Reexamining financial integration and macroeconomic volatility nexus: evidence from DSGE modeling

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Abstract:

The main goal of the paper is to study how the degree of financial integration affects macroeconomic volatility. Using a two-country DSGE model, we show that: (i) higher degree of financial integration tends to decrease short-run volatility, (ii) following monetary policy shocks, financial integration increases nominal exchange rate and output volatilities, and reduces both nominal and real interest rates and consumption volatilities; and (iii) in response to fiscal shocks, financial integration stabilizes all variables under the assumption of perfect capital mobility.

Keywords: Financial integration, Macroeconomic volatility, DSGE Models

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1. Introduction

Financial deregulation and capital account liberalization are the main phenomena having marked the last two decades. In fact, financial markets have reached high degrees of integration which becomes more and more emphasized. More integrated financial markets are then highly correlated with the decline of real business-cycle (RBC) fluctuations. Changes in the characteristics of RBCs may be related to changes in the degree of financial markets integration (Basu and Taylor 1999).

Financial integration is considered as a potential source of several benefits. While these benefits are well highlighted in the theoretical literature, it isn't always true for empirical evidences. Indeed, the major empirical works have focused on assessing the impact of capital account openness on economic growth (Edison et al., 2002; Alfaro et al. ., 2003; Klein, 2005), more attention has recently shifted to the relationship between financial openness and macroeconomic volatility. All things being equal, international financial integration leads to reducing such volatility.

Theoretically, there's no consensus about the nature of the relationship between financial integration and economic activity. It is not clear cut but it may have implications for the response of the economy to policy shocks and thus to macroeconomic volatility. In their seminal papers, Fleming (1962), Mundell (1963) and Dornbusch (1976) suggest that, in a flexible exchange rate regime, the higher is the international capital mobility, the stronger is the impact of the monetary policy shock on the output. However, the impact of government spending shocks on output decreases with the degree of international capital mobility. More recently, theoretical works agree with these findings. Sutherland (1996) and Senay (1998) use a modified version of the dynamic general equilibrium model (DGEM) developed by Obstfeld and Rogoff (1995) to show that, in the presence of monetary policy shocks, an increase in the degree of financial integration leads to an increase in the volatility of output. However, in the case of fiscal policy shocks, the volatility of production decreases when the degree of financial integration increases.

Empirically, the existing literature on the relationship between financial integration and macroeconomic volatility is still limited. Furthermore, it has generally been unable to establish a clear and empirical correlation between financial openness and volatility. Razin and Rose (1994) study the impact of economic and financial openness on the volatility of macroeconomic indicators such as consumption, investment and output for a panel of 138 countries over the period 1950-1988. The results support the absence of a significant link between openness and the volatility of these variables. This result has been corroborated by Easterly et al. (2001). The authors found no significant effect of financial openness (or capital flows volatility) on the volatility of output. However, higher trade openness causes higher volatility of output mainly in developing countries.

Buch (2001) and Buch at al. (2002) also studied the impact of financial integration on output volatility in 25 OECD countries. No significant link has been found between financial openness and output volatility. All these results indicate that neither the volatility of capital flows nor the financial openness has a significant impact on the volatility of GDP.

In the same context, by regressing financial openness[1] on output growth volatility and on consumption growth volatility for a sample of 76 countries over the period 1960-1999, Kose et al. (2003) find a non-significant positive relationship. But, once regressed on the consumption-to-output volatility, financial openness appears with a strongly significant sign only beyond a certain level. These results are consistent with the benefits in terms of consumption smoothing brought by increasing financial integration. The existence of nonlinear[2] relationships between macroeconomic volatility and international financial integration was the object of several studies such as Evans and Hnatovska (2007), Dabla-Norris and Srivisal (2013) and Arespa (2014), among others.

From another hand, Govin and Hausman (1996) found a positive and significant relationship between the volatility of capital flows and the volatility of output. Likewise, using data for 93 OECD and non-OECD countries over the period 1971-1994, Denizer et al (2002) analyze the impact of financial integration on GDP volatility. They find a negative relationship between financial integration and output volatility in OECD countries against a positive one in non-OECD countries.

In the context of less-developed economies, Delechat et al. (2009), by using a sample of 44 Sub-Saharan Africa countries over the period 2000-2007, find a consistent positive correlation between capital flows and economic growth.

However, Bekaert et al. (2006) report that financial integration increases the volatility of output and consumption in emerging market countries. By controlling for time trends, business-cycle

[1] Two indicators of financial openness are used in this study: a dummy variable for capital account restrictions and private capital flows.

[2] This means that, initially financial integration causes an increase in the volatility of output and consumption, which will be gradually replaced by a larger decrease in the volatility of macroeconomic variables.

variation, and regional effects, they use two samples of countries and find that the volatility of consumption growth significantly decreases after equity market integration in the largest sample and does not increase in the smaller one. Also, the volatility decreases are larger for consumption than for output. Finally, in a country with a fragile economy, low institutions, and an underdeveloped financial sector, real production variability is not reduced and may be even increased.

