Financial Integration and Fiscal Policy Efficiency in a Monetary Union*

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Abstract

We develop a two-country New Open Economy Macroeconomics (NOEM) model with imperfect financial integration in a monetary union in order to analyze fiscal policy efficiency and the impact of financial integration on the international transmission of fiscal policy shocks. For this, we introduce imperfect financial integration into Obstfeld-Rogoff (1995, 1996) adapted to a monetary union setup. We show that a higher degree of financial integration decreases short run consumption and interest rate volatility in both countries while it increases the volatility in the long run following a balanced-budget increase in government spending in one of the countries. Interestingly, the degree of financial integration does not affect welfare.

JEL Classification: F41, E44, E62

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1. Introduction

According to the definition given by the European Central Bank (ECB), the market of a given set of instruments and services is fully integrated if all potential market participants face the same rules, have equal access to the market and are treated equally when they take action in the market. The existence of a common currency has allowed an important increase in financial integration between the members in the European Monetary Union. However, despite the common currency, not all the conditions are met in Europe in order to achieve full financial integration. The ECB report on financial integration indicates that there is still progress to be made on assets markets integration in Europe (ECB 2007).

Advancing financial integration has been one of the major objectives of the European Community. Indeed, the degree of financial integration matters to the European monetary authority as it considers the imperfect integration as an obstacle to the transmission of monetary policy in the Euro area. However, when it comes to fiscal policy, the question of whether financial integration matters to fiscal authorities is not that straightforward. To answer that, the effect of a higher financial integration on fiscal policy efficiency must be reconsidered.

In the traditional Mundell-Fleming models, fiscal policy analysis in a monetary union frame considers generally the perfect financial integration case. Indeed, the existence of a common currency is often thought to lead automatically to full financial integration. Nevertheless, the degree of financial integration is analyzed by the traditional literature under fixed exchange rates which is close to the monetary union case. In the fixed exchange rate setup, an increase in the degree of financial integration improves fiscal policy efficiency.

The intertemporal general (dis)equilibrium models, developed beginning from the 80s have paid little attention on the relation between fiscal policy and financial integration in a two country setup[2]. One exception is Glick and Hutchinson (1990) according to which, a higher financial integration in Europe reduces the impact of fiscal policy in the implementing country while increasing its effects on the other country.

[2] See Rankin (1994) and Frenkel-Razin (2002) for a survey.

The relation between fiscal policy and financial integration has been reconsidered, in a new open economy macroeconomics (NOEM) setup, by Sutherland (1996) and Pierdzioch (2004). However, they analyze this relation in a flexible exchange rate framework providing only numerical solutions. The limited number of research considering a monetary union or fixed exchange rates assume, generally, full financial integration[3].

The present paper aims to build on the preceding work concerning fiscal policy efficiency by introducing imperfect financial integration in a monetary union using a two-country NOEM model with imperfect competition on goods markets. For this, we extend the fixed exchange rate version of Obstfeld and Rogoff (1995, 1996) analyzed by Caselli (2001) and Coutinho (2005) in two ways. First, we adapt their fixed exchange rate setup to a monetary union framework and second, we introduce imperfect financial integration. In designing the imperfection of financial market integration, we follow Sutherland (1996) whose setup inspired also Senay (1998), Pierdzioch (2004, 2005) and Cenesiz and Pierdzioch (2006). In contrast to these papers, we offer analytical solutions and we define fiscal policy efficiency by its capacity to increase welfare rather than its capacity to improve national income.

We show that, while the degree of financial integration matters for the main macroeconomic variables such as consumption and output, it does not have any impact on the level of welfare. In contrast to Mundell-Fleming models, the degree of financial integration has no effect on the efficiency of fiscal policy in a NOEM model.

The paper is organized as follows: section 2 describes the setup while sections 3 and 4 define respectively, the long run and the short run deviations with respect to the steady state. Sections 5 and 6 give, respectively, the short run and long run effects of fiscal policy on real and financial sectors. Section 7 analyses the welfare effects of fiscal policy. Finally section 8 concludes.

2. The Model

The monetary union consists of two equally sized and identical countries, Home and Foreign, inhabited by a continuum of infinitely lived agents with perfect foresight. Agents in home country are indexed by $j \in [0, \frac{1}{2}]$ while foreign agents are indexed by $j \in (\frac{1}{2}, 1]$. Each agent produces a single

[3] See Koenig and Zeyneloglu (2006) for a survey of fiscal policy in NOEM literature.

differentiated good that is an imperfect substitute to other goods and consumes a basket of all home and foreign goods.

2. 1. Consumer Preferences

All agents in the union have identical preferences so that we will focus on the representative agent in each country. The preferences of the representative home agent *j* are given by the following utility function:

$$U_s^j = \sum_{s=t}^{\infty} \beta^{s-t} \left[\log C_s^j + \chi \log \frac{M_s^j}{P_s} - \frac{\kappa}{2} (y_s^j)^2 \right] \quad ; \quad \chi \ , \kappa > 0 \ \ ; \ \ 0 < \beta < 1 \tag{1}$$

The function (1), where β denotes the subjective discount factor, implies that a representative domestic agent *j* derives utility in period $s = t$ from private consumption C_t^j and from individual real money balances defined by M_t^j / P_t where P_t is the aggregate home currency price index. The last component represents the disutility the agent bears because of labour effort.

The consumption index in equation (1) is a CES type aggregation of all available goods in the world:

$$C_t^j = \left[\int_0^1 c_t^j(z)^{\frac{\theta-1}{\theta}} dz \right]^{\frac{\theta}{\theta-1}} \quad ; \quad \theta > 1 \tag{2}$$

where $c_t^j(z)$ is agent *j*'s consumption of good *z* and θ is the elasticity of substitution between goods produced in the world.

The corresponding price index is defined as the minimum expenditure required for consuming one unit of the composite consumption good *C* and is given as:

$$P_t = \left[\int_0^1 p_t(z)^{1-\theta} dz \right]^{\frac{1}{1-\theta}} \tag{3}$$

where $p(z)$ is the price of good *z*.

Without impediments to international trade, the price of each good is equalized across countries by the law of one price. Knowing that preferences are identical across countries and assuming a common currency, we can rewrite equation (3) and its foreign analogue as follows:

$$P_t = P_t^* = \left[\int_0^{1/2} p_t(z)^{1-\theta} dz + \int_{1/2}^{1} p_t^*(z)^{1-\theta} dz \right]^{\frac{1}{1-\theta}} = \left[\tfrac{1}{2} p_t(h)^{1-\theta} + \tfrac{1}{2} p_t^*(f)^{1-\theta} \right]^{\frac{1}{1-\theta}} \tag{4}$$

where $h \in [0, 1/2]$ and $f \in (1/2, 1]$. In equation (4), P_t^* and $p_t^*(f)$ denote respectively, the foreign overall price index and the price of a single foreign good at time *t*.

We assume the same price rigidity as in Obstfeld and Rogoff (1996). All prices are fixed during the actual period but they adjust to their flexible price level in the following period, without a new shock.

The relations concerning the foreign country are identical with asterisks denoting foreign variables.

