Financial Integration in a Small Open Economy

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Abstract

The purpose of this study is to examine a dynamic, stochastic, general equilibrium framework with informational frictions and foreign borrowing in the case of money growth and technology shocks for a small open economy and to analyze the implications of varying degrees of financial integration for the impact of such shocks on the economy. Existence of informational imperfections necessitates financial intermediation in the economy. Moreover, there is uncertainty involved in the production process, which leads to collateralized borrowing by firms and therefore has to be taken into account in the design of the loan contract between the firms and the financial intermediary. It is shown that increasing financial integration amplifies the effect of a temporary monetary shock on most of the variables with output, labor supply, loans and net exports exhibiting the greatest variation in response to the shock; whereas it has barely any implication for the impact of a temporary technology shock on the economy.

Keywords: financial integration, dynamic general equilibrium, informational frictions
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1 Introduction

The empirical literature on financial integration reveals two factors that play crucial roles in analyses of financial integration; namely, the degree of financial integration and the specification of the framework in which financial integration is being investigated. The idea that these might also be influential while analyzing financial integration theoretically motivates this paper, which attempts to propose a new theoretical framework to examine financial integration, as a contribution to the existing literature. There are informational frictions in the economy necessitating financial intermediation and there is uncertainty in the production process that require special attention to the design of the loan contract between producers and the financial intermediary.

A dynamic, stochastic, general equilibrium (DSGE) framework that incorporates financial integration is developed in this study in order to analyze the sensitivity of the response of a small, open economy to money growth and technology shocks under varying degrees of financial integration. In other words, the implications of varying degrees of financial integration for the impact of money growth and technology shocks on the economy are investigated. It is shown that increasing financial integration amplifies the effect of a monetary shock on output, labor supply, loans and net exports while it has barely any implication for the impact of a technological shock on the economy. The model developed here is one of cash in advance (CIA), similar in spirit to that by Nason and Cogley (1994), modified in such a way that it incorporates financial integration. All decisions are made after, and therefore completely reflect, the current period surprise change in money growth and technology. The economy consists of four central agents; households, firms, foreign lenders and a financial intermediary, and one secondary agent with a minor role; the central bank (as the monetary authority).

The small, open economy with a fixed exchange rate regime analyzed in this paper possesses financial imperfections of the Holmstrom-Tirole (1997) type.[1] It is assumed that the producers in the economy have two different project choices for production, both of which are subject to idiosyncratic risk. More specifically, the projects yield positive output in the case of success and there is no output in the case of failure. The projects differ according to their probabilities of success and the private benefits they provide to the producers. The probability of success of the project "good" is higher than that of the project "bad" while the project "bad" yields some private benefits to the producers, which do not exist in the case of the project "good". It is those private benefits that create incentives for the firm to choose the project "bad".

As far as the roles played by the actors in the economy and the way financial integration is captured are concerned, the framework constructed here resembles that in

[1]Note that the assumption of a fixed exchange rate regime does not create an obstacle for analyses of monetary shocks and/or monetary policy since there is imperfect capital mobility in the economy.

von Hagen and Zhang (forthcoming). It is assumed that the financial intermediary has the exclusive technology to perfectly verify the project outcome of the firms. The fact that households and foreign lenders lack this technology is the reason for why there is no direct lending in the economy. Financial integration is incorporated into the model here through the introduction of a regulation in the economy that the financial intermediary can hold only a certain fraction of its total deposits as foreign deposits. The parameter representing this fraction is assumed to be controlled by the financial regulator in the economy. It is aimed in this study to capture the changes in the response of the economy to one-time, temporary technology and money growth shocks, if there are any, under varying degrees of financial integration. In other words, whether the degree of financial integration plays a role at all in the performance of the economy in response to technology and money growth shocks is investigated.

Financial integration has become an increasingly attractive topic in both theoretical and empirical literature over the last couple of decades. This is partly because of its interaction with macroeconomic fundamentals, and partly due to its contradictory consequences, especially for emerging economies. On the one hand, it provides emerging economies with the funds that might be used to realize investment opportunities. On the other hand, it exposes them to increasing financial vulnerability against external shocks since the financial infrastructure in such economies is not adequately developed.

Financial integration can be interpreted as the process resulting from reduction in financial frictions that prevent capital from freely flowing across international borders. In other words, perfect integration of financial markets would imply that all potential market participants with the same relevant characteristics face the same set of rules, constraints etc. in the financial transactions they perform. The impact of financial integration on economic growth, macroeconomic volatility, the effectiveness of government policy rules is dependent on many factors including the structure of the financial system, the quality of financial supervision and regulation, the soundness of financial institutions, and the rapidity of the integration process. Empirically, the results are sensitive to the measure of financial integration, the data set, and the methodology employed. Theoretically, it is the specification of the framework, the design of the model that determines the implications of financial integration for the economy.

