Financial Liberalization in a Two-Country Model

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Abstract

We address three related questions on financial liberalization in a two-country model, given an interest rate differential in the two countries. How does financial liberalization affect production efficiency in the country with capital inflow as well as in the country with capital outflow? Who benefits from financial liberalization in the long run and in the short run? Should financial liberalization be implemented gradually or hastily?

Our main results are as follows. First, in the country with the low interest rate, financial deregulation facilitates capital outflow and the resulting asset reallocation among domestic agents with different productivity makes domestic production less efficient. In the country with the high interest rate, financial deregulation facilitates capital inflow. However, whether financial deregulation in one sector can improve production efficiency is not clear cut and depends on financial regulation in other sectors. Second, financial liberalization may have opposite long-run welfare implications to domestic agents with different productivity in the country with capital inflow as well as in the country with capital outflow. Third, although some agents lose from financial deregulation in the long run, they might benefit during the transitional process of deregulation. Finally, financial liberalization should be implemented gradually in order to avoid large macroeconomic fluctuations.

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Keywords: Financial frictions, Financial liberalization, International capital flow, Macroeconomic fluctuations, Overshooting

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1 Introduction

We address three related questions on financial liberalization in a two-country model, given an interest rate differential in the two countries. How does financial liberalization affect production efficiency in the country with capital inflow as well as in the country with capital outflow? Who benefits from financial liberalization in the long run and in the short run? Should financial liberalization be implemented gradually or hastily?

International capital flows provide developing economies with the means to exploit promising investment opportunities; at the same time, international investors are able to earn higher returns and to reduce risk via international portfolio diversification (Stulz, 2005). Caballero and Krishnamurthy (2001, 2003) investigate the dynamic interactions between domestic and international collateral constraints and show that limited financial development reduces the incentives for foreign lenders to enter emerging markets. Iacoviello and Minetti (forthcoming) assume that foreign lenders differ from domestic lenders in their ability to recover value from borrowers' assets and, therefore, to protect themselves against contractual non-enforceability. They show that such a model can explain the co-movement of output across countries. Aoki, Benigno, and Kiyotaki (2005) analyze the medium-run adjustment process after capital account liberalization in a small open economy and show that production efficiency depends on the degree of capital account liberalization. Alessandria and Qian (2005) examine the impact of foreign borrowing on both welfare and the structure of lending contracts. The entry of foreign investors to the domestic financial market may improve or worsen the efficiency of financial intermediaries, leading to an improvement or worsening of the aggregate composition of investment projects.

During the past two decades, many countries have deregulated financial markets and reduced explicit barriers to foreign investors. As a result, global capital flows have achieved record highs relative to global income. However, financial liberalization might have unequal or opposite welfare implications to different groups of private agents. This issue cannot be addressed in the conventional representative agent model. Furthermore, the proper sequencing and implementation of financial liberalization policy are of great importance for the overall success of financial liberalization. Recent experience with financial crises clearly suggests that mistakes in the policy implementation contribute to severe macroeconomic consequences, e.g., sudden stops (WorldBank, 2005).

Financial liberalization in the country with capital outflow is modeled here as a one-dimensional issue, i.e., domestic agents are allowed to lend abroad without any official

restrictions. Thus, its long-run efficiency and welfare implications are unambiguous. In contrast, financial liberalization in the country with capital inflow is modeled here as a two-dimensional issue, its two components have sophisticated interactions, which complicate the evaluation of deregulation policy.

Our main results are as follows. First, in the country with the low interest rate, financial deregulation facilitates capital outflow and the resulting asset reallocation among domestic agents with different productivity worsens production efficiency. In the country with the high interest rate, financial deregulation facilitates capital inflow. However, whether financial deregulation in one sector can improve production efficiency might not be clear-cut and it might depend on financial regulation in other sectors. Second, financial liberalization may have opposite long-run welfare implications to domestic agents with different productivity in the country with capital inflow as well as in the country with capital outflow. It helps explain the fact that financial liberalization is controversial in many countries and receives support and opposition from different interest groups. Third, although some agents lose from financial deregulation in the long run, they might benefit during the transitional process of deregulation. Finally, financial liberalization should be implemented gradually in order to avoid large macroeconomic fluctuations.

The intuitions behind our results can be briefly shown as follows. The world in our model consists of two countries with the same structure. In each country, there are two types of private agents: households and entrepreneurs. They have different projects to produce intermediate goods using a domestic physical asset, e.g., land. Intermediate goods and labor are then employed to produce final goods. Final goods produced in the two countries are perfect substitutes and can be consumed, invested, or traded internationally. The projects of entrepreneurs are subject to idiosyncratic risk, while the project of households is safe. In addition, the projects of entrepreneurs are expected to be more productive than that of households. As households are risk averse and entrepreneurs are risk neutral, the mutual funds emerge as financial intermediaries in each country. In equilibrium, they collect deposits from domestic households and lend to domestic entrepreneurs. Thus, there are two types of domestic assets in each country: the physical asset (land) and the financial asset (deposit). If entrepreneurs could fully pledge their project outcomes for external funds, the productive asset (land) would be all allocated to them in each country. However, due to financial frictions, they cannot borrow as much as they want. Thus, some of the land stock is inefficiently allocated to households. Given that land has a fixed total supply in each country, production efficiency is measured by the fraction of the entrepreneurs' land holding in the total land stock in each country.

In the case of international financial autarky, the difference in the time discount factor of private agents in the two countries results in an interest rate differential in the two countries. Let country H (Home) denote the country with the high interest rate and let country F (Foreign) denote the country with the low interest rate. Thus, private agents in country H (F) would like to borrow (lend) abroad if they are allowed to do so. Due to debt enforcement problem, private agents in country H have to pledge their domestic assets for foreign borrowing.

