - \frac{\eta P_t C_t^{HM,PC}}{W_t} \quad (15)$$

where the superscript HM refers to hand-to-mouth households.

The aggregate per capita version of equation (10) is given as:

$$C_t^{HM,PC} = \frac{W_t}{P_t} L_t^{HM,PC} - T_t^{HM,PC} \quad (16)$$

Assuming that asset holders and hand-to-mouth consumers amount respectively to λ and (1-λ) of the population, total aggregate per capita consumption can be given as:

$$C_t^{PC} = \lambda C_t^{A,PC} + (1-\lambda) C_t^{HM,PC}$$

The aggregate per capita demand for a typical home good *h* is given below:

$$y_t^{d,PC}(h) = \left[\frac{p_t(h)}{P_{H,t}}\right]^{-\sigma} \left[\frac{P_{H,t}}{P_t}\right]^{-\theta} (C_t^{u,PC} + G_t^{u,PC}) \quad (17)$$

Equation (17) is obtained by combining the per capita versions of home private demand given in (6a) with foreign private demand for home good *h* along with home and foreign public demand for good *h* which are expressed similarly to (6a) with G_t^{PC} and G_t^{*PC} denoting respectively per capita home and foreign public demand[3]. In the above equation, the superscript *u* indicates union-wide levels given by:

$$C_t^{u,PC} + G_t^{u,PC} = Y_t^{u,PC} = a(C_t^{PC} + G_t^{PC}) + (1-a)(C_t^{*PC} + G_t^{*PC})$$

The aggregate demand for a single foreign good *f* can be expressed analogously.

Finally, the following transversality condition has to be met both in aggregate and per capita terms:

$$\lim_{T\to\infty} q_{t,t+T}\left(B_{t+1+T} + \frac{M_{t+T}^A}{P_{t+T}}\right) = 0$$

where $q_{t,t+T}$ is the market discount factor for date $t+T$ on date t and is defined as $1/\prod_{t=0}^{T}(1+r_{t+1})$.

2. 2 Firms

Domestic firms face the demand function given in (17) and hire labor in order to produce a single good, which is an imperfect substitute of other existing goods, according to the following production function:

$$Y_t^i = L_t^i \quad (18)$$

where Y_t^i is the production of home firm *i* on date *t* and L_t^i is the amount of labor hired by the firm.

Firms fix their prices according to the price adjustment mechanism defined by Calvo (1983). Each period, only a randomly selected fraction 1-α of firms gets to change their

[3] It is assumed that public spending is independent of age. Hence individual and aggregate per capita values coincide for this variable.

prices. When a firm gets the chance to adjust, it determines the new value of its price by maximizing the market value of the firm defined as the expected discounted value of current and future profits.

With probability α^{s-t}, the new (optimal) price will be in effect in period *s*. Letting $p_t^o(i)$ be the optimal price chosen at date *t* by a home firm *i*, and noting that all firms adjusting would choose the same price since they face the same demand function with same technology so that $p_t^o(i) = p_t^o$, the price setting problem yields the following optimal price:

$$p_t^o = \frac{\theta}{\theta - 1} \frac{E_t \sum_{s=t}^{\infty} (\alpha)^{s-t} q_{t,s} Y_s^u mc_s}{E_t \sum_{s=t}^{\infty} (\alpha)^{s-t} q_{t,s} Y_s^u P_{H,s}^{\theta-1}} \tag{19}$$

where *mc* denotes the real marginal cost of production. An analogous expression can be derived for the foreign optimal price set by foreign firms.

The price index $P_{H,t}$ for home goods is an average of the price charged by the adjusting firms and the average of the price charged by the remaining firms. Then, the dynamics of the aggregate price level for home goods is given as follows:

$$P_{H,t}^{1-\sigma} = (1-\alpha)(p_t^o)^{1-\sigma} + \alpha P_{H,t-1}^{1-\sigma} \tag{20}$$

A similar expression can be derived for the aggregate price index $P_{F,t}$ for foreign goods.

2. 3 Fiscal authority

It is assumed that government consumes each available good in the same way as private agents so that there is no home bias for domestically produced goods[4]. This implies that public consumption indexes are similar to equations (2).

Government expenditures are financed by lump sum taxes and by public debt. This gives the following public budget constraint in period *t*:

$$G_t + (1 + r_t) D_t = T_t + D_{t+1} \tag{21}$$

In the above equation, D_{t+1} denotes public bonds issued in period *t* arriving at maturity in period *t*+1.