At the close of this literature review, substantial evidence has been provided in the relationship between financial integration and macroeconomic volatility, but the ambiguity still remains. The objective of this paper is in line with this literature and precisely analyses the empirical link between financial integration and macroeconomic volatility. We use Dynamic Stochastic General Equilibrium (DSGE) models in order to analyze how do monetary and fiscal policy shocks impact on macroeconomic volatility? And, how do different degrees of financial integration play an important role in fueling macroeconomic volatility?

The remainder of the paper is structured as follows. Section 2 lays out the benchmark DSGE model with two countries in order to grasp the impact of monetary and fiscal policy shocks on macroeconomic volatility with different degrees of financial integration. Section 3 exposes the calibration process and discusses the different shocks. Section 4 discusses more detailed empirical results. Section 5 concludes the paper.

2. The baseline model

Since the seminal works of Obstfeld and Rogoff (1995, 1996), new open economy macro-models have become a standard tool to study international macroeconomic questions. Providing explicit micro-foundations of dynamic general equilibrium open economy macro-models is the major advantage of these models. Recently, new open economy macro-models were also used to study the implications of the international financial market integration to macroeconomic fluctuations. Sutherland (1996) showed how the new open standard macroeconomic model can be extended to analyze the implications of global financial market integration for the impact of monetary, fiscal and productivity shocks on macroeconomic volatility. The main difference between the model developed by Obstfeld and Rogoff (1995, 1996) and that of Sutherland (1996) is that the latter assumes that domestic and foreign bonds are imperfect substitutes.

In the model of Sutherland (1996), there are two equalized countries - home and foreign - which are populated by a continuum of agents. In each country, there exists a government, firms and consumers. Agents consume goods, supply labor, and rent physical capital to firms.

Each firm uses labor and capital to produce a single differentiated goods, which indexed by z on the unit interval, i.e., z ∈ [0, 1]. The home country consists of producers on the interval [0, n] and the remaining (n, 1] reside in the foreign country. It is assumed that the population size each country and both countries are of equal population size, i.e., n = 1 / 2.

This study's discussion mainly focuses on the model for the home country. The conditions for the foreign country are analogously defined in all cases, except those that are explicitly derived. The foreign variables are indicated by a star.

Households

All agents are identical and the population size of each country is normalized to one, so that national aggregates and per capita quantity variables are the same. The home representative agent's intertemporal utility function is additively separable over time. It is given by.

$$U_t = E_t \sum_{s=t}^{\infty} \beta^{s-t} u_s \qquad (1)$$

Where $$u_t = \frac{\sigma}{\sigma-1} C_t^{\frac{\sigma-1}{\sigma}} + \frac{\chi}{1-\varepsilon}\left(\frac{M_t}{P_t}\right)^{1-\varepsilon} - \frac{1}{2} L_t^2 \qquad (2)$$

Where, $\boldsymbol{E_t}$ the expectation conditional on all the available information in period *t*, $\boldsymbol{C_t}$ a basket of differentiated goods, $\boldsymbol{L_t}$ the labor supply, $\boldsymbol{M_t}$ the nominal money holdings, and *P* the general price index. The agent derives utility form holding real money balances $\left(\boldsymbol{\frac{M}{P}}\right)$ for their liquidity services. The work effort $\left(\boldsymbol{\frac{1}{2}L^2}\right)$ generates disutility. The parameter $\boldsymbol{\beta}$, $\boldsymbol{(0 < \beta < 1)}$ denotes the home agent's subjective discount rate which measures the value of future consumption in terms of present consumption. The intertemporal elasticity of substitution is denoted by $\boldsymbol{\sigma}$ $\boldsymbol{(\sigma > 0)}$, which measures the willingness of an agent to substitute the consumption across time in response to a change in the real interest rate. The positive parameter $\boldsymbol{\chi}$ governs the relative importance of real money balances in the utility function is identical for the foreign representative agent.

The real consumption index $\boldsymbol{C_t}$ is a constant elasticity of substitution function that aggregates across different varieties of consumption goods (produced domestically and foreign). It is defined as follows.

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

Where $c_t(z)$ is the consumption of the home agent for the good $\boldsymbol{z}$. The parameter θ $(\theta > 1)$ denotes the elasticity of substitution between different goods and also governs the monopolistic power of the price markup.

We assume that the law of one price holds for each individual good.

$$p_t(z) = S_t p_t^*(z) \tag{4}$$

Where $p_t(z)$ the home price of good z; $p_t^*(z)$ the foreign currency price of good z and S the nominal exchange rate (defined as the price of the foreign currency in terms of the home currency). In our study we assume that the markets of home and foreign goods are perfectly integrated, and firms set a single price for both markets. Goods indexed between 0 and ½ are made at home, and goods indexed ½ and above produced abroad. The general price index P for the home country is:

$$P_t = \left[\int_0^1 p_t(z)^{1-\theta} \, dz \right]^{\frac{1}{1-\theta}} = \left[\int_0^{\frac{1}{2}} p_t(z)^{1-\theta} \, dz + \int_{\frac{1}{2}}^1 S_t p_t^*(z)^{1-\theta} \, dz \right]^{\frac{1}{1-\theta}} \tag{5}$$