Financial regulation in country F is simply modeled as whether its public financial regulator allows its domestic agents to lend abroad. Financial regulation in country H is modeled as the upper limits that its public financial regulator imposes on the fraction of the value of domestic assets that can be pledged to foreign investors. Such limits are commonly observed in developing economies. Therefore, financial liberalization is the process in which the public financial regulator in country H raises such limits permanently, given that the public financial regulator in country F does no restrict capital outflow. The public financial regulator in country H has two policy instruments, the upper limit on the land-backed foreign borrowing and the upper limit on the deposit-backed foreign borrowing. It can choose either the big bang strategy or the gradualism strategy to raise such limits. The former refers to an announcement of an immediate increase in such limits, while the latter refers to an announcement of a policy path for such limits gradually reaching the new level over time.

Our first result says that financial deregulation allows households in country F to lend abroad for a higher rate of return. Capital outflow reduces domestic loans available for entrepreneurs in country F and they have to reduce their land stock. Thus, financial deregulation worsens production efficiency in country F in the long run.

Financial liberalization in country H involves the deregulation in two sectors: deposit-backed foreign borrowing and land-backed foreign borrowing. Consider first the case of deregulating deposit-backed foreign borrowing, keeping the financial regulation on land-backed foreign borrowing constant. Households in country H are allowed to pledge a larger fraction of their domestic deposits to the foreign investors. The no-arbitrage condition implies that the interest rate in country H converges to the interest rate in country F from above. Although entrepreneurs in country H cannot increase land-backed foreign borrowing dramatically, they still benefit from the decline in the cost of domestic loans and more land is allocated into their projects in the long run. Thus, deregulating deposit-backed foreign borrowing improves production efficiency in country H and it does not depend on financial regulation on land-backed foreign borrowing.

Things become complicated in the case of deregulating land-backed foreign borrowing. If deposit-backed foreign borrowing is highly regulated, the interest rate differential in the two countries is large. Deregulating land-backed foreign borrowing does no affect the interest rate differential but allows both entrepreneurs and households in country H to acquire cheap foreign funds against their domestic land holding. Thus, entrepreneurs substitute more foreign funds for domestic loans and the average cost of their external funds declines significantly. Although households can also borrow more foreign funds, more land is allocated to the entrepreneurs' projects in country H. In this case, deregulating land-backed foreign borrowing improves production efficiency in country H, similar as in the case of deregulating deposit-backed foreign borrowing.

Consider now the case in which deposit-backed foreign borrowing is highly deregulated. The no-arbitrage condition implies that the interest rate differential is already quite small. Deregulating land-backed foreign borrowing only slightly reduces the average cost of external funds of entrepreneurs in country H, while the cost of external funds of households in country H declines significantly. As a result, more land is allocated into the household projects. In this case, deregulating land-backed foreign borrowing worsens production efficiency in country H.

Therefore, whether financial deregulation in one sector can improve production efficiency in the country with capital inflow may depend on the regulation in other sectors.

Our second result says that financial liberalization provides the less productive agents (households) in country F with more lending opportunities and they benefit strictly, while the unfavorable asset reallocation due to the decline in the land price in country F makes the more productive agents (entrepreneurs) in country F lose strictly. In contrast, due to the substitution of cheap foreign loans for domestic loans in country H, the less productive agents (households) in country H lose strictly. The more productive agents (entrepreneurs) in country H may benefit from financial liberalization, which depends on the exact direction of asset reallocation in country H.

Our third result says that although financial liberalization has the negative long-run welfare implication to households in country H, they actually benefit in the short run. Intuitively, as some of household net deposits in country H are eventually substituted with cheap foreign funds during financial liberalization, they consume these funds during the transitional process and their short-run welfare increases.

Our fourth result says that due to financial frictions, the land price overshoots in the short run in both countries and the resulting macroeconomic fluctuation is large if financial liberalization is implemented hastily. Intuitively, the announcement of financial

deregulation induces private agents in country H to increase their land holding immediately, because they anticipate a higher land price in the future. The rise in the land price improves entrepreneurial net worth in country H contemporaneously. If the big bang strategy is chosen, a huge amount of cheap foreign funds flow into country H immediately and the interest rate in country H declines dramatically. The improvement in entrepreneurial net worth and the decline in the interest rate in country H jointly amplify the land investment of entrepreneurs. The resulting macroeconomic fluctuations are large and the land price overshoots in the sense that its immediate response exceeds its new long-run level. In contrast, If the gradual strategy is chosen, the inflow of cheap foreign funds into country H does not increase very much initially and the entrepreneurs' excess demand for domestic loans pushes up the interest rate in country H. The rise in the interest rate actually curbs the excess land investment of entrepreneurs. The resulting asset reallocation in country H is small and so are macroeconomic fluctuations.

The rest of this paper is organized as follows. Section 2 describes the model. Section 3 discusses the efficiency and welfare implications of financial liberalization in the long run. Section 4 analyzes the transitional dynamics of financial liberalization. Section 5 concludes with some final remarks.

2 The Model

The world in our model consists of two countries with the same structure: country H (Home) and country F (Foreign). In each country, there are a public financial regulator and two types of private agents, households and entrepreneurs, each of unit mass. In each country, there is a domestic durable asset, e.g., land, with a fixed total supply, K; there are two perishable goods: an intermediate good and a final good. The intermediate good is only used for the domestic production of final goods and non-traded, while the final goods in the two countries are perfect substitutes and can be consumed, invested, or traded. The final good is chosen as the numeraire.

In each country, households are risk averse and infinitely lived. In each period, they have a safe project to produce intermediate goods using domestic land as the only input and they are endowed with one unit of labor that can be supplied to the domestic production of final goods. In each country, entrepreneurs are risk neutral and have a constant probability of death. In each period, entrepreneurs of mass $(1-\pi)$ die and new entrepreneurs of the same mass are born, keeping the population size of entrepreneurs constant at unity in each country. The newcomers and the surviving entrepreneurs sup-

ply their labor endowment to the domestic production of final goods.[1] They have two available projects for the production of domestic intermediate goods using both land and final goods as inputs. Both projects are subject to idiosyncratic risk: projects have positive output in the case of success and there is no output in the case of failure. Each entrepreneur can choose only one project and his project choice is unobservable to others. It takes one period for households and entrepreneurs to complete their respective projects. Land does not depreciate, while the input of final goods fully depreciates during the project process. The project of entrepreneurs has a higher expected rate of return than that of households.