Arteta et al. (2003) argue the high sensitivity of financial integration to the context, the framework in which it is analyzed, as far as its implications are concerned, empirically. Kaminsky and Schmukler (2003) and Chinn and Ito (2005), among others, discuss that the standard of monetary and fiscal policies, the structure of financial systems, and the quality of financial supervision matter in the analysis of financial integration. Alper and Cakici (forthcoming) show empirically that financial liberalization has significantly positive effect on economic growth when it is accompanied by fiscal prudence. Sensitivity of financial integration as a topic to context and methodology creates room for research and contribution to the literature in the form of providing new frameworks to investigate it, which constitutes also the motivation of this study.

Among the studies on financial integration, Sutherland (1996) and Senay (1998) are, in a sense, similar to this study in terms of their motivation to analyze financial integration. Sutherland (1996) models the process of financial integration in an intertemporal general equilibrium framework as the elimination of trading frictions between financial markets in different countries. Sutherland shows that increasing financial market integration increases the volatility of a number of variables when shocks originate from the money market, but decreases the volatility of most variables when shocks originate from real demand or supply. Senay (1998) investigates how increasing financial and goods market integration changes the effectiveness of fiscal and monetary policy. Senay analyzes expansionary monetary and fiscal policies under different degrees of goods and financial market integration in a dynamic general equilibrium framework. Senay finds that increasing financial integration increases the effectiveness of monetary policy while it decreases that of fiscal policy. Sutherland and Senay both employ a model with households and firms as major actors, and government with a minor role. They capture financial integration through introducing adjustment costs that households have to face while transferring funds from domestic bond market to foreign bond market. Reduction in these costs implies increasing financial integration. The novelty of this paper is the provision of a framework incorporating financial intermediation for the analysis of financial integration, which is then used to analyze the response of the economy to money growth and technology shocks under varying degrees of financial integration. Financial integration is captured here as the fraction of foreign deposits the financial intermediary holds over total deposits.

As far as models with financial intermediation are concerned, there is a literature following Kiyotaki and Moore (1997) designing the loan contracts between borrowers and lenders with some durable asset, like land, as collateral.[2] In these models, lenders cannot force borrowers to repay debts unless those debts are secured. In such a context, borrowers' assets like land serve both as factors of production and as collateral for new loans. Kiyotaki and Moore (1997) employ such a framework in the dynamic equilibrium model they develop in order to analyze the transmission mechanism in the case of temporary shocks. Kiyotaki and Moore show that small, temporary shocks to technology or income distribution can generate large, persistent fluctuations in output and asset prices.[3] Another study employing land as collateral by von Hagen and Zhang (forthcoming) investigates the welfare implications of financial liberalization in a real, small, open economy and suggests that financial opening facilitates the inflows of cheap foreign funds and improves production efficiency.

The uncertainty involved in the production process requires here as well special attention to the design of the loan contract between firms and the financial intermediary.

[2]For more information on models with financial intermediation, see Freixas and Rochet (1997).

[3]For a detailed analysis on the propagation of aggregate fluctuations, see Bernanke et al. (1996).

However, it is the capital stock of the firm here suggested to be used as collateral by firms in the case of failure of their production projects. Therefore, the loan contract specifies the rate of interest on loans that is going to be valid in the case of success and the percentage of the capital stock of the firm to be handed over to the financial intermediary in the case of failure. In this context, the output produced by the firm using capital and labor as inputs is the return of the projects in the case of success. It is assumed that there is no output in the case of failure. It is shown that increasing financial integration amplifies the effect of a monetary shock on output, labor supply, loans and net exports whereas it has barely any implication for the impact of a technological shock on the economy.

The rest of the paper is structured as follows: Section 2 describes the model. The equilibrium conditions, the simulation of the model and the impulse response functions are presented in section 3. Finally, section 4 comprises the concluding remarks.

2 The Model

The model developed here is one of cash in advance (CIA), similar to the model employed by Nason and Cogley (1994), modified in a way so as to incorporate financial integration. All decisions are made after, and therefore completely reflect, the current period surprise change in money growth and technology. For the timing of the stock variables, like money and capital stock, "stock as of the end of the period" convention is used. For instance, M_t denotes the money stock as of the end of period t, that is to be transferred to period t+1, and K_t is the capital stock at the end of period t. The economy consists of four central agents; households, firms, foreign lenders and a financial intermediary, and one secondary agent with a minor role; the central bank.