The price index P_t^* for the foreign country is written as:

$$P_t^* = \left[\int_0^1 p_t^*(z)^{1-\theta} \, dz \right]^{\frac{1}{1-\theta}} = \left[\int_0^{\frac{1}{2}} \frac{1}{S_t} p_t(z)^{1-\theta} \, dz + \int_{\frac{1}{2}}^1 p_t^*(z)^{1-\theta} \, dz \right]^{\frac{1}{1-\theta}} \tag{6}$$

Since preferences are identical across countries and the law of one price holds purchasing power parity (PPP) holds:

$$P_t = S_t P_t^* \tag{7}$$

Financial Market Integration

The home agent holds three forms of financial assets: domestic money, home and foreign bonds. The home agent incurs no costs of trading home bonds in the home financial market, but needs to pay transaction costs for trading foreign bonds in the foreign financial market. The transaction costs of purchase and sale of foreign bonds are given by:

$$X_{F,t} = \frac{\psi_F}{2} I_{F,t}^2 \tag{8}$$

Where ψ_F a positive parameter and I_F the level of funds transferred from the home to the foreign bond market in period t. $X_{F,t}$ and I_F are denominated in terms of the composite consumption goods. The convex form of transaction costs in equation (8) suggests that the transaction costs in foreign financial markets incur decreasing returns to scale.

The evolution of foreign bond holding (F_t) is given by :

$$F_t = (1 + i_{t-1}^*)F_{t-1} + P_t^* I_{F,t} \tag{9}$$

The Household's Maximization Problem

Physical capital is introduced into Sutherland's (1996a) model. All domestic physical capital is owned and accumulated by domestic individuals. A unit of capital (K) is created from a unit of the composite consumption good (C) and is constructed in the same manner as C. Therefore, the price of physical capital good is also measured in terms of the general price index (P_t).

The law of motion for physical capital is specified by:

$$K_{t+1} = (1 - \delta)K_t + I_{K,t} \tag{10}$$

Where K_{t+1} denotes the stock of capital accumulated through the end of period t and $I_{K,t}$ the gross capital investment. In each period, the agent invests in physical capital and rents the existing capital stock to the firms at $r_{K,t}$ – the real rental rate per unit of capital. Physical capital depreciates at the constant rate δ. The adjustment costs $X_{K,t}$ associated with physical capital accumulation is nonlinear:

$$X_{K,t} = \frac{\psi_K}{2} I_{K,t}^2 \tag{11}$$

Where: ψ_K is a positive parameter and X_K is denominated in terms of the composite consumption goods.

The intertemporal budget constraint for each home agent is written as:

$$P_tC_t + P_t[K_{t+1} - (1-\delta)K_t] + P_tX_{K,t} + M_t + D_t + S_tF_t + P_tX_{F,t} + P_tT_t$$
$$= (1+i_{t-1})D_{t-1} + S_t(1+i^*_{t-1})F_{t-1} + P_tr_{K,t}K_t + W_tL_t + \pi_t + M_{t-1} \quad (12)$$

Where T_t stands for taxation, W_t is nominal wages, π_t is profits from the ownership of domestic firms, i_{t-1} is nominal home interests for home bonds (D_t) between $t-1$ and t, ; i^*_{t-1} is nominal foreign interests for foreign bonds (F_{t-1}) (denominated in foreign currency) between t and $t-1$. M_{t-1} is the quantity of nominal balances that is accumulated in $t-1$. In this model, the home nominal interest rate is given by the Fisher equation:

$$1+\ i_t =\ E_t\frac{P_{t+1}}{P_t}(1+r_t) \quad (13)$$

Maximizing the utility function -equation (1) subject to the budget constraint -equation (12) yields the following first order conditions for C_t, M_t, N_t, F_t and K_{t+1} respectively:

$$C_t^{-\frac{1}{\sigma}} = \lambda_t P_t \quad (14)$$

$$C_{t+1} = \left[\beta E_t(1+i_t)\frac{P_t}{P_{t+1}}\right]^{\sigma} C_t \quad (15)$$

$$\chi\left(\frac{M_t}{P_t}\right)^{-\varepsilon} = \frac{i_t}{1+i_t}C_t^{-\frac{1}{\sigma}} \quad (16)$$

$$L_t = \frac{W_t}{P_t}C_t^{-\frac{1}{\sigma}} \quad (17)$$

$$\left(1+\psi_F I_{F,t}\right)(1+i_t) = E_t\frac{S_{t+1}}{S_t}(1+i^*_t)\left(1+\psi_F I_{F,t+1}\right) \quad (18)$$

$$\frac{1}{\beta}\left[1+\psi_K\frac{(K_{t+1}-K_t)}{k_t}\right]C_t^{-\sigma}$$
$$= E_tC_{t+1}^{-\sigma}\left[r_{K,t+1} + (1-\delta) + \frac{1}{2}\psi_K\frac{K^2_{t+2}-K^2_{t+1}}{K^2_{t+1}}\right] \quad (19)$$