In equilibrium, the mutual funds emerge as financial intermediaries in each country. They accept deposits from domestic households and provide loans to domestic entrepreneurs. A domestic deposit contract is a one-period claim on the financial position of the mutual funds. There are two types of domestic assets: a physical asset (land) and a financial asset (the deposit at the domestic mutual funds). Private agents can borrow or lend abroad. The public financial regulators determine the degree of financial openness in their respective countries, as defined in subsection 2.1.

Let v_t and q_t denote the prices of the intermediate good and land in country H, respectively. Let w_t and w_t^e denote the wage rates of households and entrepreneurs in country H, respectively. The interest rate in country H, r_t, refers to the expected rate of return on domestic mutual funds. Corresponding variables in country F are denoted by v_t^*, q_t^*, w_t^*, w_t^{e*}, and r_t^*. For simplicity, land is traded at the spot market in each country.

2.1 Asset-Backed Foreign Borrowing in Country H

The mutual funds in the two countries have the exclusive technology to perfectly verify the project outcomes of domestic agents and to liquidate the land stock of failed projects of domestic entrepreneurs at no discount.

As assumed in subsection 2.2, households in country H have a higher time discount factor than households in country F. As a result, the interest rate in country H exceeds the interest rate in country F, $r_t > r_t^*$, in the neighborhood of the steady state. In equilibrium, private agents in country H prefer to borrow from country F. As private agents in country F do not have the relevant technology to verify the project output in country H, private agents in country H cannot credibly pledge their project output for foreign funds.

[1]Each entrepreneur must put a positive amount of own funds in the project in order to acquire loans. Carlstrom and Fuerst (1997) and Bernanke, Gertler, and Gilchrist (1999) adopt the same approach.

However, they can borrow abroad against their domestic physical and financial assets. Normally, foreign investors are less familiar with the domestic asset market and would incur larger costs in liquidating collateral assets in the event of debtors' default than domestic agents. Furthermore, the domestic legal system is biased against foreign investors. Either way, foreign borrowing has to be overcollateralized in the following sense. In period t, each unit of land in country H is expected to have the value of $E_t q_{t+1}$ in period $t+1$ and domestic agents can pledge only $\theta_t^k E_t q_{t+1}$ to the foreign investors for $\frac{\theta_t^k E_t q_{t+1}}{r_t^*}$ units of final goods, where $\theta_t^k \in (0, 1]$ denotes the degree of land-backed foreign borrowing. $(1-\theta_t^k)$ can be regarded as a premium the foreign investors would have to pay to the domestic land buyers when they liquidate the collateralized land.[2] θ_t^k can be affected by many factors, e.g., the efficiency of the domestic legal system, the structure and maturity of domestic market institutions, the tightness of financial regulations, and etc. Thus, θ_t^k reflects the degree of foreign investor protection and the effective financial openness.

Similarly, each unit of deposit made at the mutual funds in country H in period t has an expected rate of return r_t in period $t+1$. Households in country H can pledge only $\theta_t^d r_t$ to the foreign investors for $\frac{\theta_t^d r_t}{r_t^*}$ units of final goods in period t, where θ_t^d denotes the degree of deposit-backed foreign borrowing. Given that households in country H collectively own the domestic mutual funds, the deposit-backed foreign borrowing essentially enables them to pledge part of the value of the superior verification and liquidation technology of the domestic mutual funds to the foreign investors.

2.1.1 Two Implementation Strategies of Financial Liberalization

In order to analyze how financial liberalization and its policy implementation in country H can affect production efficiency, social welfare, and macroeconomic fluctuations in both countries, we simply assume that the public financial regulator in country H has full control over θ_t^j, where $j \in \{d, k\}$, while the public financial regulator in country F do not restrict capital outflow.[3] θ_t^j keeps constant and the world economy is in its steady state before the public financial regulator in country H announces the policy change unexpectedly at the beginning of some period. Changing θ_t^j is not a day-to-day business

[2]This premium may vary along the business cycle and so does θ_t^k. See Iacoviello and Minetti (forthcoming) for a detailed discussion.

[3]At present, we do not explicitly analyze the implications of financial regulation on capital outflow from country F but focus on the financial regulation on capital inflow into country H. Indeed, international capital flow happens in our model only if the private agents in country H are allowed to borrow abroad AND the private agents in country F are allowed to lend abroad.

but an unexpected regime change. For the long-run effects of financial liberalization, we rule out unexpected policy changes and investigate the steady state features of production efficiency and welfare in the two countries under various θ^j in section 3.