2. 2. Goods Demand

Each producer satisfies the private and public demand addressed to his own good. The domestic consumer maximizes equation (2) under the simple fixed nominal budget constraint for consumption which gives the individual demand for a typical good *z* as follows:

$$c_t^j(z) = \left[\frac{p_t(z)}{P_t} \right]^{-\theta} C_t^j \tag{5a}$$

We assume that real per capita government consumption index G_t is similar to the private consumption index given in equation (2) so that there is no home bias. Then the public demand for a single good *z* is given by:

$$g_t(z) = \left[\frac{p_t(z)}{P_t} \right]^{-\theta} G_t \tag{5b}$$

The demand by foreign public and private agents are similar.

Aggregating (5a) and (5b) along with foreign analogues gives the total demand $y_t^d(z)$, faced by the producer of a single home good *z* where we dropped the index *j* assuming that all agents are symmetric:

$$y_t^d(z) = \left[\frac{p_t(z)}{P_t} \right]^{-\theta} (C_t^u + G_t^u) \tag{6}$$

In equation (6) $C_t^u = \tfrac{1}{2} C_t + \tfrac{1}{2} C_t^*$, and $G_t^u = \tfrac{1}{2} G_t + \tfrac{1}{2} G_t^*$ where the upper index *u* indicates union aggregates. The demand addressed to a typical producer of a foreign good is similar.

2.3. Financial Market Structure

We assume that domestic agents hold three types of assets: domestic money balances, domestic real bonds D paying return r, and foreign real bonds F paying return r^*. Foreign agents can also hold three types of assets: foreign money balances, real bonds of their own country F^* and real bonds of the other country D^*.

In order to characterize the imperfect financial integration, we simply assume that home and foreign agents are not treated equally when buying the bonds of the other country. All agents in all countries have free access to all bonds but home (foreign) residents must bear a cost when buying foreign (home) bonds[4]. We assume that purchases of national bonds do not include any costs.

Following Sutherland (1996), we define the transaction costs incurred by the domestic and foreign agents, denoted by Z and Z^* respectively, by the following relations :

$$Z_t = \tfrac{1}{2}\gamma\left(I_t\right)^2 \tag{7a}$$

$$Z_t^* = \tfrac{1}{2}\gamma(I_t^*)^2 \tag{7b}$$

In the above expressions, a positive value of the parameter γ implies imperfect financial integration. I_t (I_t^*) denotes the variations in home (foreign) country's claims on foreign (home) country :

$$I_t = F_{t+1} - (1+r_t^*)F_t \tag{8a}$$

$$I_t^* = D_{t+1}^* - (1+r_t)D_t^* \tag{8b}$$

We assume that the transaction costs born by domestic (foreign) agents are collected by a domestic (foreign) institution in the form of revenue so that the assumption of intermediation costs does not alter the resource constraint of the home (foreign) country.

2. 4. Comsumer's Maximisation

Home individual maximizes his utility given in equation (1) under the following budget constraint:

$$p_t y_t - P_t Z_t - P_t T_t - P_t C_t + M_{t-1} - M_t = P_t D_{t+1} - P_t(1+r_t)D_t + P_t^* F_{t+1} - P_t^*(1+r_t^*)F_t \tag{9}$$

[4] See Sutherland (1996) for alternative explanations of the transaction costs.

where we drop the index j since all agents are symmetric. In equation (9), r_t and r_t^* are the real pay off of home and foreign bonds between t-1 and t. T_t stands for lump-sum taxes. D_{t+1} and F_{t+1} denote home and foreign bond holdings in period t reaching maturity in period t+1.

We abstract from the possibility of government debt and assume that public spending is financed by lump-sum taxes. Then, public budget constraint can be written as:

$$G_t = T_t \tag{10}$$

Foreign private and public budget constraints are similar.

The maximization of utility (1), under budget constraint (9) taking into account the goods demand given in equation (6) and the transaction cost given in (7a), with respect to C_t, M_t, D_{t+1}, y_t and F_{t+1} gives the following first order conditions:

$$\frac{M_t}{P_t} = \chi C_t \left(\frac{1+i_{t+1}}{i_{t+1}} \right) \tag{11a}$$

$$C_{t+1} = \beta(1+r_{t+1})C_t \tag{11b}$$

$$y_t^{\frac{\theta+1}{\theta}} = \tfrac{\theta-1}{\theta\kappa}(C^w + G^w)^{\frac{1}{\theta}} C_t^{-1} \tag{11c}$$

$$(1+r_{t+1})(1+\gamma I_t) = (1+r_{t+1}^*)(1+\gamma I_{t+1}) \tag{11d}$$

In equation (11a), home nominal interest rate i_{t+1} is defined by the following relation:

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

Equation (11a) is the usual money demand equation implying that agents must be indifferent between consuming a unit of consumption good and saving the same amount of money, while deriving utility from cash holdings, in order to spend in the next period. Equation (11b) is the consumption Euler equation showing the consumption smoothing behaviour. Equation (11c) is the labour-leisure trade-off equation which simply states that the marginal disutility of producing an extra unit of output must equal the extra utility coming from spending the revenue that extra unit of production brings.

Equation (11d) expresses the international financial equilibrium condition with the transaction cost taken into account. Indeed, imposing $\gamma = 0$ leads to the equality of interest rates across countries as implied by the uncovered interest rate parity condition.

Foreign agents have similar relations with asterisks denoting foreign variables.

For the equilibrium we also need the following transversality condition:

$$\lim_{T\to\infty} \left(R_{t,t+T}D_{t+T} - R^{*}{}_{t,t+T}F_{t+T} + M_{t,t+T}\right) = 0 \tag{12}$$

where $R_{t,t+T}$ is defined as $\frac{1}{\prod_{v=t+1}^{t+T}(1+r_v)}$ with $R^{*}{}_{t,t+T}$ being the foreign analogue.

2.5. External Equilibrium and Money Supply

The external equilibrium conditions can be expressed in the following way for the two countries:

$$(F_{t+1} - F_t) - (D^{*}_{t+1} - D^{*}_t) = -r_t D^{*}_t + r^{*}_t F_t + \frac{p_t(h)y_t}{P_t} - C_t - G_t \tag{13a}$$

$$(D^{*}_{t+1} - D^{*}_t) - (F_{t+1} - F_t) = r_t D^{*}_t - r^{*}_t F_t + \frac{p^{*}_t(f)y^{*}_t}{P^{*}_t} - C^{*}_t - G^{*}_t \tag{13b}$$

According to (13a and b), external equilibrium is achieved when the current account balance (right-hand side of the equations above) is equal to the capital account balance (left-hand side of the equations above) in each country. The latter equals to the difference between the variation in foreign country's claims on home country ($D^{*}_{t+1} - D^{*}_t$**)** and the variation in home country's claims on foreign country ($F_{t+1} - F_t$**)**.

Money supply stays constant on the union level while it adjusts to money demand in each country.

3. Long Run Deviations

When a permanent fiscal shock hits the initial steady-state, the economy moves immediately to a new steady-state where prices are flexible. Since the model is nonlinear, we need to approximate it around a well-defined steady-state in order to determine analytically the long run impact of this shock. This will allow us to rewrite all the variables in terms of logarithmic deviations from this steady-state. Then we will derive union aggregates and country differences to solve for the relevant variables.