An analogous set of conditions hold for the foreign country. Equation (15) is the Euler consumption equation which determines the optimal intertemporal consumption path. A higher real interest rate "*r*" implies higher opportunity costs of current consumption, so that an agent tends to postpone consumption to the next period. Equation (16) shows that the demand for real money balances is positively related to real consumption expenditures and negatively related to nominal interested rate (*i.e*, the opportunity costs of holding money). Equation (17) is the labor supply rule which equates the marginal disutility of labor to the marginal utility of real wage. The labor supply function equation (17) also implies unitary labor supply elasticity. Equation (18) describes the optimal allocation of home and foreign bonds. If home and foreign capital markets are perfectly integrated, ψ_F will be zero, and equation (18) implies the uncovered interest parity condition. Equation (19) determines the agent's investment in physical capital for which the consumption forgone today (left-hand side) must be equal to the gains in future consumption in terms of the increase in physical capital stocks and the receipt of real rental rate (right-hand side)

The individual demand for product z is:

$$c_t(z) = \left(\frac{p_t(z)}{P_t}\right)^{-\theta} C_t \qquad (20)$$

The Government

The real home government consumption expenditure G_t is a composite of government consumptions of individual goods $g_t(z)$.

$$G_t = \left[\int_0^1 g_t(z)^{\frac{\theta-1}{\theta}} \partial z\right]^{\frac{\theta}{\theta-1}} \qquad (21)$$

The government runs balanced budget each period and its expenditure is financed by lump sum taxes and increases in the monetary supply.

$$P_t G_t = P_t T_t + M_t - M_{t-1} \qquad (22)$$

An analogous budget constraint: holds for the foreign government.

Firms

Firms in the home country rent physical capital (K_t) at the rental rate (r_k) and hire labor (L_t) at the nominal wage rate (W_t). Each firm has the same production function, which is given by:

$$y_t^s(z) = A_t K_t(z)^{\alpha} L_t(z)^{1-\alpha} \qquad (23)$$

Where $y_t^s(z)$ denotes production of good z, A_t represents a technology shock common to all home firms, $K(z)$ and $N(z)$ are capital and labor input in the production of product z. Firms rent capital and hire labor in perfectly competitive factor markets. The labor markets in each country are assumed to be perfectly competitive and labor migration across countries is not allowed. The agent takes the real wage as given. All firms are assumed to face the same real wage for labor and real rental rate for capital. Firm z chooses capital and labor to minimize costs so that:

$$\begin{cases} Min \dfrac{W_t}{P_t} L_t(z) + r_{k,t} K_t(z) \\ s.t. \quad y_t^s(z) = A_t K_t(z)^{\alpha} L_t(z)^{1-\alpha} \end{cases}$$

Setting up the Lagrangian and taking derivatives with respect to K_t and L_t, respectively, give:

$$\frac{1}{Cm_t(z)} \frac{W_t}{P_t} = (1-\alpha) \frac{y_t^s}{L_t(z)} \qquad (24)$$

$$\frac{1}{Cm_t(z)} r_{k,t} = \alpha \frac{y_t^s(z)}{K_t(z)} \qquad (25)$$

Where $Cm_t(z)$, the real marginal costs of production evaluated on the home currency and is equal for all firms within the home country.

With regard to the pricing-setting behavior, this paper follows the assumptions of Sutherland (1996a). First, firms set a unified price for home and foreign markets. In other words, the price for goods sold in the foreign market is the price for goods sold in the home market multiplied by the exchange rate. Second, firms adjust the price in the way of Calvo's (1983) random price staggering. In each period, a firm has probability γ of maintaining the current price level inherited form the previous period and probability (1- γ)of resetting its price to the new optimal level. These probabilities are the same for all firms in the country.

The home firm z faces a downward sloping demand curve:

$$y_t^d(z) = \left[\frac{p_t(z)}{P_t}\right]^{-\theta} Q_t \tag{26}$$

Where Q_t denotes the world per capita consumption of home goods. It is defined as:

$$\begin{aligned} Q_t &= n\{C_t + G_t + [K_{t+1} - (1-\delta)K_t] + X_{K,t} + X_{F,t}\} \\ &+ (1-n)\{C_t^* + G_t^* + [K_{t+1}^* - (1-\delta)K_t^*] + X_{K,t}^* \\ &+ X_{F,t}^*\} \end{aligned} \tag{27}$$

Firm z's real profit is given by

$$\frac{\Pi_t(z)}{P_t} = \frac{p_t(z)}{P_t}\left[\frac{p_t(z)}{P_t}\right]^{-\theta} Q_t - \frac{Cm_t(z)}{P_t}\left[\frac{p_t(z)}{P_t}\right]^{-\theta} Q_t \tag{28}$$

In the presence of the price inertia, the price set in the current period has an impact on profits in future periods.