Infinitely lived households maximize their utility functions which depend on consumption, C_t, and hours worked, H_t. They decide how much money to transfer to the next period as cash, M_t, how much to deposit at the bank, DD_t, in order to earn $R_{Ht} - 1$ of net interest, how much to spend on consumption, and how much labor to supply.

Firms trade off paying households larger dividends or accumulating more capital. They maximize the net present value of future dividends, discounted by the marginal utility of consumption (since they are owned by households), by choosing dividends, F_t, next period's capital stock, K_t, labor demand, N_t, and loans, L_t, they borrow from the financial intermediary. There is Holmstrom-Tirole (1997) type of uncertainty in the production process. Firms have two available project choices to produce output, both of which are subject to idiosyncratic risk; namely, they yield positive return in the case of success and zero return in the case of failure. The projects differ according to their probabilities of success, with p^H in the case of project "good" and p^L in the case of project "bad". The reason for why the firm might have incentives to choose project "bad" is that it yields some private benefits, PB, to the firm. Project "good" yields no private benefits. It is assumed, as in von Hagen and Zhang (forthcoming), that the project outcome can be perfectly verified by the financial intermediary, which has the exclusive technology to do so, while the project choice of the firm is uncertain. It is this uncertainty of the project choice of the firm together with the fact that households and foreign lenders lack this exclusive technology, that rationalizes the existence of the financial intermediary in the economy.

Foreign lenders prefer lending through the financial intermediary channel instead of directly to the firms also due to their limited familiarity with the domestic economy. They are assumed to supply funds, FD_t, inelastically at a constant interest rate, R^*, that is lower than the domestic loan rate.

Finally, the financial intermediary (FI henceforth) maximizes the expected infinite horizon discounted stream of dividends it pays to households, B_t. It receives cash deposits from households, DD_t, cash deposits from foreign investors, FD_t, and cash injection, X_t, from the central bank (which equals the net change in nominal money balances, $M_t - M_{t-1}$). The FI then uses these funds to give loans to firms. According to the loan contract between the FI and the firms, the FI gains a net return of $R_{Ft} - 1$ in the case of success of the firms' projects and a certain fraction, μ, of the capital stock of the firms in the case of failure.

Financial integration is captured in this model through the introduction of the parameter ψ that represents the fraction of foreign deposits over total deposits the FI collects. The parameter, higher levels of which imply higher degrees of financial integration, is assumed to be controlled by the financial regulator.

2.1 Households

A typical infinitely lived household maximizes an expected utility function of the form

$$E_0 \left\{ \sum_{t=0}^{\infty} \beta^t [(1-\phi) lnC_t + \phi ln(1-H_t)] \right\}, 0 < \beta, \phi < 1 \tag{1}$$

where β is the discount factor, subject to the CIA constraint

$$P_t C_t \leq M_{t-1} + W_t H_t - DD_t \tag{2}$$

where it is assumed that only the money stock transferred from previous period and labour income net of current period deposits are available for consumption purchases of households, to the budget constraint

$$M_t = M_{t-1} + W_t H_t - P_t C_t + r_{Ht} DD_t + F_t + B_t \tag{3}$$

and to the nonnegativity constraint

$$0 \leq DD_t \tag{4}$$

where P_t and W_t denote the price level of the consumption good and the nominal wage rate, respectively. r_{Ht} is the net nominal interest rate on household deposits. DD_t is denominated in domestic currency.

2.2 Firms

A typical firm maximizes the expected infinite horizon discounted stream of dividends it pays to households:

$$E_0 \left\{ \sum_{t=0}^{\infty} \beta^{t+1} \frac{F_t}{C_{t+1} P_{t+1}} \right\} \tag{5}$$

There is uncertainty involved in the production process of the firm, resulting from the fact that the firm has two available projects to produce goods, both of which are subject to idiosyncratic risk. More specifically, the firm has two project choices that differ according to their probabilities of success and the private benefits they provide to the firm, and there is positive output in the case of success of the projects while there is no output in the case of failure. p^H and p^L denote the probabilities of success of the "good" and the "bad" project, respectively, where $0 < p^L < p^H < 1$. The firm gets PB amount of private benefits if it chooses the project "bad" whereas there is no private benefit obtained from the project "good".