It is assumed that fiscal authority is faced to an upper limit for public debt and deficit which rules out the possibility of a continuous increase in public spending. In order not to exceed this upper limit, the fiscal authority has to reduce public deficit and debt sometime after the fiscal expansion. This can be achieved either by reducing public spending or increasing taxes as well as by a combination of the two, as the following rules imply:

$$G_{t+1}^{PC} = (1 - \phi_{gg})\overline{G} + \phi_{gg} G_t^{PC} + \phi_{gd}(1+n) D_{t+1}^{PC} + \varepsilon_{t+1} \tag{22}$$

$$T_t^{PC} = \overline{G}\left(\frac{G_t^{PC}}{\overline{G}}\right)^{\phi_{tg}} + \phi_{td} D_t^{PC} \tag{23}$$

where an overbar indicates the steady-state level and ε denotes an i.i.d shock to public spending. According to equation (22), government expenditures will adjust endogenously to

[4] This assumption can be considered plausible for Europe given the increasing degree of goods market integration and emergence of multinational firms selling the same good in different countries leading to a lower degree of home bias. Furthermore, public measures, such as the obligation for the European administrations to call for public tender at the union level, eliminate the home bias in public spending.

the level of outstanding public debt, following an initial increase assuming that $\phi_{gd} < 0$. Indeed, when this parameter equals zero, public spending will follow an exogenous path towards its steady-state level following the shock. In contrast, a negative value will induce an endogenous cut in public spending as long as the public debt stock is in an increasing trend. Similarly, equation (23) translates the efforts for reducing public deficit through higher taxes in response to an increase in public spending and debt assuming $\phi_{td} > 0$. When ϕ_{td} equals zero, public debt has no feedback on taxes.

2. 4 Monetary authority

The common central bank is assumed to pursue an interest rate policy that responds to the deviations of union-wide consumer price inflation $\hat{\pi}^{CPI}$ and output from their steady-state levels. Following Rottemberg and Woodford (1999), the interest rule is given as:

$$\hat{i}_{t+1} = \phi_i \hat{i}_t + \phi_p \hat{\pi}^{CPI}_{t+1} + \phi_y \hat{Y}^u_t \tag{24}$$

where the carets over variables denote percentage deviations from steady-state levels.

The assumption that period t+1 nominal interest rate i_{t+1} depends on its lagged value allows for interest rate smoothing so that sustained changes in output and inflation lead only to gradual changes in the nominal interest rate.

2. 5 External equilibrium

Let F denote the private bonds which are internationally traded between domestic and foreign private agents such that $F = B - D$. Then aggregating the individual budget constraint for asset holders (5) along with that of hand-to-mouth consumers across generations making use of the fact that $W_t L_t + \int_0^a \Pi^i_t di = P_{H,t} Y_t$, yields:

$$\begin{aligned}(1-\lambda)P_t(D_{t+1} + F_{t+1}) + M^A_t = (1-\lambda)P_t(1+r_t)(D_t + F_t) + M^A_{t-1} \\ + P_{H,t}Y_t - P_t\left(\lambda C^{HM}_t + (1-\lambda)C^A_t\right) - P_t T_t\end{aligned} \tag{25}$$

Combining the government budget constraint (21) and (25), assuming that money supply adjusts to money demand, gives the aggregate home country resource constraint as follows:

$$(1-\lambda)P_t F_{t+1} = (1-\lambda)(1+r_t)P_t F_t + P_{H,t}Y_t - P_t\left(\lambda C^{HM}_t + (1-\lambda)C^A_t\right) - P_t G_t$$

Knowing that newborn households do not hold financial assets, the per capita version of equation (25) becomes:

$$(1-\lambda)(1+n)F^{PC}_{t+1} = (1-\lambda)(1+r_t)F^{PC}_t + \frac{P_{H,t}}{P_t}Y^{PC}_t - (1-\lambda)C^{A,PC}_t - \lambda C^{HM,PC}_t - G^{PC}_t \tag{26}$$

Equation (26) states that the variation in the stock of home per capita private assets corresponds to the current account balance in per capita terms. The foreign analogue is similar.

3 General Equilibrium

Aggregate total per capita labor demand must be equal to the sum of labor supplied by asset holders and hand-to-mouth consumers:

$$\int_0^a L^{i,PC}_t di = L^{PC}_t = (1-\lambda)L^{A,PC}_t + \lambda L^{HM,PC}_t \tag{27}$$

Similar equilibrium conditions hold for the foreign country.