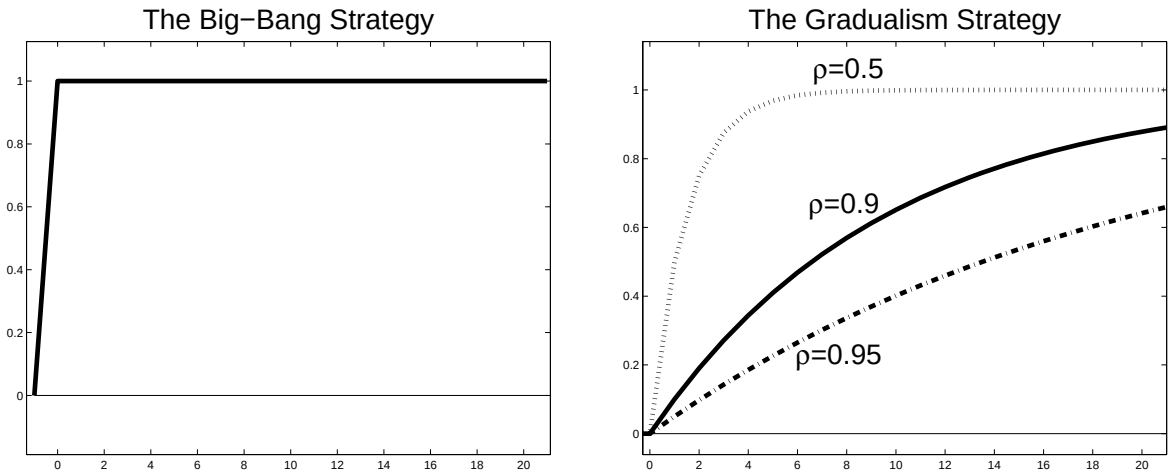

Figure 1: The Policy Path of Two Strategies

For the short-run dynamics, we model financial liberalization as the process in which the public financial regulator in country H raises θ^j permanently. It can choose either the big-bang strategy or the gradualism strategy. According to the big-bang strategy, it raises θ^j immediately in period t and keeps it constant at the new level before any further policy decision. The big-bang strategy can be modeled as the following process,

$$\log \theta_t^j = \log \theta_{t-1}^j + \varepsilon_t^j,$$

where ε_t^j denotes the one-time policy change in period t. According to the gradualism strategy, it announces a policy path for θ^j gradually rising to its new level over time. The gradualism strategy can be modeled as the following process,

$$\begin{aligned}
\log \theta_t^j &= \log G_t^j - \log J_t^j, \\
\log G_t^j &= \log G_{t-1}^j + \varepsilon_t^j, \\
\log J_t^j &= \rho \log J_{t-1}^j + \varepsilon_t^j,
\end{aligned}$$

where $\rho \in [0, 1]$ determines the speed of θ^j rising to the new level. The one-time policy change ε_t^j does not have immediate impact on θ^j in period 0, but θ^j rises gradually to the new level since period 1. See Gilchrist and Leahy (2002) for the modeling approach. Figure 1 shows the time path of θ^j under the two strategies, given a 1% positive policy change in period 0. A larger ρ in the gradualism strategy implies that it takes longer for θ^j to reach the new level. In section 4, we set $\rho = 0.9$ and compare the transitional dynamics of the world economy under the two implementation strategies.

2.1.2 Financial Contracts between Entrepreneurs and Foreign Investors

As shown in subsection 2.3, entrepreneurs in country H differ in their end-of-period wealth and are indexed by $i \in [0,1]$. As $r_t^* < r_t$, entrepreneur i prefers to pledge his land stock $k_{i,e}^e$ to the foreign investors for $z_{i,t}^{e,*}$ units of final goods before he turns to the domestic mutual funds for domestic loans. His collateral constraints are binding in equilibrium,

$$r_t^* z_{i,t}^{e,*} = \theta_t^k E_t q_{t+1} k_{i,t}^e. \tag{1}$$

As the production projects of entrepreneurs in country F have a higher expected rate of return than the interest rates in the two countries, they do not lend abroad. In the meantime, as the interest rate in country F is smaller than the interest rate in country H, they do not borrow abroad, either. Thus, only the households in country F lend abroad.

Since households in country F are risk averse and entrepreneurs in country H is risk neutral, the optimal financial contract should be a non-contingent contract providing households in country F with a secured return. In other words, it involves the split of capital gains (losses) between the contracting parties. If the public financial regulator in country H does not change θ^j, there is no aggregate uncertainty and thus there will not be any capital gains (losses). Even if the public financial regulator in country H changes θ^j, capital gains (losses) only occur at the date of announcement. Thus, different repayment forms do not change our results qualitatively. In period $t+1$, households in country F get $\theta_t^k E_t q_{t+1} k_{i,t}^e$ units of final goods as a safe repayment and the land has a net value of $q_{t+1} k_{i,t}^e - \theta_t^k E_t q_{t+1} k_{i,t}^e$ to the entrepreneur.

2.1.3 Financial Contracts between Households and Foreign Investors

As $r_t^* < r_t$, households in country H prefer to borrow cheap foreign funds and deposit at the domestic mutual funds so as to take advantage of the interest rate differential. Be specific, they pledge their land stock k_t to the foreign investors for $z_t^{h,*}$ units of final goods and pledge their domestic deposits d_t to the foreign investors for $z_t^{d,*}$ units of final goods in period t. The two collateral constraints are binding in equilibrium,

$$r_t^* z_t^{h,*} = \theta_t^k E_t q_{t+1} k_t, \tag{2}$$

$$r_t^* z_t^{d,*} = \theta_t^d r_t d_t. \tag{3}$$

As households in both countries are risk averse, the optimal financial contract should be a contract sharing unexpected changes in the land price and the deposit returns among them. As mentioned above, different specifications on debt repayment do not change our

results qualitatively. For simplicity, we assume that the international lending contract backed by the land stock of households in country H provides households in country F with a safe return, $\theta_t^k E_t q_{t+1} k_t$, and land has a net value of $q_{t+1}k_t - \theta_t^k E_t q_{t+1} k_t$ to households in country H in period $t+1$. Similarly, the international lending contract backed by the deposits of households in country H provides households in country F with a safe return, $\theta_t^d r_t d_t$, and the deposits have a net value of $\tilde{r}_{t+1} d_t - \theta_t^d r_t d_t$ to households in country H in period $t+1$, where $\tilde{r}_{t+1}$ is the ex post rate of return on the mutual funds in country H in period $t+1$. By definition, $r_t = E_t \tilde{r}_{t+1}$.

2.2 Households

Consider first the households in country H. They have identical preferences,

$$E_0 \sum_{t=0}^{\infty} \beta^t \left[\frac{c_t^{1-\sigma}}{1-\sigma} + \chi \frac{(1-l_t)^{1+\psi}}{1+\psi} \right],$$

where $\beta \in (0,1)$ denotes the time discount factor. c_t and l_t denote household consumption and labor supply in period t, respectively.