The firm faces three constraints. First, there is a budget constraint

$$F_t/P_t \leq p^H[L_t + P_tC_t - W_tN_t - R_{Ft}L_t]/P_t + (1-p^H)[-\mu(1-\delta)K_{t-1}] \quad (6)$$

where N_t denotes labor demand and $C_t = Y_t - I_t - NX_t$ where Y_t, I_t and NX_t are physical output, physical investment and net exports, respectively. Given that the firm chooses the project "good" (which will be the case as long as the incentive constraint stated below holds), with probability p^H the firm is able to make use of the loans it borrows from the FI to hire N_t amount of labor, which it can employ together with the capital stock it has, K_{t-1}, to produce Y_t amount of output. The firm makes in this case an interest payment to the FI for the loans at the rate specified in the loan contract. In the case of failure, there is no output produced, and the firm has to transfer a certain amount of its capital stock to the FI. μ represents the fraction of the capital stock of the firm guaranteed in the loan contract to be handed over to the FI in the case of failure. Due to the fact that capital stock is employed in the production process and therefore subject to depreciation independent of the project outcome of the firm, it is the net-of-depreciation amount of capital stock, the fraction of which is to be handed over to the FI in the case of failure.

The production function of the firm is given by

$$Y_t = K_{t-1}^{\alpha}(A_tN_t)^{1-\alpha} \quad (7)$$

where A_t denotes technology, the shock process of which is a unit root with drift in the log of technology, given as

$$lnA_t = \gamma + lnA_{t-1} + \epsilon_{A,t}, \qquad \epsilon_{A,t} \sim N(0, \sigma_A^2) \quad (8)$$

The law of motion of capital that determines gross investment is given as

$$K_t = p^H[I_t + (1-\delta)K_{t-1}] + (1-p^H)[(1-\mu)(1-\delta)K_{t-1}], \qquad 0 < \delta < 1 \quad (9)$$

where δ is the constant physical depreciation rate of capital. The firm is able to produce Y_t amount of output and therefore make I_t amount of investment in the case of success of the project, whereas it is able to accumulate only that part of its capital stock not used as collateral in the case of failure.

The second constraint the firm faces reflects the fact that the firm finances its wage payments with the loans it borrows from the FI. Hence, it obeys

$$W_tN_t \leq L_t \quad (10)$$

Finally, there is an incentive constraint for the firm to choose the project "good":

$$Y_t - \frac{R_{Ft}L_t}{P_t} \geq \frac{PB}{(p^H - p^L)P_t} \quad (11)$$

2.3 The Financial Intermediary

The objective of the FI is similar to that of firms. It maximizes the net present value of future dividends

$$E_0 \left\{ \sum_{t=0}^{\infty} \beta^{t+1} \frac{B_t}{C_{t+1} P_{t+1}} \right\} \tag{12}$$

subject to first the budget constraint

$$\frac{B_t}{P_t} \leq \frac{X_t}{P_t} + [p^H R_{Ft} \frac{L_t}{P_t} + (1-p^H)\mu(1-\delta)K_{t-1}] - (R_{Ht}-1)\frac{DD_t}{P_t} - (R^* - 1)\frac{FD_t}{P_t^*} - \frac{L_t}{P_t} \tag{13}$$

where $FD_t \geq 0$ is denominated in foreign currency and E_t is the nominal exchange rate (the domestic currency value of one unit of the foreign currency). Purchasing power parity (PPP) holds so that $P_t = E_t P_t^*$, with P_t^* denoting the foreign price level.

X_t is the monetary injection during date t, $X_t = M_t - M_{t-1}$.

The exogenous stochastic process for the growth rate of the monetary injection is given as

$$lnm_t = (1-\rho)lnm^* + \rho lnm_{t-1} + \epsilon_{M,t}, \qquad \epsilon_{M,t} \sim N(0, \sigma_M^2) \tag{14}$$

where $m_t = \frac{M_t}{M_{t-1}}$.

It is therefore an autoregressive stationary process in the growth rate of money, but an AR(2) with a unit root in the log of the level of money. This can be seen from the definition of m_t which can be rewritten as $lnM_t = lnM_{t-1} + lnm_t$.

The second constraint the FI faces, namely the balance sheet constraint, requires that the liabilities of the FI are less than or equal to its assets, with deposits as the liabilities and loans and the monetary injection by the central bank as the assets

$$D_t \leq X_t + L_t \tag{15}$$

where $D_t = DD_t + FD_t E_t$ and $FD_t E_t = \psi D_t$, $DD_t = (1-\psi)D_t$.

ψ represents the financial openness parameter assumed to be controlled by the financial regulator. Higher levels of ψ imply higher degrees of financial integration.