The international bond market equilibrium condition requires that global net private assets be zero i.e. $(1-\lambda)F_{t+1} + (1-\lambda)F^*_{t+1} = 0$ which, in per capita terms, yields:

$$aF^{PC}_{t+1} + (1-a)F^{*PC}_{t+1} = 0 \quad (28)$$

Equilibrium is a sequence of prices, wages, consumption and production levels as well as policy instruments and financial assets which i) clear the labor market in each country in each period according to (27) and its foreign counterpart; ii) clear the goods market in each country where goods demand is given by (17) and its foreign analogue while goods supply is equal to the amount of labor used as implied by the production function (18) along with its foreign analogue; iii) clear bonds market according to (28); iv) clear the money market where money demand is given in (14) and its foreign analogue while money supply is determined by the central bank; v) satisfy the optimality conditions for consumption and prices given respectively in (13), (16) and (19) along with their foreign counterparts; vi) satisfy the resource constraints of each country according to (26) and its foreign analogue.

The model is solved under the assumption of rational expectations after log-linearizing the relevant equations around their steady-state levels. The symmetrical steady state is characterized by the absence of price rigidities, of inflation as well as of public and private debt.

4. Calibration and Results

This section compares the impact of two types of fiscal policy. First, it considers a one per cent increase in home public spending assuming that fiscal authority is not concerned about the budget deficit as long as public debt is not explosive (weak fiscal discipline). In this case public debt is permanent. Second, the same policy exercise is reconsidered assuming, this time, that fiscal policy is designed to ensure a balanced budget in the medium run (strong fiscal discipline). In this case, fiscal authority aims to ensure that the impact of fiscal expansion on public debt is only temporary by introducing fiscal discipline through spending cuts sometime after the stimulus. Foreign public spending is assumed to remain unchanged throughout the rest. This last assumption can be considered as plausible given the asymmetric structure of the uncoordinated fiscal stimulus plans implemented in Europe during 2009-2010[5].

4.1 Calibration

Table 1 below, resumes the values and the descriptions of various parameters used for calibration on quarterly basis.

Table 1. Calibrated Parameters

Parameter	Value	Description
β	0.99	Subjective discount factor
σ	6	Substitution elasticity between domestic goods
θ	6	Substitution elasticity between home and foreign goods

[5] According to the data on the 11 biggest members of the euro zone reported by Cwik and Wieland (2010), the 2009 fiscal stimulus plans amount respectively to 1%, 0.68% and 0.63% of GDP in Spain, Germany and France while Belgium and Finland committed for 20% of their GDP. The amount of the stimulus plan is negligible in other countries such as Italy, Netherlands, Greece and Ireland.

α	0.75	Measure of price rigidity
n	0.001	Growth rate of country population
a	0.3	Home country size
λ	0.3	Share of hand-to-mouth consumers
ϕ_i	0.9	Interest rate smoothing
ϕ_y	0.1	Monetary rule coefficient on output
ϕ_p	1.5	Monetary rule coefficient on inflation
ϕ_{gg}	0.8	Public spending persistence
ϕ_{tg}	0	Share of public spending financed by taxes
ϕ_{td}	0.02	Tax response to public debt
ϕ_{gd}	-0.02	Public spending response to public debt

The discount factor β is set to 0.99 implying that the annual real interest rate is equal to four per cent at the steady-state. The rate of growth of country population is set to 0.1 per cent which is equal to the average growth rate in the EMU. The elasticity of substitution between goods produced within a country σ is fixed to 6 following Ganelli (2005) implying that the mark up rate is equal to 20 percent at the steady state. Given the efforts for enhancing goods market integration across EMU members and the trade structure among the large EMU countries, one can plausibly assume that the elasticity of substitution among home and foreign goods are also equal to 6. However, other values for this parameter will also be considered when running sensitivity analysis. The value of η is calibrated to have a steady state labor supply equal to one third of the available time. The measure of price rigidity α is equal to 0.75 which, on a quarterly basis, implies that prices remain fixed during one year on average.

The interest rate smoothing parameter is set to 0.9 which is in line with the estimations in the recent literature (e.g Fendel and Frenkel, 2006). The responsiveness of the interest rate to the inflation deviation is traditionally set to 1.5 while the coefficient on output is assumed to be equal to 0.1. Since there is some divergence between the values reported in empirical work on output coefficient of the interest rate rule, various values of ϕ_y will be assumed when running sensitivity analysis.