The objective of the firm is to choose the price level in period *t* so as to maximize the discounted value of current and future profits with each future period weighted by the probability that the current price will still be in force in that period. Firm z's maximand is thus:

$$V_t(z) = E_t \sum_{s=t}^{\infty} \gamma^{s-t} R_{t,s} \frac{\pi_s(z)}{P_s} \tag{29}$$

$R_{t,s}$ is the discount factor between time *t* and time *s*. The first-order condition for firm z is :

$$P_t(z)(\theta-1)\sum_{s=t}^{\infty} \gamma^{s-t} R_{t,s} \frac{Q_t}{P_s}\left(\frac{1}{P_s}\right)^{-\theta} = \theta \sum_{s=t}^{\infty} \gamma^{s-t} R_{t,s} \frac{Q_s}{P_s}\left(\frac{1}{P_s}\right)^{-\theta} Cm_s \tag{30}$$

The structure of the pricing setting behavior is that all home firms which are allowed to change their prices in period t will all set their prices at P_t. More specifically, in period t, a proportion $(1-\gamma)$ of home firms is able to set in domestic prices at P_t, a proportion $(1-\gamma)\,\gamma$ has to keep prices unchanged at P_{t-1} as set in period $(t-1)$, a proportion $(1-\gamma)^S\,\gamma$ keeps prices unchanged at P_{t-s}, and so on. As a result, the sub-price index for home goods in period t is defined as follows:

$$q_t = \left[(1-\gamma)P_t^{1-\theta} + (1-\gamma)\gamma P_{t-1}^{1-\theta} + (1-\gamma)\gamma^2 P_{t-2}^{1-\theta} + \cdots\right]^{\frac{1}{1-\theta}}$$

$$= \left[(1-\gamma)\sum_{s=0}^{\infty}\gamma^s P_{t-s}^{1-\theta}\right]^{\frac{1}{1-\theta}} \qquad (31)$$

Where $s \leq t$ and P_t denotes the price level set all home firms. From equation (31), the sub-price index in the current period *t* is the weighted average of the past price P_{t-s} and the newly set price (P_t). The sub-price index for the foreign goods is:

$$q_t^* = \left[(1-\gamma)\sum_{s=0}^{\infty}\gamma^s P_{t-s}^{*1-\theta}\right]^{\frac{1}{1-\theta}} \qquad (32)$$

Using equation (30) and (31), the general price index equation (5) is rewritten as:

$$P_t = \left[nq_t^{1-\theta} + (1-n)s_t q_t^{*1-\theta}\right]^{\frac{1}{1-\theta}} \qquad (33)$$

Market Clearing and Consolidated Budget Constraint

In equilibrium, all goods and factor markets have to clear: To aggregate the production function equation (23) across firms, the aggregate output in the home country becomes:

$$Y_t^s = \int_0^{\frac{1}{2}} y_t^s(z)\partial z = \int_0^{\frac{1}{2}} A_t K_t(z)^\alpha L_t(z)^{1-\alpha}\partial z \qquad (34)$$

Substitution of $\mathrm{p_t(z)}$ with the sub-price index $(\mathrm{q_t})$ into equation (26) gives the aggregate demand for the home goods:

$$Y_t^d = \left[\frac{q_t}{P_t}\right]^{-\theta} Q_t \qquad (35)$$

Equilibrium in the goods market requires that,

$$Y_t^s = Y_t^d = Y_t \qquad (36)$$

Similarly, the market clearing conditions for the goods market and the factor market apply to the foreign country.

The asset market also needs to clear, In the aggregate; the real domestic nominal money supply must equal the real domestic money demand in each country.

Clearing condition for bond market requires that the net supply of bond is zero, so that bonds held by foreign agents are issued by home residents. For bonds denominated in domestic currency, the zero net supply condition is:

$$(1-n)D_t + nF_t^* = 0 \tag{37}$$

For bonds denominated in the foreign currency, the zero net supply condition is:

$$nD_t^* + (1-n)F_t = 0 \tag{38}$$

The aggregated profits of home firms are:

$$\pi_t = q_t Y_t - W_t L_t - P_t r_{K,t} K_t \tag{39}$$

By combining the agent's budget constraint equation (12), the home government budget constraint equation (22), the aggregated profits equation (39), the consolidated budget constraint for the home country is expressed as:

$$\begin{aligned} P_t C_t + P_t[K_{t+1} - (1-\delta)K_t] + P_t X_{K,t} + P_t X_{F,t} + D_t + P_t I_{F,t} + P_t G_t - (1 + i_{t-1})D_{t-1} \\ - q_t Y_t = 0 \end{aligned} \tag{40}$$

Rearranging equation (40) gives:

$$\begin{aligned} q_t Y_t - P_t C_t - P_t I_{k,t} - P_t X_{k,t} - P_t X_{F,s} - P_t G_t + \\ i_{t-1} D_{t-1} + S_t i_{t-1} F_{t-1} = (D_t - D_{t-1}) + S_t (F_t - F_{t-1}) \end{aligned} \tag{41}$$

Where the left-hand-side represents the current account balance which is equal to sum of the value goods produced by home firms, net factor income from home and foreign bond holdings, and the expenditures on goods, and the right-hand-side represents the capital account balance which is equal to sum of net capital flows.