Given that k_{t-1} units of land were invested in the household project in period $t-1$, $H(k_{t-1})$ units of intermediate goods are produced at the beginning of period t and household sales revenues amount to $v_t H(k_{t-1})$. Given that $z_{t-1}^{h,*}$ units of final goods were borrowed abroad against the household land stock k_{t-1} in period $t-1$, the land stock has a net value of $q_t k_{t-1} - \theta_{t-1}^k E_{t-1} q_t k_{t-1}$ to households in period t. Given that households deposited d_{t-1} units of final goods at the mutual funds in period $t-1$ and borrowed $z_{t-1}^{d,*}$ units of final goods abroad against their deposit returns, the deposits has a net value of $\tilde{r}_t d_{t-1} - \theta_{t-1}^d r_{t-1} d_{t-1}$ to households in period t. The household wage income is $w_t l_t$.

At the end of period t, households consume c_t units of final goods, invest k_t units of land in their projects, deposit d_t units of final goods, and borrow $z_t^{h,*}$ and $z_t^{d,*}$ units of final goods abroad against their land stock and domestic deposits, respectively. According to equation (2), for each unit of land invested in period t, households only have to pay $u_t = q_t - \frac{\theta_t^k E_t q_{t+1}}{r_t^*}$ units of final goods, which is defined as the household unit down payment. According to equation (3), for each unit of deposit made in period t, households only have to put down $\left(1 - \frac{\theta_t^d r_t}{r_t^*}\right) d_t$ units of final goods, which is defined as the household net deposits. The household flow-budget constraints are binding in equilibrium,

$$\begin{aligned} \left(q_t - \frac{\theta_t^k E_t q_{t+1}}{r_t^*}\right) k_t + \left(1 - \frac{\theta_t^d r_t}{r_t^*}\right) d_t + c_t = \left(q_t - \theta_{t-1}^k E_{t-1} q_t\right) k_{t-1} + v_t H(k_{t-1}) \\ + \left(\tilde{r}_t - \theta_{t-1}^d r_{t-1}\right) d_{t-1} + w_t l_t. \end{aligned} \tag{4}$$

The optimization over $\{c_t, l_t, d_t, k_t\}$ gives the equilibrium conditions,

$$w_t = \chi(1-l_t)^{\psi} c_t^{\sigma}, \tag{5}$$

$$\left(\frac{1}{r_t} - \frac{\theta_t^d}{r_t^*}\right) = \beta(1-\theta_t^d) E_t \left(\frac{c_{t+1}}{c_t}\right)^{-\sigma}, \tag{6}$$

$$q_t - \frac{\theta_t^k E_t q_{t+1}}{r_t^*} = \beta E_t \left(\frac{c_{t+1}}{c_t}\right)^{-\sigma} [(1-\theta_t^k) q_{t+1} + v_{t+1} H'(k_t)]. \tag{7}$$

Consider now the households in country F. They have identical preferences,

$$E_0 \sum_{t=0}^{\infty} (\beta^*)^t \left[\frac{(c_t^*)^{1-\sigma}}{1-\sigma} + \chi^* \frac{(1-l_t^*)^{1+\psi}}{1+\psi}\right],$$

where $\beta^* \in (0,1)$ denotes the time discount factor. c_t^* and l_t^* denote household consumption and labor supply in period t, respectively.

Assumption 1. *The households in country F are more patient than the households in country H, $\beta^* > \beta$.*

Assumption 1 guarantees that the interest rate in country H exceed that in country F in the neighborhood of the steady state. In countries with the same time discount factor, the interest rate differential may still exist due to the difference in the growth rate of productivity. For simplicity, we model the interest rate differential via the difference in the time discount factor in the two countries.

The economic activities of households in country F almost resemble those of households in country H, except that they lend instead of borrow abroad. Let k_t^*, d_t^*, z_t^*, and $F(k_t^*)$ denote their land holding, domestic deposits, foreign lending, and the production function, respectively. Their period-budget constraints are binding in equilibrium,

$$q_t^* k_t^* + c_t^* + d_t^* + z_t^* = q_t^* k_{t-1}^* + v_t^* F(k_{t-1}^*) + \tilde{r}_t^* d_{t-1}^* + r_{t-1}^* z_{t-1}^* + w_t^* l_t^*, \tag{8}$$

where $\tilde{r}_t^*$ denotes the ex post rate of return on the mutual funds in country F. The optimization over $\{c_t^*, l_t^*, k_t^*, z_t^*, d_t^*\}$ gives the following conditions,

$$w_t^* = \chi^*(1-l_t^*)^{\psi}(c_t^*)^{\sigma}, \tag{9}$$

$$q_t^* = \beta^* E_t[q_{t+1}^* + v_{t+1}^* F'(k_t^*)] \left(\frac{c_{t+1}^*}{c_t^*}\right)^{-\sigma}, \tag{10}$$

$$1 = \beta^* r_t^* E_t \left(\frac{c_{t+1}^*}{c_t^*}\right)^{-\sigma}, \tag{11}$$

$$1 = \beta^* E_t \tilde{r}_{t+1}^* \left(\frac{c_{t+1}^*}{c_t^*}\right)^{-\sigma}. \tag{12}$$

Subsection 2.1 shows that their international lending in period t has a safe ex post rate of return r_t^* in period $t+1$. Subsection 2.4 shows that the mutual funds in country F cannot guarantee a safe ex post rate of return, $\tilde{r}_{t+1}^* \neq r_t^*$, if the policy is changed unexpectedly in period $t+1$. However, the no-arbitrage condition for the domestic deposits and the international lending of households in country F implies that $r_t^* = E_t \tilde{r}_{t+1}^*$.