Regarding the fiscal policy parameters, the present paper follows Corsetti et al. (2010) and assumes $\phi_{tg} = 0$, $\phi_{td} = 0.02$ and $\phi_{gd} = -0.02$ to indicate the strong fiscal discipline case. For the weak fiscal discipline case, these two parameters are calibrated to have debt stability at an endogenously determined point in time. Gali and Perotti (2003) estimate the persistence coefficient of fiscal policy around 0.8 for the post-Maastricht period in EU. Accordingly, the present paper assumes $\phi_{gg} = 0.8$. The steady state public spending-to-output ratio is set to 0.20.

Germany, who has implemented the largest fiscal stimulus plan for the period 2009-2010 and whose GDP corresponds roughly to 30% of that of the euro area, is taken as the benchmark for the size of the policy implementing country. Finally, the share of hand-to-mouth consumers is set to 0.30 although it generally ranges from 0.25 to 0.50 in the

literature[6]. Note that, in contrast to representative agent models, the existence of hand-to-mouth consumers is not necessary for the real allocation to be affected by the time path of public debt in this setup.

4. 2 Fiscal Policy Efficiency under weak and strong fiscal discipline

Figure 1 below shows the impact of a public spending increase by one per cent of the steady state real GDP on the main variables under weak fiscal discipline (solid lines) and under strong fiscal discipline (dashed lines) where x-axis measures time in quarters. The deviations of quantity variables are measured in per cent of steady state GDP while price variables are measured in percentage deviations from their steady state level.

----------insert Figure 1----------

In the weak fiscal discipline case, home fiscal authority increases public spending without worrying about the public debt persistence as long as the public debt is not explosive. Initially, the increase in public spending is entirely debt-financed. The implied budget deficit and the increased real short run interest rate raise public debt. In the medium run public spending increases less according to (22) and the real interest rate falls with respect to the initial increase. These effects, combined with higher taxes in response to higher debt, lead to public debt stabilization in the long run although at a level higher than the steady state. This requires a permanent primary surplus.

In the strong fiscal discipline case, the desire to restore the budget balance in the medium run induces fiscal authorities to spend less while increasing taxes starting from the date of implementation. Hence, in the short run, public spending increases less than under the weak discipline case and taxes increase more. This slows down the increase in public debt in the short run and starts a decreasing trend in the medium run. Such measures, similar to those that are likely to be implemented in Europe following a stronger SGP, are not costless regarding production and consumption.

The initial fiscal multipliers for per capita production are positive and lower than unity in both countries regardless of the degree of fiscal discipline. Indeed, because of the absence of home bias, the positive expenditure shifting effect of higher public demand stimulates per capita output by the same amount at home and abroad. However, at the aggregate level, public demand for foreign goods increases more than that for home goods due to the higher number of foreign goods varieties. The resulting increase in the terms of trade reallocates demand towards home goods due to the expenditure switching effect. Therefore, per capita production increases at the union level but the increase is higher in the home country with respect to the foreign. The production function implies that per capita labor demand is also higher in the home country for a given level of labor supply. Hence, nominal wages rise more at home compared to foreign. Combined with the evolution of prices, this implies higher real wages at home. As a result, home country incurs a loss of price-competitiveness against the foreign country in the medium run as implied by the evolution of the terms of trade given in figure 1.

Contrary to the short run effects of the fiscal expansion, the medium run effects depend on the degree of fiscal discipline. In contrast to the weak fiscal discipline case, strong discipline leads to output recession both at home and abroad in the medium run. Remember that under

[6] See Campbell and Mankiw (1989) and Gali et al (2007) for estimations.

strong discipline public spending falls below its steady state level in the medium run reflecting the wish to restore fiscal discipline through spending cuts rather than a radical change in taxation as is the case for Europe. This leads to a fall in total demand despite the increase in private consumption and home output also falls below its steady-state level. The output recession is more pronounced in the foreign country because private demand is much lower than in the home country. The output recession in the two countries lead to a fall in labor demand which causes a decrease in home and foreign real wages with respect to the steady state. Lower production costs- combined with the fact that the nominal interest rate reaction is only gradual- translates into a CPI deflation under strong discipline in contrast to the weak discipline case. As the nominal interest rate adjusts to the fall in consumer prices and world output, the real interest rate falls below the steady state level. In contrast, a home fiscal expansion under weak fiscal discipline does not bring about a deflation despite the fall in prices. Similarly, the real interest rate remains above the steady-state level although it decreases with respect to the initial rise.