Calibration and Policy Shocks

1- The Calibration Parameters

The calibrated parameter values used in the simulations are given in the following table:

Table 1: Baseline parameterization

Descriptions	Notations	Values
Subjective discount rate	β	1/1.05
Intertemporal elasticity of substitution	σ	0.75
Elasticity of substitution between varieties of goods	θ	6
Consumption elasticity of money demand	ε	9
Capital share in production	α	0.36
Probability that firm cannot reset price	γ	0.5
Transaction costs for taking positions in international bond market if capital is high (low)	ψ_F	4 (0.01)
Physical capital adjustment costs	ψ_K	4
Depreciation rate	δ	0.1
Consumption share to GDP		0.7
Investment share to GDP		0.28
ρ_M autoregressive coefficient of the money supply process	ρ_M	1
ρ_g autoregressive coefficient of the fiscal policy process	ρ_g	1

The foreign country is completely symmetric.

2- Policy Shocks

Our model is subject to monetary or fiscal shocks in each country. These shocks are log-normally distributed as follows:

$$\widehat{M}_t = \rho_M \widehat{M}_{t-1} + \varepsilon_{Mt} \tag{42}$$

$$\widehat{G}_t = \rho_G \widehat{G}_{t-1} + \varepsilon_{Gt} \tag{43}$$

Where the "hat" denotes the logarithmic deviation from the initial steady state, and ε_{Mt} and ε_{Gt} are monetary policy and government spending shocks respectively. In the case of permanent shocks, ρ_M and ρ_G, are set at unity. The shock variable value increases by one unit in period one and returns to zero in the subsequent period.

Further, combining the log-linear versions of money equilibrium condition in the home country (Eq. 16) and its foreign counterpart, and the purchasing power condition (Eq. 7) yields:

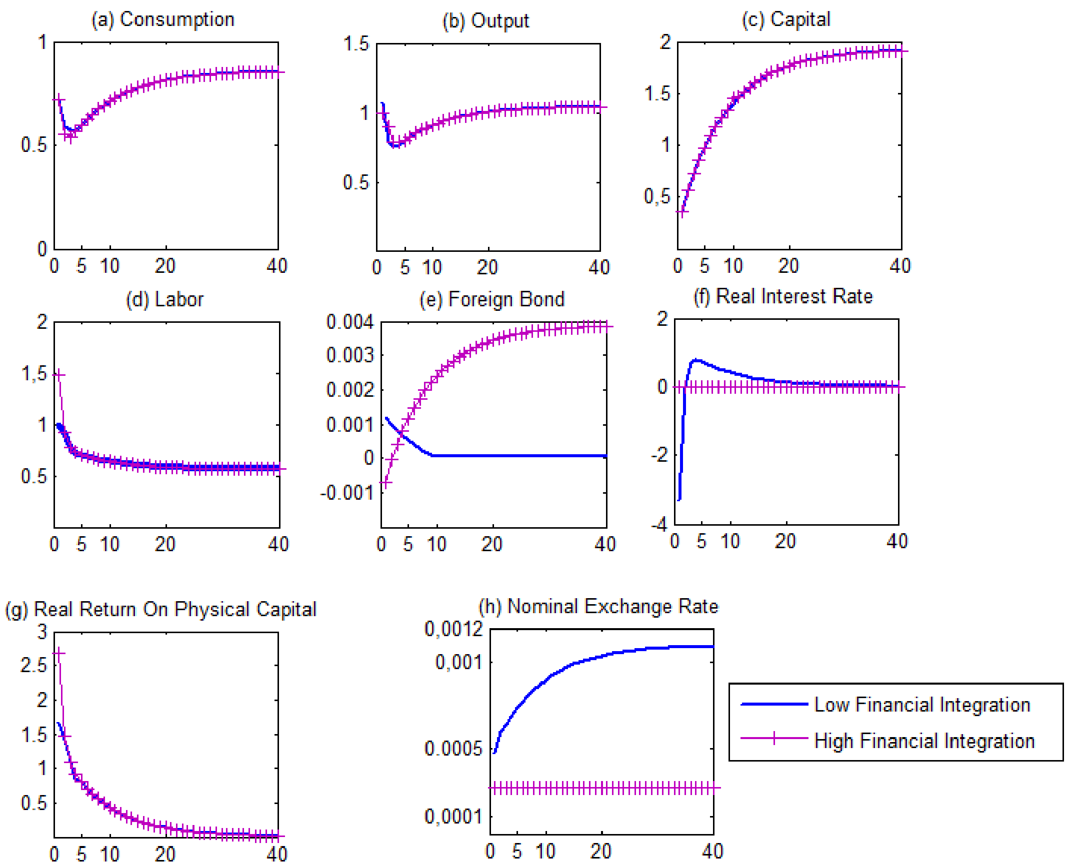
$$\left(\hat{M}_t - \hat{M}_t^*\right) - \hat{S}_t = \frac{1}{\sigma\varepsilon}\left(\hat{C}_t - \hat{C}_t^*\right) - \frac{\beta}{\varepsilon}\left(\hat{i}_t - \hat{i}_t^*\right) \tag{44}$$

3. Responses of the volatility of macroeconomic aggregates to monetary and fiscal policy shocks.

Monetary policy Shocks

Figure (1) illustrates the impulse responses of a permanent increase by one unit of a shock of monetary policy only in the domestic country. The responses of the foreign country are mirror images of the domestic country. The output volatility is measured by the production gap from its initial steady state when a political shock hits the system in the first period. The solid (cross) lines represent the responses of a weak (high) financial integration. The impulse responses are plotted for forty periods.