3. 1. The Initial Steady State

We consider a symmetric steady-state where an overbar denotes the constant steady-state values and where we drop the time subscripts.

In a steady state where all endogenous variables are constant, the consumption Euler equation given in (11b) implies $\bar{r} = \bar{r}^* = \dfrac{1-\beta}{\beta}$ where $\beta = \beta^*$ because of identical preferences.

In the steady state, total income coming from financial operations and from production must be equal to total consumption. Remembering that steady-state interest rates are equal across countries, the steady-state versions of equations (13) become:

$$\bar{C} = \bar{r}(\bar{F} - \bar{D}^*) + \frac{\bar{p}(h)\bar{y}}{\bar{P}} - \bar{G} \tag{14a}$$

$$\bar{C}^* = -\bar{r}(\bar{F} - \bar{D}^*) + \frac{\bar{p}^*(f)\bar{y}^*}{\bar{P}^*} - \bar{G}^* \tag{14b}$$

Assuming that, initially, countries' financial claims on each other as well as government spending in both countries are equal to zero, equations (14) imply $\dfrac{\bar{p}_0(h)}{\bar{P}_0} = \dfrac{\bar{p}_0^*(f)}{\bar{P}_0^*} = 1$. Hence $\bar{C}_0 = \bar{C}_0^* = \bar{C}^w = \bar{y}_0 = \bar{y}_0^*$, where the subscript 0 indicates the preshock initial steady state. Since there are no capital movements in this initial steady-state, transaction costs Z and Z^* are also absent.

Introducing this relation into the labour-leisure trade off equation in (11c) gives:

$$\bar{y}_0 = \bar{y}_0^* = \left(\frac{\theta - 1}{\theta\kappa}\right)^{\frac{1}{2}} \tag{15}$$

Equation (15) and the equality between steady-state output and consumption imply:

$$\frac{\bar{M}_0}{\bar{P}_0} = \frac{\bar{M}_0^*}{\bar{P}_0^*} = \frac{\chi}{1-\beta}\left(\frac{\theta - 1}{\theta\kappa}\right)^{\frac{1}{2}} \tag{16}$$

3.2. Long Run Consumption and Output: Union Aggregates and Country Differences

The log-linearized version of the long run model is given in appendix A. The deviation of any long run variable $\bar{x}$ with respect to its initial steady-state value $\bar{x}_0$ is denoted by an overbar and a tilde, so that $\tilde{\bar{x}} \cong (\bar{x} - \bar{x}_0)/\bar{x}_0$. As the initial value of public spending and foreign bond holdings are assumed to be zero, the deviations of these variables are defined with respect to the initial steady-state value of consumption so that $\tilde{\bar{G}} = d\bar{G}/\bar{C}_0$, $\tilde{\bar{G}}^* = d\bar{G}^*/\bar{C}_0^*$, $\tilde{I} = dI/\bar{C}_0$, $\tilde{I}^* = dI^*/\bar{C}_0^*$. Since the economy reaches its new steady state immediately after the shock hits, in what follows we can drop time subscripts.

In order to define long run home and foreign consumption as well as long run home and foreign production, we begin by deriving the deviations in unionwide consumption and production. Then, we proceed with relative home consumption and production.

Combining the population weighed average of home and foreign labour-leisure trade off equations given in (A4a and b) with goods market equilibrium condition (A6), we get:

$$\tilde{\bar{y}}^u = \tfrac{1}{2}\tilde{\bar{G}}^u \ ; \tilde{\bar{C}}^u = -\tfrac{1}{2}\tilde{\bar{G}}^u \tag{17}$$

According to (17), a permanent increase in unionwide public spending leads to a fall in long run world consumption while it increases long run world production.

Combining long run home and foreign consumption gap given by the difference between (A1a and b) and the long run home and foreign output gap given by the difference between (A3a and b) and (A4a and b) yields the following expressions:

$$\tilde{\bar{C}} - \tilde{\bar{C}}^* = \frac{\theta+1}{\theta}\bar{r}(\tilde{I} - \tilde{I}^*) - \frac{\theta+1}{2\theta}(\tilde{\bar{G}} - \tilde{\bar{G}}^*) \tag{18}$$

$$\tilde{\bar{y}} - \tilde{\bar{y}}^* = -\bar{r}(\tilde{I} - \tilde{I}^*) + \tfrac{1}{2}(\tilde{\bar{G}} - \tilde{\bar{G}}^*) \tag{19}$$

As we will see in a while, the transaction cost will affect the long run relative consumption and output through its effect on net capital movements $(\tilde{I} - \tilde{I}^*)$. For that, we need to determine the short run equilibrium.

4. Short Run Deviations

In the short run, individual prices are fixed. Due to the common currency, the overall price index is also fixed in the short run. Since prices are higher than the marginal costs, monopolistic producers are willing to meet extra demand for the same price. Therefore, supply will be demand determined in the short run.

In order to evaluate the short run effects of a fiscal shock, we need to approximate the short run model around the initial steady state. The resulting log-linear version is given in appendix A. In the short run, the deviation of any variable x from the initial steady state is indicated by a tilde so that $\tilde{x} \cong (x - \overline{x}_0)/\overline{x}_0$. Since we look only at one period changes in the economy, we can drop the time subscripts.

As in the long run analysis, we will determine the deviations in union aggregates and relative consumption and production.

In a monetary union with an independent central bank, money market equilibrium requires that money supply in the union be equal to the sum of the money demand in the two member countries. Since we focus on fiscal policy, we will assume that the central bank pursues a passive monetary policy so that the unionwide money supply will remain unchanged both in the short and in the long run. Taking a population weighted average of long run money demand equations given in (A5a and b) and plugging the result in the population weighted average of short run money demand equations (A9a and b) to substitute for long run price levels gives a relationship between short run world consumption and average interest rate as follows:

$$\tilde{r} + \tilde{r}^* = \frac{2}{1-\beta}\tilde{\tilde{C}}^u + 2\tilde{C}^u \tag{20a}$$

Another relation can be derived from the population weighted average of consumption Euler equations given in (A8a and b):

$$\tilde{r} + \tilde{r}^* = \frac{2}{1-\beta}\left(\tilde{\tilde{C}}^u - \tilde{C}^u\right) \tag{20b}$$

Combining the two relations implies that the short run deviation of union consumption from its initial steady state is zero. A fiscal expansion does not crowd out private consumption in the short run because output is completely demand driven. Private consumption is not undermined since there are no price changes due to extra demand. Then the short run equilibrium on goods market implies $\tilde{y}^u = \tilde{G}^u$.

Subtracting foreign consumption Euler equation (A8b) from home (A8a) gives:

$$\tilde{C} - \tilde{C}^* = (\tilde{\tilde{C}} - \tilde{\tilde{C}}^*) - (1-\beta)(\tilde{r} - \tilde{r}^*) \tag{21}$$

Equation (21) captures the effect of the degree of financial integration. When integration is perfect, the interest rate gap is zero and the long run home relative consumption deviation is equal to the short run deviation. The reason is that, with perfectly integrated markets, agents in both countries face the same interest rate and hence the country consumption profiles are affected in the same way. However, when assets are imperfect substitutes, the interest rate differential tilts the home consumption profile relative to the foreign. If, for example, home interest rate increases relative to the foreign, short run home consumption decreases compared to short run foreign consumption because home agents are induced to save more with respect to foreign agents. In the long run, this leads to a higher increase in home consumption relative to the foreign.