These results are both qualitatively and quantitatively in line with those of Cwik and Wieland (2010) who estimate the GDP impact of the recent fiscal stimulus plan in Europe. The authors find an output multiplier around 0.5-0.6 percent for the first year which falls to about 0.1-0.2 percent the second year. They also find that the output multiplier becomes negative, implying an output recession, starting from the third year which corresponds to the fiscal discipline period as advised by the European council.

Figure 2 below gives the impact of public spending on the per capita consumption of asset holders and hand-to-mouth consumers in both countries.

---------- insert figure 2 ----------

The per capita consumption of asset holders depends mainly on the long run real interest rate. Corsetti et al (2009), define the latter as the real return of an asset with infinite duration. Accordingly, the deviation of the long run real interest rate from its steady state is equal to the infinite sum of deviations of future expected short run real interest rates from the steady state. In the case of weak fiscal discipline, the increase in inflation and output brings about an increase in the short run nominal interest rate but since the latter changes only gradually, it increases less than the CPI inflation and hence the short run real interest rate falls on impact. However, as the nominal interest rate continues to increase in response to output and inflation, the short run real interest rate increases in the following periods. Accordingly, the long run real interest rate also increases under weak fiscal discipline and remains above its steady state level throughout the time interval considered. Therefore, fiscal expansion leads to a fall in asset holders' consumption under weak fiscal discipline. This negative impact is dampened by the expectations on future tax burden which will be shared by an increasing number of households due to population growth. However, the effect of the common interest rate largely dominates the population growth effect which explains the similarity between home and foreign consumption of asset holders.

Despite the fall in asset holders' consumption, the total home and foreign consumption increase in the short run. This reflects that the increase in the consumption of hand-to-mouth households dominates the fall in asset holders' consumption. This is due to the rise in real wages and to the fact that taxes increase only moderately in the short run since public spending is mostly debt-financed. However, the increase in consumption of hand-to-mouth

households fades away as the tax burden adjusts to the higher public debt and as real wages start to fall following output. Note also that foreign total private consumption increases less than the home because of lower real wages with respect to home.

Total home and foreign private consumption increase also under strong fiscal discipline but, in contrast to the weak discipline case, they increase regardless of the assumption of hand-to-mouth households. Indeed, due to the fall in the short run real interest rate starting from the medium run under strong fiscal discipline, the long term real interest rate remains below the steady state level throughout the time interval considered. Hence, in contrast to the weak discipline case, asset holders increase their consumption on impact. In the medium run, total private consumption falls at the union level because of the fall in the consumption of hand-to-mouth households following the decrease in real wages.

The inspection of Figure 1 and Figure 2 shows that strong fiscal discipline (a balanced budget) is desirable to stimulate private consumption but has undesirable effects on output growth in the medium run despite its positive effect on private demand. One possible explanation is that the crowding-in effect of public spending on private demand is not enough to compensate for the fall in public demand because private and public spending are not close substitutes. Indeed, private consumption is much smoother than public consumption due to intertemporal behavior while public spending fluctuates more freely. The output recession effect of a balanced-budget in the medium run is likely to be valid even in the presence of investment possibilities and capital accumulation. Indeed, in a flexible exchange rate setup with investment and capital accumulation, Corsetti et al (2010) show that fiscal policy under strong discipline leads to negative output growth in the medium run.

The expenditure shifting effect due to home fiscal expansion increases the demand for foreign goods while the expenditure switching effect reduces this demand. The expenditure shifting effect dominates the expenditure switching effect and net home imports increase. The resulting trade deficit causes a fall in net foreign assets in the short run (an increase in private debt vis-à-vis the foreign) regardless of the degree of fiscal discipline. The reduction in net foreign assets continues in the medium run when fiscal discipline is weak whereas in the strong fiscal discipline it is mitigated in the medium run.

4.3Sensitivity Analysis

While empirical evidence provides commonly accepted estimates for some of the parameters of the present setup, the estimates of others are more or less controversial. For example, there is consensus on the value of the coefficient of reaction to inflation or to past interest rate in the monetary policy design while various values are reported for the coefficient on output. The same is true for the elasticity of substitution between domestic and foreign goods (θ). Hence, it would be convenient to run sensitivity analysis for these parameters.