3 Results

3.1 System of Equations

In a stochastic setting, the solution of the model is not a series of numbers that match a given set of equations, as in a deterministic setting. In a stochastic environment, the best thing agents can do is to specify a decision, policy or feedback rule for the future, in other words, their optimal actions contingent on each possible realization of shocks. Therefore, it is a function satisfying the model's equilibrium conditions that is being searched. The system of equations consists of the first order conditions of the agents' optimization problems and the market clearance conditions of the goods, labor, money and credit markets.

From the household's optimization problem, we have the following first order conditions:

$$\frac{(1-\phi)}{C_t} = \frac{\phi P_t}{W_t(1-H_t)} \tag{16}$$

from the maximization of the household's utility function with respect to consumption, and

$$\frac{\beta R_{Ht}}{W_{t+1}(1-H_{t+1})} = \frac{1}{W_t(1-H_t)} \tag{17}$$

from the maximization with respect to deposits.

Combining (16) and (17) we have one of the equations of the solution of the model:

$$\frac{1}{C_t P_t} = \frac{\beta R_{Ht}}{C_{t+1} P_{t+1}} \tag{18}$$

The optimization of the firm with capital stock and labor demand as the choice variables yields

$$\beta[p^H P_{t+1}(1-\delta) + p^L P_{t+1} \alpha K_t^{\alpha-1} (A_{t+1} N_{t+1})^{1-\alpha}] C_{t+1} P_{t+1} = p^H P_t C_{t+2} P_{t+2} \tag{19}$$

and

$$R_{Ft} = \frac{P_t K_{t-1}^{\alpha} (1-\alpha)(A_t N_t)^{-\alpha} A_t}{W_t} \tag{20}$$

Finally, the FI maximizes its dividends with respect to deposits, which leads to the following first order condition:

$$p^H R_{Ft} = (1-\psi) R_{Ht} + \psi R^* \tag{21}$$

As stated above, all markets clear at the equilibrium. The following equations represent equilibrium in the goods, labor, money, and credit markets, respectively:

$$C_t + I_t + NX_t = Y_t \tag{22}$$

$$N_t = H_t \tag{23}$$

$$P_t C_t = M_{t-1} + X_t \tag{24}$$

$$D_t = X_t + L_t \tag{25}$$

NX_t denotes net exports, the return on which is used for the net interest payment on foreign deposits. Therefore, we have

$$P_t NX_t = (R^* - 1) FD_t E_t \tag{26}$$

Combining (16) with (23) and the firm's borrowing constraint $W_t N_t = L_t$ we have

$$(\frac{\phi}{1-\phi}) \frac{P_t C_t}{1 - N_t} = \frac{L_t}{N_t} \tag{27}$$

which constitutes another equation of the solution.

The model, however, needs to be stationarized first so that it can be linearized around the steady-state and that it returns to the steady-state after a shock.[4] The problem of non-stationarity arises because of having stochastic trends in money and technology. In the absence of shocks, real variables grow with A_t (except N_t which is stationary since there is no population growth), nominal variables grow with M_t and prices grow with M_t/A_t. Detrending is carried out as follows (where hats above variables denote stationarity):

For real variables, $\hat{q}_t = q_t/A_t$ where $q_t = [Y_t, C_t, K_t]$. For nominal variables, $\hat{z}_t = z_t/M_t$ where $z_t = [W_t, D_t, L_t]$. For prices, $\hat{P}_t = P_t A_t / M_t$.

[4]In the case of linearization up to the first order, agents behave as if future shocks were equal to zero (since their expectation is null), due to certainty equivalence. In the linearization up to second order, agents make their decisions knowing that the future value of innovations are random but will have zero mean. This is not the same thing because of Jensen's inequality. For more detailed information, see DYNARE User Guide.

The stationarized system of equations is as follows:

$$(1-\phi)(1-N_t)L_t = \phi P_t C_t N_t \tag{28}$$

$$m_t C_{t+1} P_{t+1} = \beta R_{Ht} C_t P_t \tag{29}$$

$$\beta P_{t+1} m_t [p^L \alpha K_t^{\alpha-1} N_{t+1}^{1-\alpha} a_t^{-\alpha} + p^H (1-\delta)/a_{t+1}] C_{t+1} P_{t+1} = C_{t+2} P_{t+2} m_{t+1} p^H P_t \tag{30}$$

$$R_{Ft} = \frac{P_t K_{t-1}^{\alpha}(1-\alpha) a_t^{-\alpha} N_t^{-\alpha}}{W_t} \tag{31}$$