5. Short Run Effects of Fiscal Policy

In the short run, a balanced-budget increase in home public spending affects the consumption and production of the two countries, as well as the interest rates, international capital movements and monetary equilibrium.

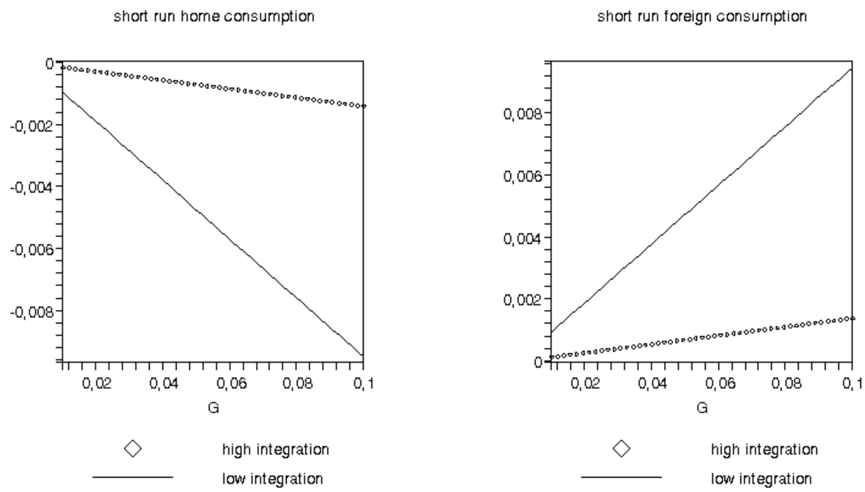
5.1. The Effects of Fiscal Policy on Consumption and Output

Equations (B3a and b) and (B4) imply that following a temporary increase in home government spending ($\tilde{G} \succ 0,\ \tilde{\tilde{G}} = 0$), home consumption decreases and foreign consumption increases while production increases in the same way in both countries. The fall in home consumption is due to the negative welfare effect of the tax. Since government spending increases more than the fall in private consumption, domestic output increases. Because of the no home bias assumption, home public demand expansion has a positive effect on foreign output while the decrease in home private demand has a negative effect. However, the net effect is positive and foreign output also increases in the short run. Higher income in the foreign country leads to higher foreign consumption.

Note that, in contrast to the flexible exchange rate setup, the deviations of production are of the same magnitude in the two countries. This is because, with the same currency across countries and sticky prices, the expenditure switching effect of the terms of trade is absent in the short run. The only effect is the expenditure shifting effect of home public spending which is symmetric across countries.

The effect of fiscal policy on short run consumption decreases as financial integration increases (γ decreases). This is illustrated in Figure 1 which depicts the effects of an increase in home public spending on short run home and foreign consumption for high and low degrees of financial integration[5].

Figure 1:



(a) (b)

The fall (increase) in home (foreign) consumption is higher when financial integration is low. Indeed, an increase in γ induces an increase in home interest rate with respect to the foreign. Therefore, home (foreign) agents are induced to adjust their current consumption downwards (upwards) in anticipation of higher (lower) future consumption.

Note that the degree of financial integration does not affect short run output because with fixed prices and a common currency, the short run supply block of the model is independent of the current account equation which includes the cost.

When the home fiscal shock is permanent ($\tilde{G} = \tilde{\tilde{G}} \succ 0$), agents anticipate a higher deviation in their future consumption compared to the temporary shock, which induces a higher adjustment of current consumption. Therefore, permanent fiscal expansion has a higher impact on short run consumption with respect to temporary fiscal expansion. The effects of a permanent fiscal shock on output are the same with those of a temporary shock.

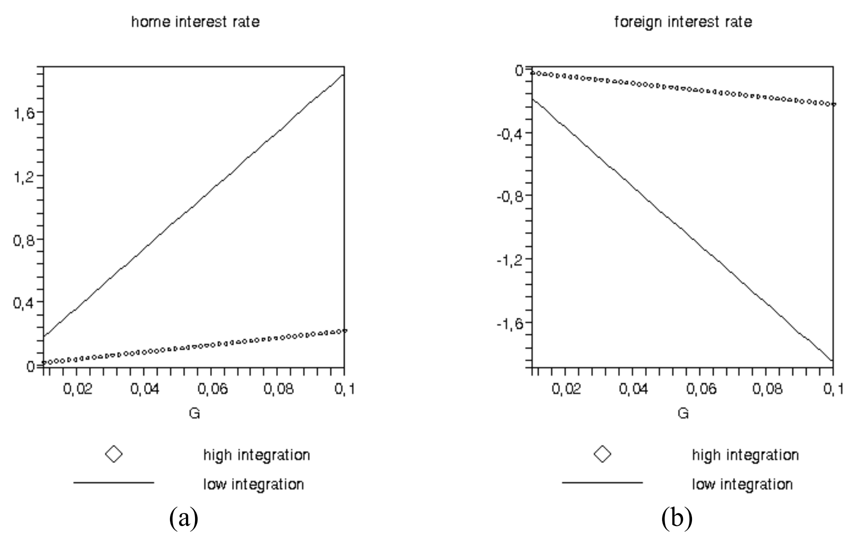
5.2. The Effects of Fiscal Policy on Interest Rates and Capital Movements

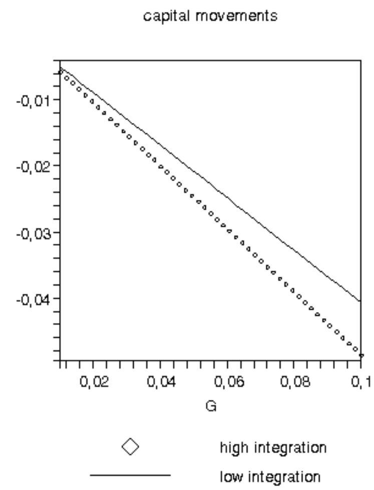
[5] We took the following parameter values for numerical illustrations. $\theta = 6$, $\beta = 0.99$, $\gamma = 0.1$ for low value and 1 for high value, κ=1.

According to (B5a), a temporary home fiscal expansion increases home interest rate. This is because, the fall in short run home consumption relative to long run induces home agents to sell domestic bonds as required by consumption smoothing. This reduces the price of domestic bonds and increases the home interest rate. By the same reason, foreign agents buy foreign bonds and foreign interest rate falls (see equation B5b).

The positive interest rate gap leads to a net capital inflow towards the home country as implied by equation (B2b). This inflow is more pronounced when financial integration is high (γ is low) as illustrated in Figure 2 which depicts the response of home and foreign interest rates as well as the capital inflow, for high and low degrees of γ following a temporary home fiscal shock. Indeed, a high degree of financial integration implies a lower transaction cost which induces a higher net capital inflow. Our model nests the Obstfeld and Rogoff (1996) case of full financial integration under fixed exchange rates. Indeed, imposing $\gamma = 0$ leads to the same results as in Coutinho (2005).