2.3 Entrepreneurs

Consider first the entrepreneurs in country H. Each entrepreneur can choose one of the two projects: "Good" or "Bad", at the end of each period and his project choice is irreversible. Both projects have the same Leontief technology, i.e., a units of final goods are required for each unit of land invested.[4] At the beginning of the next period, both projects produce R units of intermediate goods per unit of land invested if they succeed; there is no output if they fail. The two projects provide the entrepreneur with safe, non-pecuniary private benefits[5] during the project process. For convenience of aggregation, we assume that private benefits are proportional to the amount of land invested. Project "Good" ("Bad") has a probability of success p^G (p^B) and provides entrepreneurs with private benefits b^G (b^B) per unit of land invested, where $0 < p^B < p^G < 1$ and $b^B > b^G > 0$. In other words, project "Good" is safer than projects "Bad", but entrepreneurs get larger unit private benefits from project "Bad".

As shown below, entrepreneurs differ in their end-of-period wealth and are indexed by $i \in [0,1]$. The expected utility function of entrepreneur i is,

$$E_0 \sum_{t=0}^{\tilde{T}} \beta^t \left[c_{i,t}^e + \mathcal{B} k_{i,t-1}^e \right],$$

where $\tilde{T}$ is the stochastic time of death and $\mathcal{B} \in \{b^G, b^B\}$ denotes private benefits per unit of land invested in project "Good" or project "Bad". $c_{i,t}^e$ denotes his consumption in period t and $k_{i,t-1}^e$ denotes his land stock invested in period $t-1$.

[4] In models with collateral constraints à la Kiyotaki and Moore (1997), the leverage ratio of borrowers, defined as the ratio of total investment over own funds, is equal to the inverse of the gross interest rate, which is too high and cannot be justified by the empirical data. We introduce the input of final goods to reduce the leverage ratio of entrepreneurs to the reasonable level, e.g., two.

[5] Our set-up resembles the principal-agent setting in Holmstrom and Tirole (1997, 1998). According to Hart (1995), private benefits may refer to any nonpecuniary benefits from running a project, e.g., large offices or luxury business cars. Private benefits are good for the project owners but may reduce the success probability of projects. The trade-off between the success probability and private benefits is a short-cut to capture the divergent objectives between the project owners and the outside financiers.

Our calibration guarantees that only project "Good" has a positive expected net present value around the steady state,

$$E_t\left[\frac{p^G Rv_{t+1}+(1-\theta_t^k)q_{t+1}}{r_t}+\frac{\theta_t^k q_{t+1}}{r_t^*}\right] > q_t + a > E_t\left[\frac{p^B Rv_{t+1}+(1-\theta_t^k)q_{t+1}}{r_t}+\frac{\theta_t^k q_{t+1}}{r_t^*}\right].$$

Therefore, project "Bad" should not be financed in equilibrium. Project "Good" also has a larger expected marginal rate of return than the household project.

At the end of period t, the entrepreneur invests $k_{i,t}^e$ units of land and $ak_{i,t}^e$ units of final goods into either project "Good" or project "Bad", using his own funds, $n_{i,t}$, land-backed foreign loans, $z_{i,t}^{e,*}$, and domestic loans, $z_{i,t}^m$. Thus, $n_{i,t} = (q_t + a)k_{i,t}^e - (z_{i,t}^{e,*} + z_{i,t}^m)$ is his net worth in the project. The land-backed foreign loan contract has been specified in subsection 2.1.2. As shown in Holmstrom and Tirole (1997), the loan contract between the entrepreneur and the domestic mutual funds resembles the standard loan contract. It specifies a promise to repay $R_t^m k_{i,t}^e$ units of final goods in period $t+1$ if the project succeeds. As the mutual funds can perfectly verify the output of the entrepreneur's project, the entrepreneur always repays the promised amount to the mutual funds if he is able to do so. If the project fails in period $t+1$, the entrepreneur hands over his land stock to the mutual funds. After repaying the foreign liabilities owed by the entrepreneur, the mutual funds keep the rest $(q_{t+1} - \theta_t^k E_t q_{t+1})k_{i,t}^e$. In order to induce the entrepreneur to choose project "Good", the mutual funds must give him enough incentives,

$$\left\{p^G E_t[Rv_{t+1}+(1-\theta_t^k)q_{t+1}-R_t^m]+b^G\right\}k_{i,t}^e \geq \left\{p^B E_t[Rv_{t+1}+(1-\theta_t^k)q_{t+1}-R_t^m]+b^B\right\}k_{i,t}^e.$$

The left (right) hand side denotes the expected utility of the entrepreneur if he chooses project "Good" ("Bad"). As the expected rate of return on project "Good" exceeds the domestic interest rate, the entrepreneur prefers to borrow to the limit. The incentive constraints are binding around the steady state and can be simplified to,

$$R_t^m = E_t[Rv_{t+1}+(1-\theta_t^k)q_{t+1}] - \tilde{b}, \quad \text{where} \quad \tilde{b} \equiv \frac{b^B - b^G}{p^G - p^B} > 0. \tag{13}$$

Each unit of land invested in project "Good" in period t has an expected pecuniary value of $E_t(p^G Rv_{t+1} + q_{t+1})$ in period $t+1$, in which $\theta_t^k E_t q_{t+1}$ is pledged to foreign lenders first. Any promise to repay more than $R_t^m k_t^e$ to the mutual funds in the case of success would violate the incentive constraints and is not credible. Thus, the entrepreneur can pledge $p^G R_t^m + (1-p^G)(1-\theta_t^k)E_t q_{t+1}$ per unit of land invested to the mutual funds in period t. $E_t(p^G Rv_{t+1}+q_{t+1})$ and $p^G(R_t^m+\theta_t^k E_t q_{t+1})+(1-p^G)E_t q_{t+1}$ are defined as the expected full unit value and external unit value of the land invested in project "Good", respectively.

The difference between the two values, $p^G\tilde{b}$, is used to motivate the entrepreneur to choose project "Good" despite the lower private benefits it promises, $b^G < b^B$.