The parameter n will also be allowed to vary in this section for two reasons. First, the population growth differs across members of the euro zone, suggesting that the transition dynamics may differ from one country to another. Second, population growth may play an important role in an overlapping generations model since it is one of the factors that determine the degree of deviation from the ricardian equivalence.

Finally, in a two country setup the size of the policy implementing country is important since it affects the international policy transmission and thereby the policy efficiency. As the

country size differs significantly from one member to the other in the euro zone, it will be convenient to consider alternative values for this parameter.

Table 2 gives the first year output and consumption multipliers for the two countries against various values of the relevant parameters according to the degree of fiscal discipline[7]. A row-by-row comparison of Table 2 allows to see how multipliers vary with the relevant parameters whereas a column-by-column inspection allows to compare the performances of the two fiscal regimes. The first row of each panel gives the multipliers of the benchmark calibration.

Table 2. Sensitivity Analysis for various parameters

		Weak fiscal discipline				Strong fiscal discipline			
		Y	Y^*	C	C^*	Y	Y^*	C	C^*
(a)	θ=6	0.561	0.234	0.072	0.015	0.597	0.281	0.111	0.061
	θ=4	0.591	0.221	0.078	0.013	0.628	0.267	0.116	0.058
	θ=2	0.782	0.139	0.111	-0.002	0.820	0.185	0.150	0.044
(b)	n=0.001	0.561	0.234	0.072	0.015	0.597	0.281	0.111	0.061
	n=0.005	0.646	0.198	0.088	0.008	0.595	0.28	0.110	0.059
	n=0.01	0.737	0.159	0.106	0.001	0.593	0.279	0.108	0.058
(c)	a=0.3	0.561	0.234	0.072	0.015	0.597	0.281	0.111	0.061
	a=0.45	0.678	0.352	0.08	0.023	0.737	0.421	0.141	0.091
	a=0.65	0.834	0.508	0.09	0.033	0.925	0.608	0.181	0.131
(d)	$\phi_y = 0.1$	0.561	0.234	0.072	0.015	0.597	0.281	0.111	0.061
	$\phi_y = 0.2$	0.553	0.227	0.065	0.007	0.589	0.272	0.102	0.052
	$\phi_y = 0.3$	0.546	0.219	0.057	0.0001	0.581	0.264	0.094	0.044

Remember that in the benchmark calibration, the terms of trade increases on impact favoring home goods. However, this advantage disappears rapidly afterwards due to faster growth of home production prices. When θ decreases, home demand is less affected by this loss of price-competitiveness since a lower θ implies that home and foreign goods are poor substitutes and that demand switches less easily from one country to the other following relative price movements. In this case, the advantage of the terms of trade lasts longer which implies higher output and hence consumption growth at home while the opposite is true for the foreign country variables. Under weak fiscal discipline, foreign consumption may even fall following the home fiscal shock as θ approaches to unity in contrast to the strong fiscal discipline case.

The population growth rate plays a similar role under weak fiscal discipline. Specifically, home output and consumption multipliers of public spending increase as population grows faster. Indeed, the consumption of asset holders increases as they anticipate a reduction in the

[7] Specifically, the table gives the cumulative four-quarter response of the relevant variable with respect to the cumulative four-quarter change in public spending.

future fiscal burden of the current public debt which will be shared among a larger number of households. Similarly, the consumption of hand-to-mouth households also increases due to higher disposable income.

In the case of strong fiscal discipline, the anticipation of a mitigation of public debt in the medium run and its elimination in the long run implies that the increase in n has a lower impact on the consumption of asset holders and on home output with respect to the weak fiscal discipline case. The slight increase in asset holders' consumption is more than compensated by the fall in the consumption of hand-to-mouth consumers resulting from the reduction of per capita disposable income. The inspection of the multipliers suggests that countries with higher levels of population growth (n=0.01) may prefer weak fiscal discipline while those with low or constant population growth (n=0.001), like the majority of the euro zone, prefer strong fiscal discipline.

Since the policy considered in this setup involves a public spending increase of one percent of the GDP of a country, the multiplier effects of this policy are higher the bigger the size and the GDP of that country independently of the fiscal discipline degree. Therefore, the multipliers for per capita consumption and output in both countries increase with the parameter a. Indeed, a bigger country size leads to a higher expansion of world demand following the fiscal shock which, then, stimulates foreign variables through spillover effects. This result shows the importance of policy decisions taken by the big countries of the euro zone like France and Germany for the euro area as a whole in the absence of a fiscal cooperation or a common fiscal policy.