Figure 1: Dynamic responses to monetary shocks



Notes: *consumption, output, capital, labor, real interest rate, real return on physical capital and nominal exchange rate are measured in terms of percentage deviation from the initial steady state. The foreign bond holdings are measured in terms of deviation from its initial steady state as a percentage of initial output level.*

The impulse responses show that the impact of monetary policy shock on output tends to have much more powerful effects in more financially integrated economies (MFIEs) than in less financially integrated economies (LFIEs): 1.3475 versus 0.8837, as shown in panel (b) of Figure 1. These results are similar to those of Sutherland (1996a).

The transmission mechanism is explained as follows. An unexpected and punctual increase in the money supply in the domestic country led to an increase in the real balances. In an economy, given the excessive real money, the agents buy more shares outside, so there is a capital outflow, which leads to a real and nominal depreciation of the national currency. Consequently, the relative price of domestic goods decreases leading to a greater domestic and foreign demand for these products and engendering an increase in domestic production. This relationship is presented by the demand function of domestic goods (Eq. 26).
On another hand, in LFIEs, domestic agents are unable to buy foreign securities. They respond to a permanent increase in the money supply by increasing their demand for domestic assets. The limited outflows of LFIEs lead to a lower depreciation of the national currency. Therefore, the increase in production is lower in LFIEs than in MFI ones.

The effect of the monetary shock on the exchange rate can be determined by considering the condition of the money market equilibrium (Eq. 44). This is confirmed in Figure 1 which shows that the exchange rate depreciates by about 0.02% in response to a money supply shock in the case of MFIEs. Similarly in the case of LFIEs, the exchange rate depreciates because of two effects according to which consumption is much more strongly positive in the case of imperfect capital mobility while the interest rate differential becomes negative. Both effects imply that the exchange rate should depreciate more in the case of perfect capital mobility. This result is confirmed in Figure 1.

As in output volatility, the consumption volatility is measured by the standard deviation of consumption from its initial steady state when an economic policy shock hits the system in the period 1. Under the assumption of fully integrated financial markets, there is one interest rate. A perfectly asymmetric shock implies that the amount of funds that domestic agents want to lend (or borrow) is always equal to the amount of funds that foreign agents want to borrow (or lend). Following asymmetric shocks, interest rates do not change. This is confirmed in panel (f) of Figure 1 showing the dynamic response of the real interest rate. From the Euler equation (Eq. 15), we show that the response of domestic consumption to a money supply shock should have a change to a long term new level. This is confirmed in the first panel (a) of Figure 1.

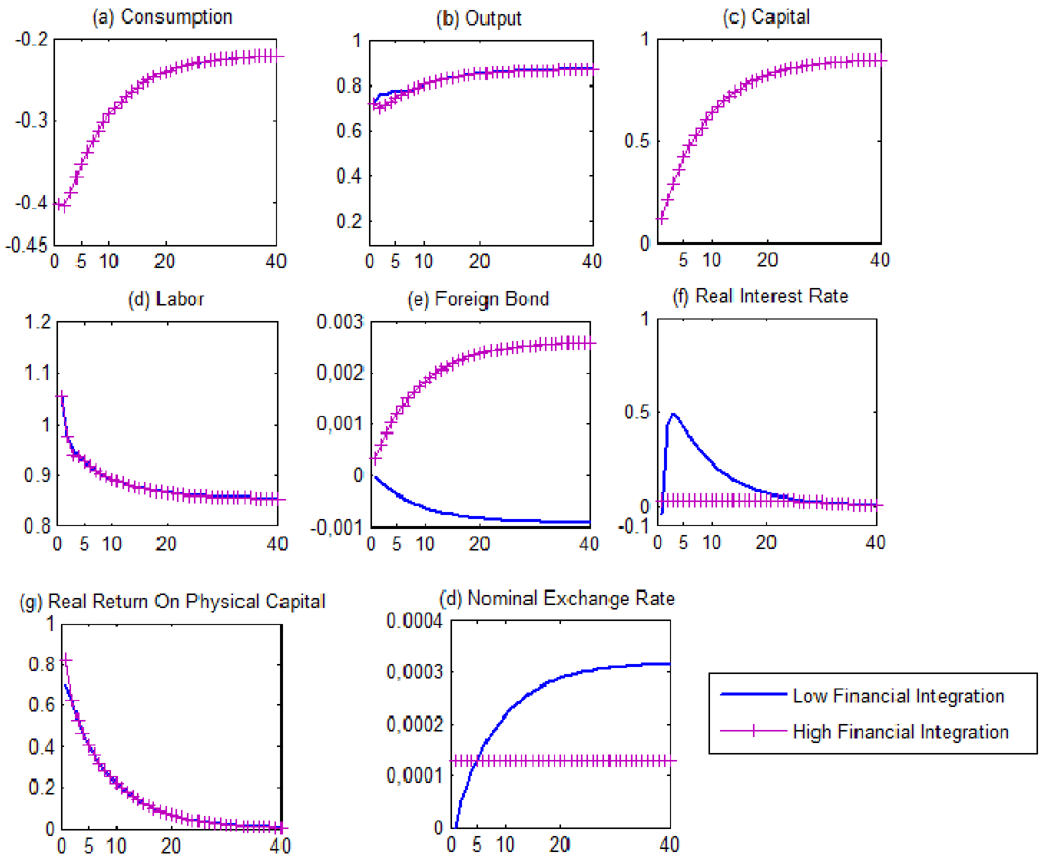
In addition to the above transmission mechanism, our model considers only the presence of physical capital as a source of income and investments. Permanent increases in the money supply lead to increases in investments in physical capital. Since an increase in capital stock is lower in LFIEs than in MFIEs (panel c of figure 1), the increase of production is lower in the first case than in the second one.