The mutual funds are expected to break even in period t, $r_t z^m_{i,t} = [p^G R^m_t + (1-p^G)(1-\theta^k_t)E_t q_{t+1}]k^e_{i,t}$. It implies a credit constraint for the entrepreneur,

$$z^m_{i,t} = \Gamma_t n_{i,t}, \quad \text{where} \quad \Gamma_t \equiv \frac{\frac{p^G(RE_t v_{t+1}-\tilde{b})+(1-\theta^k_t)E_t q_{t+1}}{r_t}}{(q_t+a) - \frac{\theta^k_t E_t q_{t+1}}{r^*} - \frac{p^G(RE_t v_{t+1}-\tilde{b})+(1-\theta^k_t)E_t q_{t+1}}{r_t}}.$$

Γ_t is the domestic credit multiplier. As we are interested in the case where entrepreneurs finance their projects using both own funds and external funds, we calibrate the model in such a way that the denominator in the definition of Γ_t is positive around the steady state; otherwise, entrepreneurs can finance their projects using external funds only. As Γ_t is independent of $n_{i,t}$, domestic loans are proportional to the entrepreneur's net worth.

Suppose that entrepreneurs financed their project investment using foreign and domestic loans in period $t-1$. At the beginning of period t, entrepreneurs of mass p^G have successful projects and the rest have failed projects. After repaying foreign and domestic loans, entrepreneurs of mass $\pi \in (0,1)$ get a signal of survival and the rest have to die.

Entrepreneurs who have successful projects and receive the signal of death are of mass $p^G(1-\pi)$. They repay their liabilities, sell off their assets, consume all proceeds, and exit from the economy. Entrepreneurs who have failed projects and receive the signal of death are of mass $(1-p^G)(1-\pi)$. They hand over their land stock to the mutual funds and exit from the economy without consumption.

The newcomers and the surviving entrepreneurs are endowed with a unit of labor and in equilibrium, they supply their labor endowment inelastically $l^e_t = 1$ to the domestic production of final goods and their wage income is w^e_t. At the end of period t, entrepreneur i maximizes his expected utility function, subject to his foreign borrowing constraints specified in equation (1), domestic credit constraints, and period-budget constraints,

$$\begin{aligned} z^m_{i,t} &= \Gamma_t n_{i,t}, \\ (q_t+a)k^e_{i,t} &= n_{i,t} + z^m_{i,t} + z^{e,*}_{i,t} \quad \text{where} \quad n_{i,t} \equiv \mathcal{N}_{i,t} - c^e_{i,t}, \end{aligned}$$

where $\mathcal{N}_{i,t}$ denotes his end-of-period wealth. The newcomers and entrepreneurs who have failed projects and survive to the next period are of mass $(1-\pi)+(1-p^G)\pi$ and their end-of-period wealth is $\mathcal{N}_{i,t} = w^e_t$; entrepreneurs who have successful projects and survive to the next period are of mass $p^G\pi$ and their end-of-period wealth is $\mathcal{N}_{i,t} = w^e_t + (Rv_t + q_t - \theta^k_{t-1}E_{t-1}q_t - R^m_{t-1})k^e_{i,t-1}$. As the marginal rate of return on project "Good" exceeds the foreign and domestic interest rates, entrepreneurs put all end-of-period wealth

into their project, borrow external funds to the limit, and postpone consumption to the period of death. It also justifies the fact that the newcomers and the surviving entrepreneurs supply all of their labor endowment.

Due to the linear nature of the project technologies and the preferences, the external funds and the project investment of entrepreneur i are proportional to his net worth. Thus, only the first moment of the distribution of entrepreneurial net worth matters for the aggregate land stock in the entrepreneurial sector. Let lower-case letters without the index i denote per capita variables of entrepreneurs. Their per capita consumption c_t^e, net worth n_t, domestic loans z_t^m, foreign loans, $z_t^{e,*}$, and land holding k_t^e are

$$c_t^e = (1-\pi)p^G(Rv_t + q_t - \theta_{t-1}^k E_{t-1}q_t - R_{t-1}^m)k_{t-1}^e, \tag{14}$$

$$n_t = \pi p^G(Rv_t + q_t - \theta_{t-1}^k E_{t-1}q_t - R_{t-1}^m)k_{t-1}^e + w_t^e, \tag{15}$$

$$z_t^m = \frac{[p^G(RE_tv_{t+1} - \tilde{b}) + (1-\theta_t^k)E_tq_{t+1}]k_t^e}{r_t}, \tag{16}$$

$$z_t^{e,*} = \frac{\theta_t^k E_t q_{t+1} k_t^e}{r_t^*}, \tag{17}$$

$$k_t^e = \frac{n_t + z_t^{e,*} + z_t^m}{q_t + a}. \tag{18}$$

We introduce three auxiliary variables. The first is the entrepreneur unit down payment, defined as the amount of own funds the entrepreneur pays for a unit of land and the required input of final goods, $u_t^e = \frac{n_{i,t}}{k_{i,t}^e} = (q_t + a) - \frac{\theta_t^k E_t q_{t+1}}{r_t^*} - \frac{p^G(RE_tv_{t+1} - \tilde{b}) + (1-\theta_t^k)E_tq_{t+1}}{r_t}$. The second is the entrepreneur leverage ratio, defined as the ratio of total investment over his net worth, $\Omega_t \equiv \frac{(q_t+a)k_{i,t}^e}{n_{i,t}} = \frac{q_t+a}{u_t^e}$. The third is the profitability of project "Good", defined as the expected gross rate of return on the entrepreneur's net worth, $\xi_t \equiv \frac{p^G E_t[Rv_{t+1} + (1-\theta_t^k)q_{t+1} - R_t^m]k_{i,t}^e}{n_{i,t}} = \frac{p^G\tilde{b}}{u_t^e}$. The three auxiliary variables are independent of the entrepreneurs' net worth. Our calibration guarantees that the profitability of project "Good" exceeds the domestic interest rate around the steady state, $\xi_t > r_t$. As a result, entrepreneurs prefer to postpone consumption and borrow to the limit.