A higher reaction coefficient of output in the monetary policy causes a fall in consumption and output multipliers in both countries regardless of the fiscal regime. When monetary authority reacts more aggressively to output deviations, any expansionary effect of public spending is counterbalanced by a higher increase in the nominal interest rate. This implies that, some kind of cooperation between fiscal and monetary authorities, inducing a less active monetary behavior, may increase the efficiency of fiscal stimulus plans.

Except for the population growth, a column-by-column comparison of Table 2 shows that initially, strong fiscal discipline is preferred to weak fiscal discipline. Indeed, multipliers are always higher in the former. However, Figure 1 shows that strong fiscal discipline leads to output recession in the medium run. Hence, in this setup, strong fiscal discipline favors current generations at the expense of future generations.

5. Conclusion

The present paper uses a two-country OLG framework in order to analyze the effects of a fiscal stimulus implemented in a currency union taking account of the necessity of future spending cuts conformably to a fiscal discipline rule. This rule may imply a weak degree of discipline as suggested by the relatively loose application of the Stability and Growth Pact (SGP) in the euro area since 1999. It may also bring about a permanent public deficit slightly lower than the upper limit indicated in the SGP along with a relatively high but stable public debt. A higher degree of fiscal discipline, as suggested by the European Council in October 2010, consists of achieving a low public debt and a balanced-budget in the medium run as suggested by the SGP. By comparing fiscal policies pursued under these two cases of fiscal discipline, the present paper evaluates the effects of a strengthening of fiscal discipline on private consumption and output of the currency union.

The results show that, initially, a fiscal stimulus implemented under the condition of returning to a balanced budget leads to a higher increase in output and consumption in the currency union with respect to a fiscal expansion with permanently higher public debt. However, in the medium run, the strict fiscal discipline case leads to an output recession in the currency area despite the increase in private consumption whereas a loosening of the fiscal discipline helps avoid the recession at the cost of higher public debt.

Generally, public debt is considered to be unfair from an intergenerational point of view because the costs of current fiscal expansion are transferred to future generations via the debt burden. The OLG structure of the present setup allows to see the intergenerational impact of a fiscal expansion. The results suggest that it is the strong fiscal discipline case, rather than the permanent debt case, which favors the current generation at the expense of future generations. Indeed, although the initial output and consumption multipliers are higher, the strong fiscal discipline case causes an output recession in the medium run.

The multipliers seem to be sensitive especially to the size of the policy implementing country, which suggests that a generalized fiscal expansion coordinated at the union level may help increase the efficiency of fiscal policy in the euro area. The reaction of the common central bank is also important for the effects of a fiscal stimulus. A more accommodating monetary policy enhances the efficiency of fiscal policy.

The present setup neglects the possibility of multiple equilibria and therefore does not account for government solvency and sovereign debt issues. Indeed, in a multiple equilibria setup, households may refuse to lend government even when the permanent public debt is stable, which may cause government insolvency and thereby render undesirable a high level of public debt. Introducing these issues into the present setup may be interesting for future research.

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Appendix

Iterating forward the budget constraint given in (5) and applying the transversality condition yields the present value life-time budget constraint of asset holder household *j* born in period υ as follows:

$$\sum_{s=t}^{\infty} q_{t,s} C_s = (1+r_t)B_t + \sum_{s=t}^{\infty} q_{t,s}\left[\frac{W_s}{P_s}L_s - T_s + \int_0^a \frac{\Pi_s^i di}{P_s}\right] \quad \text{A.1}$$

where the upper index υ^j is dropped to ease notation. Imposing $B_t = 0$ gives the present value life-time budget constraint of a new-born household.

Iterating forward the consumption Euler equation (7) allows to define date-*t* consumption of a household *j* as follows:

$$C_t = \beta^{t-s} q_{t,s} C_s \quad \text{A.2}$$

The labor supply decision (9) implies:

$$\frac{W_s}{P_s} L_s = \frac{W_s}{P_s} - \eta C_s \quad \text{A.3}$$

Introducing A.2 and A.3 into A.1 yields:

$$C_t = \tfrac{1-\beta}{1+\eta}\left[H_t + (1+r_t)B_t\right] \quad \text{A.4}$$

where $H_t = \sum_{s=t}^{\infty} q_{t,s}\left[\frac{W_s}{P_s}L_s - T_s + \int_0^a \frac{\Pi_s^i di}{P_s}\right]$ is the human wealth which is equal to the present value life-time budget constraint of a new-born household. Hence, period-*t* consumption of a household belonging to an earlier generation is given by A.4 whereas date-*t* consumption of a new-born is equal to $\frac{1-\beta}{1+\eta} H_t$. Then the difference between the two consumptions at date t+1 in per capita terms is given by:

$$C_{t+1}^{PC} - C_{t+1}^{PC,t+1} = \tfrac{1-\beta}{1+\eta}(1+r_{t+1})B_{t+1}^{PC} \quad \text{A.5}$$

Inserting A.5 into (12) in the text gives (13).