It seems reasonable to conclude that, due to a higher depreciation of the domestic currency and a greater increase in physical capital in MFIEs than in LFIEs, output volatility tends to be higher in the first world than in the second one when a monetary policy shock strikes the system (panel b of Figure 1). Besides, consumption is less volatile when integrated financial markets offer more consumption smoothing opportunities.

Fiscal policy Shocks

Figure 2 illustrates the effects of one unit unexpected increase in the domestic public expenditures, expected to be financed by flat taxes. Since domestic agents should pay more taxes, there are reductions in both consuming domestic and foreign goods (panel c), and investing in domestic and foreign securities (panel e). The decrease in the domestic securities demand leads to the reduction of the domestic interest rate. In MFIEs, high real interest rate attracts foreign agents to buy more domestic securities and domestic interest rates return immediately to their steady state (panel f). In LFIEs, given the restrictions on capital inflows, interest rates were maintained at high levels.

Figure 2: Dynamic responses to Government spending shocks



Notes: *consumption, output, capital, labor, real interest rate, real return on physical capital and nominal exchange rate are measured in terms of percentage deviation from the initial steady state. The foreign bond holdings are measured in terms of deviation from its initial steady state as a percentage of initial output level.*

Lower consumption and higher interest rates imply a fall in the real money demand. Since then the nominal money supply (M) is kept constant, and there is an excess in real money supply. To restore the money market equilibrium, the price should rise. Under the assumption of price rigidity, the national currency depreciates in the manner of increasing the price of foreign goods in the domestic currency, and thereby increasing the domestic general price level (Eq. 5).

Compared to LFIEs, MFIEs show a slightly greater reduction in the consumption (-0.4392 vs. -0.4365) and a big jump in the nominal interest rate. Using eq. 44, the exchange rate depreciates much more in LFIEs than in MFIEs. Consequently, the production increases more in LFIEs (panel b, Figure 2).

Unlike the case of monetary shocks, public spending shocks tend to reduce fluctuations in production in MFIEs while expanding the output volatility in LFIEs. This result supports hose obtained by Buch et *al.* (2002). In addition, as shown in panel b of figure 2, the differences in the production responses between MFIEs and LFIEs are very low (0.7442 vs. 0.7684). All these results are similar to those of Sutherland (1996a).

4. Conclusion

This paper has analyzed the effects of financial markets integration in a two-country intertemporal general equilibrium model with imperfect competition and nominal inertia. The general picture that emerges is that, with a few exceptions, increasing financial market integration tends to decrease short-run volatility. The main exception to this rule is the case of monetary shocks. Indeed, financial integration tends to increase the short-run volatility of the nominal exchange rate and output. Besides, it reduces nominal and real interest rates and consumption volatilities.

From another side, financial integration stabilizes all variables in response to a fiscal shock in the sense that short-term effects of shocks is smaller under the assumption of perfect capital mobility. Also, the results show that some of the conclusions of the Dornbusch (1976) model do carry over to a more general model; but there are many important cases where they do not.

Our model can be improved in several ways. For instance, there are strong empirical and theoretical arguments for supposing that current account behavior is driven in large part by capital accumulation such as Sachs (1981) and Baxter and Crucini (1993). The behavior of capital stocks is therefore likely to have important implications about the eventual effects of financial market integration. Another important modification we could make to the model consists at relaxing the assumption of perfect integration of goods market.

Finally, this paper has considered the general equilibrium effects of increasing capital mobility. But this is not the only way to analyze the effects of market integration. It may be that market microstructure is much more important in determining the effects of greater integration. The day-to-day interaction between agents in financial markets may give rise to forces which far outweigh the effects identified in this paper.

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