Figure 2:





(c)

The effects of a permanent fiscal expansion are similar to those of a temporary fiscal shock except for the home interest rate. Indeed, when the shock is permanent the effect on home interest rate is reversed. This is because; home agents anticipate a fall in future consumption relative to current consumption due to permanent taxes. This induces them to accumulate domestic bonds as consumption smoothing requires. Hence, home interest rate falls. Foreign agents will also foresee a fall in their future consumption relative to current, which will induce them to accumulate foreign bonds. Hence foreign interest rate will fall as in the temporary shock case. Since the fall in future consumption relative to current consumption is higher in the foreign country foreign interest rate will fall more than the home interest rate.

5.3. Fiscal Policy and the Monetary Equilibrium

Because of the common currency assumption money supply adjusts to money demand in each country. However, on the union level, short run money supply is constant in nominal and real terms. Hence, money demand in the union has to adjust following a fiscal shock through deviations in interest rates, expected average prices and short run global consumption as implied by (A9c).

Following a temporary or a permanent shock, short run union wide consumption does not move as implied by equations (B3a) and (B3b). Furthermore, $\tilde{r} + \tilde{r}^* = 0$ following a temporary shock. Then, the expected deviation of long run average prices in the union must also be zero. However, if the fiscal shock is permanent, both interest rates fall, which implies $\tilde{r} + \tilde{r}^* \prec 0$. Then, the monetary equilibrium is achieved through the anticipation of a higher average price level in the union.

6. Long Run Effects of Fiscal Policy

In the long run, where prices are flexible, the economy reaches a new steady-state immediately in the aftermath of a balanced-budget increase in public spending. The fiscal shock affects consumption and output in both countries, as well as prices and monetary equilibrium.

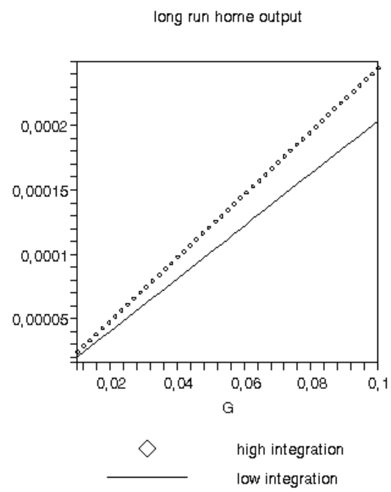
6.1. The Effects of Fiscal Policy on Long Run Consumption and Output

We already said that a temporary increase in home government spending induces a net capital inflow towards the home country according to equation (B2b). Hence, in the long run the interest burden increases at home while financial income increases in the foreign country. This, in turn, induces a fall in long run home consumption by the same amount as the increase in long run foreign consumption (see equation B7a and B7b). Therefore, marginal utility of consumption increases at home and home agents shift out of leisure into work as implied by the labour-leisure trade-off equation. Home output increases (B9a), which allows to meet the extra demand for home goods. In the foreign country, the consumption increase lowers the marginal utility of consumption. Foreign agents increase their demand for leisure and foreign output decreases (B9b). This reduction corresponds to the fall in home private demand for foreign goods as well as the fall in foreign private demand due to the expenditure switching effect of the long run terms of trade.

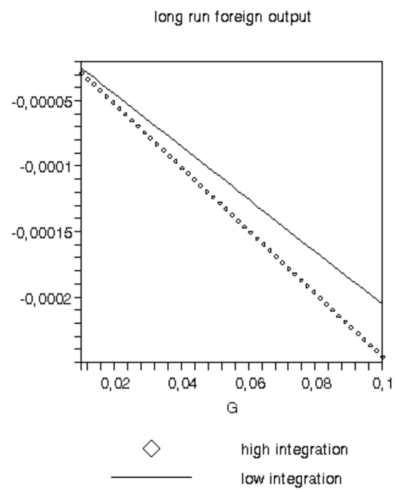
Long run consumption and output deviations following a temporary fiscal expansion decrease as financial integration deteriorates. Indeed, as illustrated in Fig.2c, for high values of γ home agents accumulate less debt following a temporary fiscal shock, which limits the fall (increase) in the long run disposable income and consumption at home (abroad).

Figure 3 illustrates long run home and foreign consumption as well as long run home and foreign output for high and low values of γ following a temporary fiscal shock.

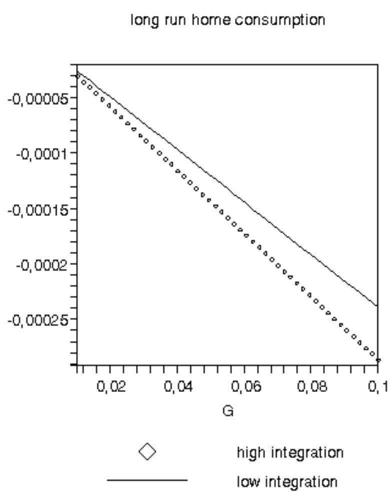
Figure 3:



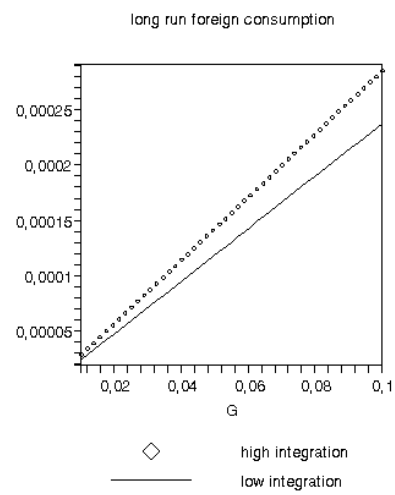
(a)



(b)



(c)



(d)

A permanent home fiscal expansion reduces home long run consumption and foreign output while it increases foreign long run consumption and home output.

The impact of a permanent fiscal shock on long run home consumption is higher than that of a temporary shock. Indeed, home agents suffer not only from an increase in debt burden but also from permanently higher taxes in order to finance the public spending. In the foreign country, agents enjoy higher interest revenues along with higher demand for foreign goods. Since permanent public spending decreases home consumption more than when the spending is temporary, it leads to a higher increase in home output compared to the temporary shock case. However, foreign output decreases less following a permanent shock with respect to the temporary shock because of the expenditure switching effect of relative prices.

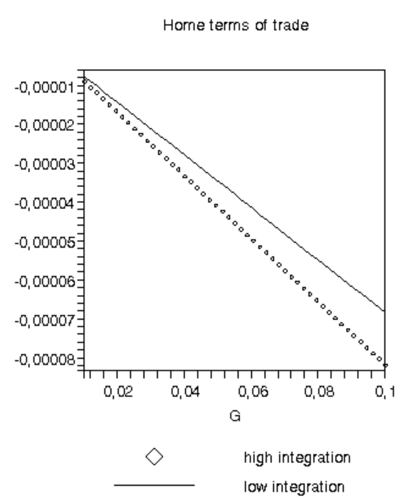
6.2. The Effect of Fiscal Policy on Monetary Equilibrium and the Terms of Trade

According to equation (17) a permanent home fiscal expansion reduces the union consumption. Knowing that the union's nominal money supply remains unchanged, the union's average price level has to increase in order to maintain the long run monetary equilibrium (see equation B11). Note that, a temporary fiscal shock does not affect union's real money supply since the union's average price level remains unchanged following temporary shocks.