Figure 1. Impact of fiscal policy on main variables under weak and strong fiscal discipline

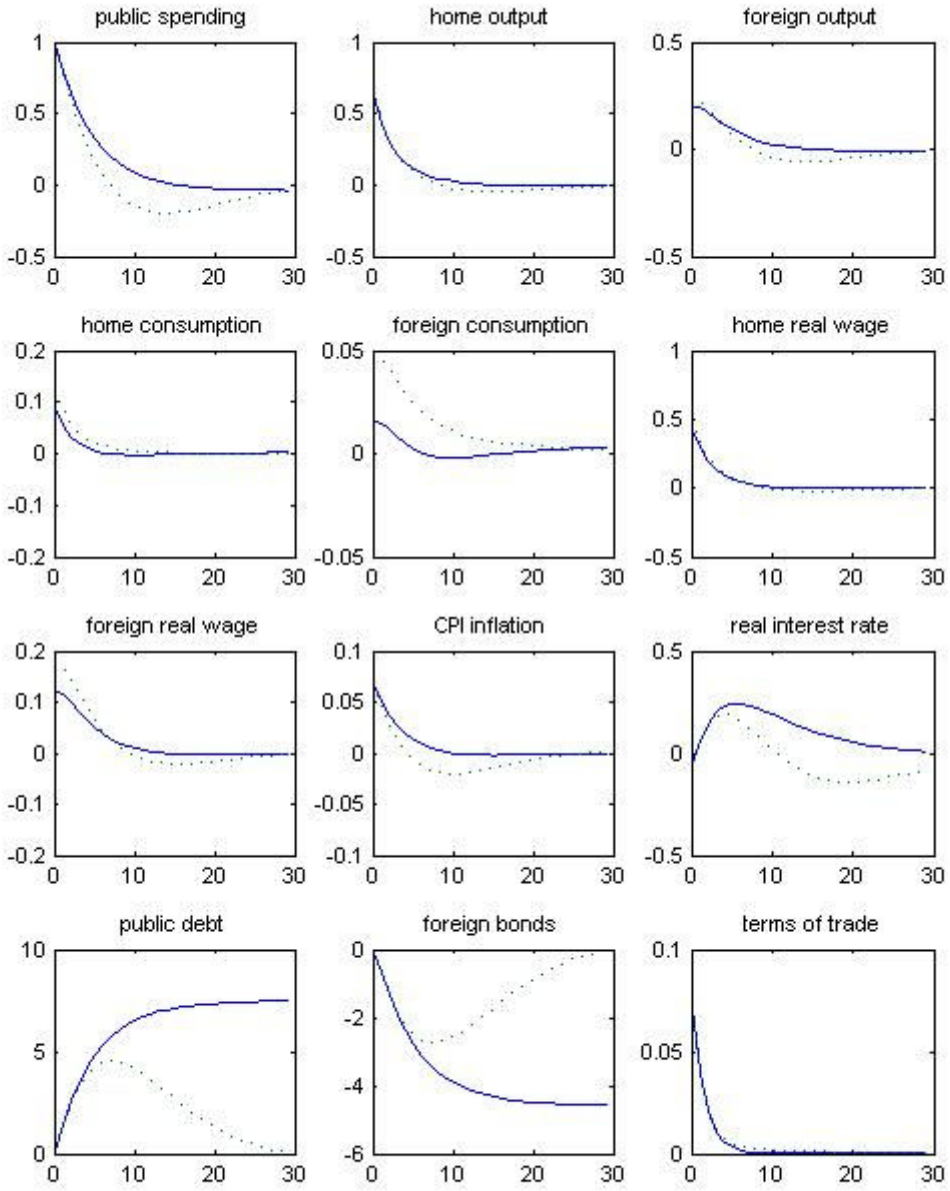

Figure 2. Impact of fiscal policy on consumption under weak and strong fiscal discipline