$$p^H R_{Ft} = (1-\psi) R_{Ht} + \psi R^* \tag{32}$$

$$C_t + I_t + NX_t = Y_t \tag{33}$$

$$P_t C_t = m_t \tag{34}$$

$$DD_t = (1-\psi)(m_t - 1 + L_t) \tag{35}$$

$$W_t N_t = L_t \tag{36}$$

$$Y_t = K_{t-1}^{\alpha} a_t^{-\alpha} N_t^{1-\alpha} \tag{37}$$

$$I_t = K_t/p^H - (1-\delta) K_{t-1}/a_t - (1-p^H)(1-\delta)(1-\mu) K_{t-1}/a_t p^H \tag{38}$$

$$NX_t = (R^* - 1)\psi(L_t + m_t - 1)/P_t \tag{39}$$

Given the equations (28)-(39) and the shock processes (8) and (14), the expected future paths of the variables [Y_t, C_t, I_t, NX_t, P_t, DD_t, L_t, N_t, K_t, W_t,R_{Ft},R_{Ht}], namely, the impulse response functions, conditional on temporary money growth and technology shocks in period 1 are obtained next.[5]

[5]The linearization and the simulation of the model are carried out using DYNARE, which is a pre-processor and a collection of MATLAB routines that have been developed to support modern macro modeling.

3.2 Simulation

The procedure of making the model stationary is followed by linearization and simulation. The model is linearized up to second order. The second-order linearization of the model leads to impulse response functions that are the results of actual Monte Carlo simulations of future shocks. This is due to the fact that there are cross terms involving the shocks in second-order linear equations, so that the effects of the shocks depend on the state of the system when the shocks hit. Therefore, it is not possible to get algebraic average values of all future shocks and their impact. What is instead done is to pull future shocks from their distribution and see how the system is affected by them, and to repeat this procedure several times in order to obtain an average response.

For simulations, the following values are assigned to the structural parameters of the model: α=0.32, β=0.99, ϕ=0.76, δ=0.1, γ=0.003, ρ=0.7.[6] For the success probability of project "bad" and the unconditional mean of monetary injection growth p^L=0.4 and m^*=1.01, respectively, are used. The fraction of the capital stock to be used as collateral by firms, μ, is taken to be equal to 0.1. Three parameters are of special interest, namely, ψ -the parameter measuring the degree of financial integration, p^H -the success probability of project "good", and R^* -the gross interest rate on foreign deposits. These parameters are interrelated through equation (32), which relates the loan rate, the interest rate on domestic deposits and the interest rate on foreign deposits. Due to the fact that degree of financial integration, captured by ψ, is the main parameter of interest here, those parameters that are closely linked to ψ might also play crucial roles, and therefore should be taken into account in the analysis of the implications of financial integration for the impact of shocks on the economy. Simulations are run using the following sets of values for those parameters: $\psi = [0.01, 0.5, 0.99]$, $R^* = [1.1, 1.01, 1.0001]$, and $p^H = [0.7, 0.8, 0.9]$. In the next section, the impulse response functions that are obtained as a result of the simulations are presented.

[6]For the parameter values, Mendoza (1991), Nason and Cogley (1994) and Dib (2003) are followed.