According to equation (B10), a temporary home fiscal expansion deteriorates the terms of trade because of its effects on relative consumption and output as well as on net capital movements. Temporary fiscal policy reduces home prices $p(h)$ by the same amount it increases the foreign prices $p(f)$ since home output increases by the same amount as the decrease in foreign output.

The terms of trade deteriorates less under imperfect financial integration compared to the perfect integration case as illustrated by Figure 4. This is because, under imperfect financial integration home (foreign) output increases (decreases) less.

Figure 4:



The terms of trade deteriorates more when the shock is permanent with respect to the temporary shock case. Furthermore, foreign prices increase more than the decrease in home prices and average price level in the union increases, which re-equilibrates the union's money market.

7. Welfare Effects of Fiscal Policy

In order to evaluate the effects of a fiscal expansion in one country on the welfare of both countries, we will consider, as it is now traditional in this literature, only the real part of utility neglecting the utility coming from real balances. Then the home utility function takes the following form:

$$U_t \equiv \sum_{s=t}^{\infty} \beta^{s-t} \left(\log C_s - \tfrac{\kappa}{2} y_s^2 \right) \tag{1'}$$

Totally differentiating the equation above and evaluating at the initial steady state gives:

$$dU = \tilde{C} - \kappa \overline{y}_0^2 \tilde{y} + \frac{1}{\overline{r}} \left[\tilde{\tilde{C}} - \kappa \overline{y}_0^2 \tilde{\tilde{y}} \right]$$

Substituting equation (B9a) for long run output, (B4) for short run output, (B7a) for long run consumption, (B3a) for short run consumption and plugging in the value of output in the initial steady state given in equation (15), we get:

$$dU = -\frac{2\theta - 1}{2\theta} \tilde{G} + \frac{1}{2\theta} \tilde{G}^* - \frac{4\theta - 1}{4\theta \overline{r}} \tilde{\tilde{G}} + \frac{1}{4\theta \overline{r}} \tilde{\tilde{G}}^* \tag{22}$$

According to (22), a temporary or permanent balanced-budget home fiscal expansion decreases the welfare of domestic agents because of its negative impact on consumption and leisure in both short and long run. Hence, tax-financed fiscal policy is *beggar-thyself*.

An increase in γ has opposite effects on short run and long run welfare. Indeed, in the short run, an increase in γ amplifies the fall in home consumption while it has no effects on home output. This implies that short run home welfare is lower under imperfect financial integration with respect to full integration.

In the long run, lower debt accumulation under imperfect financial integration mitigates the fall in the long run domestic consumption. Moreover, long run output increases less, as γ increases, because of the lower expenditure switching effect. Both of these effects imply that long run welfare is higher under imperfect financial integration.

Equation (22) shows that welfare is not affected by the degree of financial integration. Indeed, this expression is the same with the one derived in Coutinho (2005) for the perfect mobility case under fixed exchange rates. This implies that the decrease in short run welfare due to lower financial integration exactly offsets the increase in the long run welfare.

According to (22), a foreign fiscal expansion increases home welfare because it increases consumption and decreases production in the short run. This positive effect is mitigated in the long run because of the lower increase in home leisure. A home fiscal expansion increases foreign welfare in the same way. Hence, tax-financed fiscal policy is *prosper-thy-neighbour*.

The following table resumes the fiscal policy impact on relevant variables under imperfect financial integration. The positive or negative sign is associated with the effect of fiscal policy on the variables while the letters *a* and *m* point out respectively to an amplification or a mitigation of the effects of fiscal policy following a decrease in financial integration (an increase in γ). The number 0 denotes that the effect of fiscal policy on the variable is not affected by the degree of financial integration. For example, a permanent home fiscal expansion decreases long run home consumption and the effect is mitigated as the degree of financial integration decreases while the effect on short run home consumption is a fall and this effect is amplified by the imperfect degree of financial integration.

Table 1: Effects of fiscal policy under imperfect financial integration

$dG-dG^{*}>0$	$\tilde{C}$	$\tilde{C}^{*}$	$\tilde{y}$	$\tilde{y}^{*}$	$\tilde{\tilde{C}}$	$\tilde{\tilde{C}}^{*}$	$\tilde{\tilde{y}}$	$\tilde{\tilde{y}}^{*}$	$\tilde{r}$	$\tilde{r}^{*}$	$\tilde{I}-\tilde{I}^{*}$	dU
temporary	-/a	+/a	+/0	+/0	-/m	+/m	+/m	-/m	+/a	-/a	-/m	-/0
permanent	-/a	+/a	+/0	+/0	-/m	+/m	+/m	-/m	-/a	-/a	-/m	-/0

8. Conclusion

The paper aims to contribute to the NOEM literature by introducing imperfect financial integration in a two country general equilibrium model with optimizing agents. Much of the analysis in the NOEM literature is limited to perfect financial integration case. Some exceptions consider the degree of financial integration under flexible exchange rates. Moreover, they provide only numerical solutions. Since, one of the aims of the NOEM literature is to provide an alternative to the M-F type of models, we find it important to provide analytical solutions. In this aim, we extend the fixed exchange rate version of Obstfeld and Rogoff (1995), proposed by Caselli (2001) and Coutinho (2005), by introducing imperfect capital mobility. In this way, we also extend Sutherland (1996) and Pierdzioch (2001) by assuming a monetary union.

The paper uses this setup to reconsider the implications of traditional models. Namely, we show the inefficiency of a balanced-budget fiscal expansion while the same policy proves to be efficient in M-F type of models. The contrast comes from the difference concerning the efficiency criterion between the traditional and new literature. In the NOEM literature, efficiency is measured by the welfare while in M-F models it is measured by the output or real income. For the same reason, M-F and NOEM models have different implications on the impact of financial integration on the efficiency of fiscal policy. Indeed, fiscal policy efficiency measured by its effect on output is affected by the degree of financial integration while the efficiency measured by its effect on welfare is independent of the financial transaction costs. Therefore, in a NOEM model, the question of financial integration which is important for a central bank is not crucial for the fiscal authorities in a monetary union. Fiscal authorities may nevertheless prefer to improve financial integration since higher financial integration decreases the volatility of short run consumption and interest rate following unanticipated fiscal shocks stemming from abroad.

We have to note that our assumption of pure waste nature of public spending is crucial for the inefficiency of fiscal policy. Useful government spending as in Ganelli (2003) or Corsett-Pesenti (2001) would probably lead to an increase in welfare following a fiscal expansion. However, welfare would be independent of the degree of financial integration even with useful public spending.

APPENDIX A: Log-linearized model

Long run

Current account

$$\tilde{\bar{C}} = \bar{r}(\tilde{I} - \tilde{I}^{*}) + \tilde{\bar{p}}(h) + \tilde{\bar{y}} - \tilde{\bar{P}} - \tilde{\bar{G}} \qquad \text{(A1a)}$$

$$\tilde{\bar{C}}^{*} = -\bar{r}(\tilde{I} - \tilde{I}^{*}) + \tilde{\bar{p}}^{*}(f) + \tilde{\bar{y}}^{*} - \tilde{\bar{P}}^{*} - \tilde{\bar{G}}^{*} \qquad \text{(A1b)}$$

Price indexes

$$\tilde{\bar{P}} = \tilde{\bar{P}}^{*} = \tfrac{1}{2}\left[\tilde{\bar{p}}(h) + \tilde{\bar{p}}^{*}(f)\right] \qquad \text{(A2)}$$

Goods demand

$$\tilde{\bar{y}} = \theta\left[\tilde{\bar{P}} - \tilde{\bar{p}}(h)\right] + \tilde{\bar{C}}^{u} + \tilde{\bar{G}}^{u} \qquad \text{(A3a)}$$

$$\tilde{\bar{y}}^{*} = \theta\left[\tilde{\bar{P}}^{*} - \tilde{\bar{p}}^{*}(f)\right] + \tilde{\bar{C}}^{u} + \tilde{\bar{G}}^{u} \qquad \text{(A3b)}$$

Labour-leisure trade-off

$$(\theta + 1)\tilde{\bar{y}} = -\theta\tilde{\bar{C}} + \tilde{\bar{C}}^{u} + \tilde{\bar{G}}^{u} \qquad \text{(A4a)}$$

$$(\theta + 1)\tilde{\bar{y}}^{*} = -\theta\tilde{\bar{C}}^{*} + \tilde{\bar{C}}^{u} + \tilde{\bar{G}}^{u} \qquad \text{(A4b)}$$

Money demand

$$\tilde{\bar{M}} - \tilde{\bar{P}} = \tilde{\bar{C}} - \beta\bar{r} \qquad \text{(A5a)}$$

$$\tilde{\bar{M}}^{*} - \tilde{\bar{P}}^{*} = \tilde{\bar{C}}^{*} - \beta\bar{r} \qquad \text{(A5b)}$$

Global goods market equilibrium

$$\tilde{\bar{y}}^{u} = \tilde{\bar{C}}^{u} + \tilde{\bar{G}}^{u} \qquad \text{(A6)}$$

Short run

Goods demand

$$\tilde{y} = \tilde{y}^{*} = \tilde{C}^{u} + \tilde{G}^{u} \qquad \text{(A7)}$$

Consumption Euler Equations

$$\tilde{\bar{C}} = \tilde{C} + (1 - \beta)\tilde{r} \qquad \text{(A8a)}$$

$$\tilde{\bar{C}}^{*} = \tilde{C}^{*} + (1 - \beta)\tilde{r}^{*} \qquad \text{(A8b)}$$

Money demand

$$\tilde{M} = \tilde{C} - \beta\tilde{r} - \tfrac{\beta}{1-\beta}\tilde{\bar{P}} \qquad \text{(A9a)}$$

$$\tilde{M}^{*} = \tilde{C}^{*} - \beta\tilde{r}^{*} - \tfrac{\beta}{1-\beta}\tilde{\bar{P}}^{*} \qquad \text{(A9b)}$$

$$\tilde{M}^{u} = \tilde{C}^{u} - \beta(\tilde{r} + \tilde{r}^{*}) - \frac{\beta}{1-\beta}\tilde{\bar{P}}^{u} \qquad \text{(A9c)}$$

Current account

$$\tilde{I} - \tilde{I}^{*} = \tilde{y} - \tilde{C} - \tilde{G} \qquad \text{(A10a)}$$

$$\tilde{I}^{*} - \tilde{I} = \tilde{y}^{*} - \tilde{C}^{*} - \tilde{G}^{*} \qquad \text{(A10b)}$$

Interest rate gap

$$\tilde{r} - \tilde{r}^{*} = -\frac{\gamma\bar{C}_{0}}{2(1-\beta)}(\tilde{I} - \tilde{I}^{*}) \qquad \text{(A11)}$$

APPENDIX B

In order to solve for individual variations of the relevant variables we use the Aoki method (1981) which indicates that for any home variable $x = x^{u} + 0{,}5(x - x^{*})$ and for any foreign variable $x^{*} = x^{u} - 0{,}5(x - x^{*})$.

1. Short Run

The Effects on Consumption and net capital inflow

The following system of two equations allows to solve for the relative short run consumption and net capital inflow deviations :

$$(\tilde{I} - \tilde{I}^{*}) = -\tfrac{1}{2}\left[(\tilde{C} - \tilde{C}^{*}) + (\tilde{G} - \tilde{G}^{*})\right] \qquad \text{(B1a)}$$

$$(\tilde{I}-\tilde{I}^*) = \frac{2\theta}{2\bar{r}(\theta+1)+\theta\gamma\bar{C}_0}(\tilde{C}-\tilde{C}^*) + \frac{(\theta+1)}{2\bar{r}(\theta+1)+\theta\gamma\bar{C}_0}(\tilde{\tilde{G}}-\tilde{\tilde{G}}^*) \tag{B1b}$$

Equation (B1a) is obtained by subtracting equation (A10b) from (A10a) taking into account that short run deviation of relative output is zero (equation (A7)).

To obtain equation (B1b), we first plug (21) into (18) in order to eliminate long run consumption. Then, we make use of equation (A11) to eliminate the interest rate gap.

Solving the system consisting of equations (B1a) and (B1b) gives the following expressions:

$$\tilde{C}-\tilde{C}^* = -\frac{1}{2\Psi+\theta\gamma\bar{C}_0}\left[\left\{2\bar{r}(\theta+1)+\theta\gamma\bar{C}_0\right\}(\tilde{G}-\tilde{G}^*)+2(\theta+1)(\tilde{\tilde{G}}-\tilde{\tilde{G}}^*)\right] \tag{B2a}$$

$$\tilde{I}-\tilde{I}^* = \frac{1}{2\Psi+\theta\gamma\bar{C}_0}\left[-2\theta(\tilde{G}-\tilde{G}^*)+(\theta+1)(\tilde{\tilde{G}}-\tilde{\tilde{G}}^*)\right] \tag{B2b}$$

where $\Psi = \bar{r}(\theta+1)+2\theta$.