3.3 Impulse Response Functions

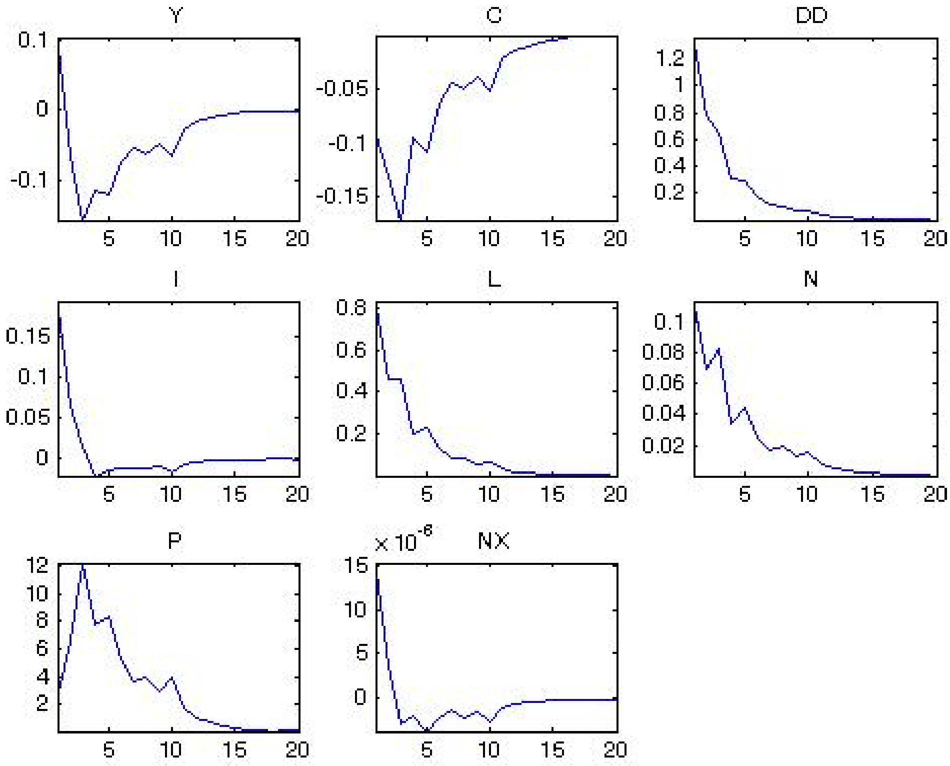

Figure 1: Temporary Monetary Shock

Figure 1 displays the impulse response functions of the variables in the model in the case of a one-time, temporary money growth shock in period 1.[7] The model predicts an expansion in output, investment, domestic deposits, labor supply, and net exports. Considering first that the FI uses the deposits it has plus the monetary injection to give loans to firms and second that firms use these loans to hire labor for production, the results are in line with expectations. Moreover, higher money growth resulting in higher output is consistent with the empirical literature that shows the positive correlation between output growth and money growth.[8] Last but not least, households rather save than consume as a result of the monetary shock; therefore, a positive correlation between savings and investment, that has been pointed out in the real business cycle literature on small open economies[9], is obtained in a monetary framework under money growth shocks.

[7]The values used in the simulations that lead to the impulse responses presented here are $\psi = 0.9$, $R^* = 1.0001$ and $p^H = 0.9$.

[8]For a more detailed analysis, see, among others, McCandless (2008).

[9]Among others, see Mendoza (1991).

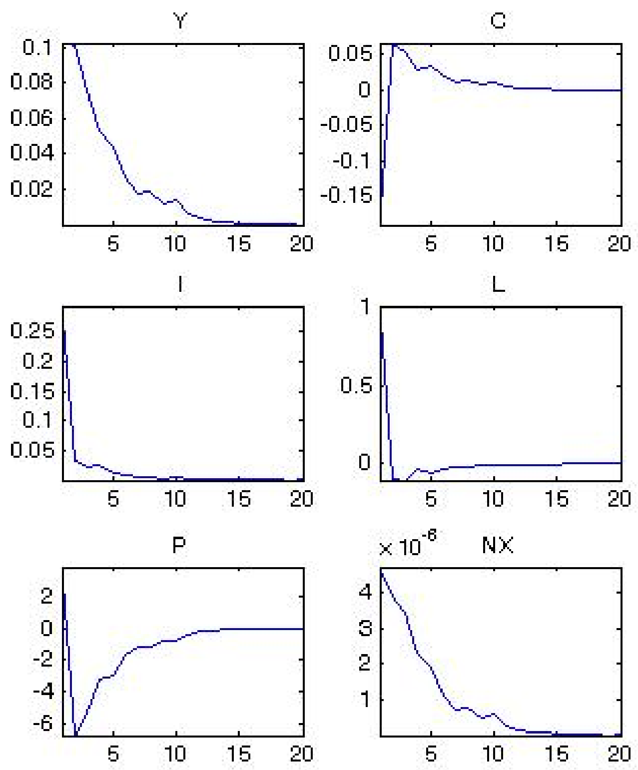

Figure 2: Temporary Technology Shock

The responses of the variables to a one-time, positive, temporary technology shock in period 1 are depicted in figure 2. It can be seen that output, investment, domestic deposits, loans, labor supply and net exports increase as a reaction to the shock while consumption exhibits contraction. The increase in investment and net exports outweighing the decrease in consumption, thereby leading to an expansion in output makes sense considering that the shock is positive. Moreover, the positive correlation between savings and investment is again in line with the point raised by Mendoza (1991) in the real business cycle literature for small open economies under imperfect capital mobility, constituting therefore a confirmation of this argument in a monetary setting.

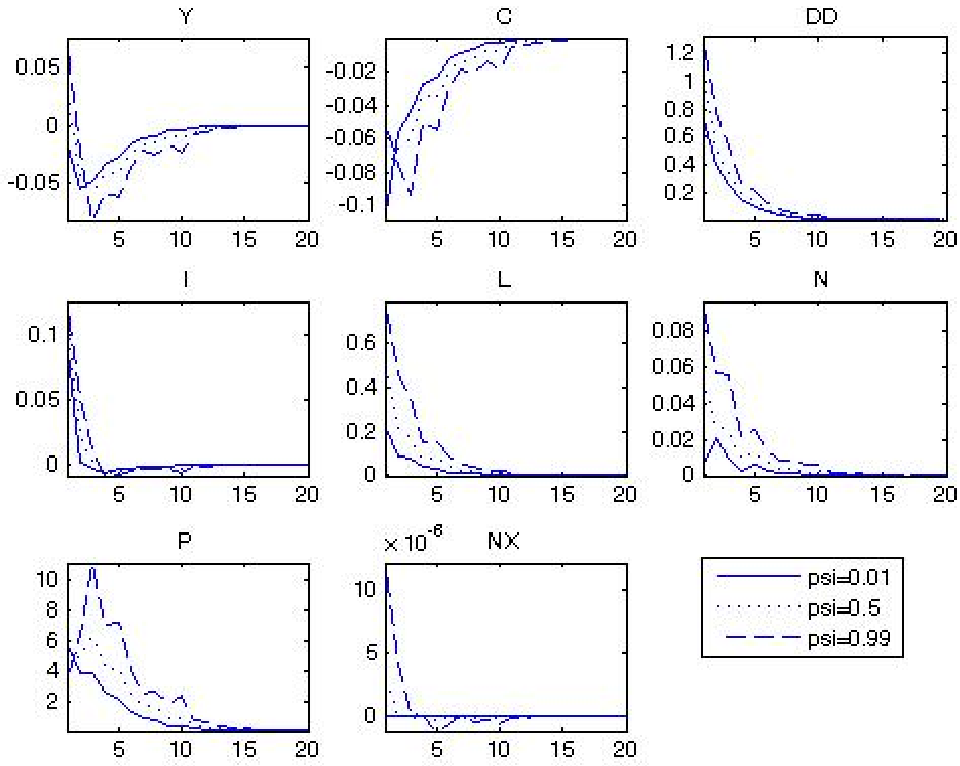

Figure 3: Temporary Monetary Shock with Varying Degrees of Financial Integration

Figure 3 shows the responses of the economy to a one-time, temporary money growth shock, under three different levels of financial integration. The straight line, the dotted line, and the dashed line represent the cases with ψ equal to 0.01, 0.5, and 0.99, respectively. It can be seen that increasing financial integration amplifies the impact of the monetary shock on most of the variables with output, loans, labor supply and net exports exhibiting the greatest variation in response to the shock.[10] Increasing financial integration also leads to a reduction in the loan rate, the graph of which is not displayed here, which is in line with the study of von Hagen and Zhang (forthcoming), who argue that this reduction improves production efficiency in their real, small, open economy framework.

[10]Simulations with different levels of financial integration were carried out also for temporary technology shock and it was found that varying the degree of financial integration has negligible implications for the impact of a temporary technology shock on the economy. Therefore, the simulation results are not presented here.

4 Conclusion

The implications of varying degrees of financial integration in the case of money growth and technology shocks for a small, open economy are analyzed in this paper in a dynamic, stochastic, general equilibrium framework with informational frictions and foreign borrowing. The idea that degree of financial integration and the framework in which financial integration is being examined might matter theoretically in terms of their implications for small open economies as well as they do empirically motivates this study. Financial intermediation is incorporated into the model to cope with the informational frictions in the economy. There is uncertainty in the production process due to Holmstrom-Tirole type of project choice on the side of firms and lack of the exclusive technology to perfectly verify the project outcomes of firms on the side of households and foreign investors.

The simulation experiments with different levels of financial integration reveal that increasing financial integration amplifies the impact of temporary monetary shocks on most of the variables with output, labor supply, loans and net exports exhibiting the greatest variation in response to the shock; whereas it has barely any implication for the effect of temporary technology shocks on the variables in the model. Furthermore, it turns out that the success probability of project "good", which is the alternative to project "bad", and the interest rate on foreign funds play crucial roles in the analyses due to their link to the degree of financial integration.

The small, open economy DSGE model presented here confirms, in a monetary framework, the findings of the real business cycle literature on small open economies in terms of the positive correlation between savings and investment, in the case of both monetary and technology shocks. Moreover, analyzing the impact of monetary shocks on the economy under varying degrees of financial integration allows us to gain insights into the design of optimal monetary policy in the case of varying levels of financial integration. This might have crucial implications especially for emerging economies, for most of which the process of financial liberalization has not yet been completed.

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