Using the Aoki formula and remembering that $\tilde{C}^u = 0$, we can derive the short run home and foreign consumption deviation following a temporary ($\tilde{G}-\tilde{G}^* \neq 0$; $\tilde{\tilde{G}} = \tilde{\tilde{G}}^* = 0$) or a permanent ($\tilde{G}-\tilde{G}^* = \tilde{\tilde{G}}-\tilde{\tilde{G}}^* \neq 0$) home fiscal expansion :

$$\tilde{C} = -\frac{1}{2\left[2\Psi+\theta\gamma\bar{C}_0\right]}\left[\left\{2\bar{r}(\theta+1)+\theta\gamma\bar{C}_0\right\}(\tilde{G}-\tilde{G}^*)+2(\theta+1)(\tilde{\tilde{G}}-\tilde{\tilde{G}}^*)\right] \tag{B3a}$$

$$\tilde{C}^* = \frac{1}{2\left[2\Psi+\theta\gamma\bar{C}_0\right]}\left[\left\{2\bar{r}(\theta+1)+\theta\gamma\bar{C}_0\right\}(\tilde{G}-\tilde{G}^*)+2(\theta+1)(\tilde{\tilde{G}}-\tilde{\tilde{G}}^*)\right] \tag{B3b}$$

The Effects on relative output

Since (A7) implies that $\tilde{y}-\tilde{y}^* = 0$ and $\tilde{y}^u = \tilde{G}^u$ because $\tilde{C}^u = 0$, we have :

$$\tilde{y} = \tilde{y}^* = \tfrac{1}{2}(\tilde{G}+\tilde{G}^*) \tag{B4}$$

The Effects on relative interest rates

The introduction of (B2b) into (A11) gives the interest rate gap in reduced form while equation (20b) gives the sum of the interest rates. Knowing that $\tilde{C}^u = 0$ and $\tilde{\tilde{C}}^u = -0{,}5\tilde{\tilde{G}}^u$, we can use these two relations to solve for the individual deviations of home and foreign interest rates:

$$\tilde{r}=\frac{\theta\gamma\bar{C}_0}{2(1-\beta)\left[2\Psi+\theta\gamma\bar{C}_0\right]}(\tilde{G}-\tilde{G}^*)-\frac{2\Psi+(2\theta+1)\gamma\bar{C}_0}{4(1-\beta)\left[2\Psi+\theta\gamma\bar{C}_0\right]}\tilde{\tilde{G}}+\frac{\gamma\bar{C}_0-2\Psi}{4(1-\beta)\left[2\Psi+\theta\gamma\bar{C}_0\right]}\tilde{\tilde{G}}^* \tag{B5a}$$

$$\tilde{r}^*=-\frac{\theta\gamma\bar{C}_0}{2(1-\beta)\left[2\Psi+\theta\gamma\bar{C}_0\right]}(\tilde{G}-\tilde{G}^*)+\frac{\gamma\bar{C}_0-2\Psi}{4(1-\beta)\left[2\Psi+\theta\gamma\bar{C}_0\right]}\tilde{\tilde{G}}-\frac{2\Psi+(2\theta+1)\gamma\bar{C}_0}{4(1-\beta)\left[2\Psi+\theta\gamma\bar{C}_0\right]}\tilde{\tilde{G}}^* \tag{B5b}$$

2. Long Run

The Effects on consumption

In order to solve for long run consumption, we introduce the interest gap from (A11), net capital movements from (B2b) and short run relative consumption from (B2a) into (21). This gives the long run relative consumption deviation:

$$\tilde{\tilde{C}}-\tilde{\tilde{C}}^*=-\frac{\bar{r}(\theta+1)}{2\Psi+\theta\gamma\bar{C}_0}\left[2(\tilde{G}-\tilde{G}^*)+\frac{4+\gamma\bar{C}_0}{2\bar{r}}(\tilde{\tilde{G}}-\tilde{\tilde{G}}^*)\right] \tag{B6}$$

Introducing (B6) and (17) into the Aoki formula gives :

$$\tilde{\tilde{C}}=-\frac{2(\Psi+2\theta+2)+(2\theta+1)\gamma\bar{C}_0}{4(2\Psi+\theta\gamma\bar{C}_0)}\tilde{\tilde{G}}+\frac{4(\theta+1)-2\Psi+\gamma\bar{C}_0}{4(2\Psi+\theta\gamma\bar{C}_0)}\tilde{\tilde{G}}^*-\frac{\bar{r}(\theta+1)}{2\Psi+\theta\gamma\bar{C}_0}(\tilde{G}-\tilde{G}^*) \tag{B7a}$$

$$\tilde{\tilde{C}}^*=\frac{4(\theta+1)-2\Psi+\gamma\bar{C}_0)}{4(2\Psi+\theta\gamma\bar{C}_0)}\tilde{\tilde{G}}-\frac{2(\Psi+2\theta+2)+(2\theta+1)\gamma\bar{C}_0}{4(2\Psi+\theta\gamma\bar{C}_0)}\tilde{\tilde{G}}^*+\frac{\bar{r}(\theta+1)}{2\Psi+\theta\gamma\bar{C}_0}(\tilde{G}-\tilde{G}^*) \tag{B7b}$$

The Effects on output

Combining equations (B6) and the difference between (A4a) and (A4b) gives:

$$\tilde{\tilde{y}}-\tilde{\tilde{y}}^*=\frac{\theta\bar{r}}{2\Psi+\theta\gamma\bar{C}_0}\left[2(\tilde{G}-\tilde{G}^*)+\frac{4+\gamma\bar{C}_0}{2\bar{r}}(\tilde{\tilde{G}}-\tilde{\tilde{G}}^*)\right] \tag{B8}$$

Introducing (B8) and (17) into the Aoki formula, we obtain:

$$\tilde{\tilde{y}}=\frac{\Psi+2\theta+\theta\gamma\bar{C}_0}{2\left[2\Psi+\theta\gamma\bar{C}_0\right]}\tilde{\tilde{G}}+\frac{\bar{r}(\theta+1)}{2\left[2\Psi+\theta\gamma\bar{C}_0\right]}\tilde{\tilde{G}}^*+\frac{\theta\bar{r}}{\left[2\Psi+\theta\gamma\bar{C}_0\right]}(\tilde{G}-\tilde{G}^*) \tag{B9a}$$

$$\tilde{\tilde{y}}^*=\frac{\bar{r}(\theta+1)}{2\left[2\Psi+\theta\gamma\bar{C}_0\right]}\tilde{\tilde{G}}+\frac{\Psi+2\theta+\theta\gamma\bar{C}_0}{2\left[2\Psi+\theta\gamma\bar{C}_0\right]}\tilde{\tilde{G}}^*-\frac{\theta\bar{r}}{\left[2\Psi+\theta\gamma\bar{C}_0\right]}(\tilde{G}-\tilde{G}^*) \tag{B9b}$$

The Effect on the terms of trade

In order to determine the effects of fiscal policy on the terms of trade, we plug (B6) and (B8) along with equation (B2b) into the difference between (A1a) and (A1b) remembering that $\tilde{\tilde{P}} = \tilde{\tilde{P}}^*$. The result is the following expression giving the long run deviation of the terms of trade:

$$\tilde{\tilde{p}}(h) - \tilde{\tilde{p}}^*(f) = -\frac{\bar{r}}{2\Psi + \theta\gamma\bar{C}_0}\left[2(\tilde{G} - \tilde{G}^*) + \frac{4+\gamma\bar{C}_0}{2\bar{r}}(\tilde{\tilde{G}} - \tilde{\tilde{G}}^*)\right] \tag{B10}$$

Monetary Equilibrium

Taking a population weighed average of equations (A5a) and (A5b) and combining the result with equation (17) yields:

$$\tilde{\tilde{M}}^u - \tilde{\tilde{P}}^u = -\frac{1}{2}\tilde{\tilde{G}}^u \tag{B11}$$

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