Consider now the entrepreneurs in country F. Their preferences, production projects, and economic activities almost resemble those of entrepreneurs in the home country, except that they do not borrow abroad. Let lower-case letters with star denote the corresponding parameters and variables in country F. The domestic external value of project "Good" per unit of land in the case of project success, R_t^{m*}, per capita consumption c_t^{e*}, net worth n_t^*, domestic loans z_t^{m*}, and land holding k_t^{e*} of entrepreneurs are

$$R_t^{m*} = E_t(R^* v_{t+1}^* + q_{t+1}^*) - \tilde{b}^*, \tag{19}$$

$$c_t^{e*} = (1-\pi)p^G(R^* v_t^* + q_t^* - R_{t-1}^{m*})k_{t-1}^{e*}, \tag{20}$$

$$n_t^* = \pi p^G(R^* v_t^* + q_t^* - R_{t-1}^{m*})k_{t-1}^{e*} + w_t^{e*}, \tag{21}$$

$$z_t^{m*} = \frac{[p^G(R^* E_t v_{t+1}^* - \tilde{b}^*) + E_t q_{t+1}^*]k_t^{e*}}{r_t^*}, \tag{22}$$

$$k_t^{e*} = \frac{n_t^* + z_t^{m*}}{q_t^* + a^*}. \tag{23}$$

Our calibration guarantees that the expected rate of return on project "Good" exceed the interest rates in both countries,

$$\xi_t^* \equiv \frac{p^G E_t(R^* v_{t+1}^* + q_{t+1}^* - R_t^{m*})k_{i,t}^{e*}}{n_{i,t}^*} = \frac{p^G \tilde{b}^*}{(q_t^* + a^*) - \frac{p^G(R^* E_t v_{t+1}^* - \tilde{b}^*) + E_t q_{t+1}^*}{r_t^*}} > r_t > r_t^*.$$

Thus, entrepreneurs do not lend abroad. Their leverage ratio is $\Omega_t^* = \frac{(q_t^* + a^*)\xi_t^*}{p^G \tilde{b}^*}$.

2.4 Mutual Funds

Consider first the mutual funds in country H. As the entrepreneurs' projects are subject to idiosyncratic risk and households are risk averse, the mutual funds emerge as the financial intermediaries. They collect deposits from domestic households and perfectly diversify their lending to domestic entrepreneurs in order to provide their owners (domestic households) with the least risky return. The loan contract described in subsection 2.3 implicitly provides domestic entrepreneurs with a net unit return, with a positive expected value, $p^G \tilde{b} > 0$, in period $t-1$. For a successful entrepreneur in country H, the post-repayment return on a unit of land in period t is

$$R v_t + q_t - R_{t-1}^m - \theta_{t-1}^k E_{t-1} q_t = \tilde{b} + R(v_t - E_{t-1} v_t) + (q_t - E_{t-1} q_t).$$

As shown in section 4, the policy shock results in unexpected changes in the prices of land and intermediate goods in period t. Let K_{t-1}^e and Z_{t-1}^m denote the aggregate land stock and domestic borrowing of entrepreneurs at the end of period $t-1$, respectively. The aggregate expected break-even condition of the mutual funds in period $t-1$ is $r_{t-1} Z_{t-1}^m = [p^G R_{t-1}^m + (1-p^G)(1-\theta_{t-1}^k) E_{t-1} q_t] K_{t-1}^e$. At the beginning of period t, the total repayment of entrepreneurs with successful projects is $p^G R_{t-1}^m K_{t-1}^e$; entrepreneurs with failed projects hand over their total land stock $(1-p^G) K_{t-1}^e$ to the mutual funds. After repaying $(1-p^G)\theta_{t-1}^k E_{t-1} q_t K_{t-1}^e$ to the foreign investors, the mutual funds keep the rest, $(1-p^G)(q_t -$

$\theta^k_{t-1}E_{t-1}q_t)K^e_{t-1}$. The ex post rate of return on mutual funds in period t is

$$\begin{aligned}\tilde{r}_t &= \frac{[p^G R^m_{t-1} + (1-p^G)(q_t - \theta^k_{t-1}E_{t-1}q_t)]K^e_{t-1}}{Z^m_{t-1}} \\ &= r_{t-1}\left\{1 + \frac{(1-p^G)(q_t - E_{t-1}q_t)}{E_{t-1}[p^G(Rv_t - \tilde{b}) + (1-\theta^k_{t-1})q_t]}\right\},\end{aligned} \tag{24}$$

which differs from its expected value $r_{t-1} \equiv E_{t-1}\tilde{r}_t$ due to unexpected changes in the price of land. The positive expected net return to entrepreneurs, $p^G\tilde{b}K^e_{t-1}$, helps absorb most of aggregate risk. According to our calibration, $1-p^G = 0.01$, the ex post rate of return on mutual funds and deposits does not differ much from its expected value.

Consider now the mutual funds in country F. Similar as the mutual funds in country H, they collect deposits from domestic households and perfectly diversify their lending to domestic entrepreneurs. Their ex post rate of return in period t is

$$\tilde{r}^*_t = \frac{[p^G R^{m*}_{t-1} + (1-p^G)q^*_t]K^{e*}_{t-1}}{Z^{m*}_{t-1}} = r^*_{t-1}\left\{1 + \frac{(1-p^G)(q^*_t - E_{t-1}q^*_t)}{E_{t-1}[p^G(R^*v^*_t - \tilde{b}^*) + q^*_t]}\right\}, \tag{25}$$

which differs slightly from its expected value $r^*_{t-1} \equiv E_{t-1}\tilde{r}^*_t$ due to unexpected changes in the land price.

2.5 Final Goods Production and Balance of Payment

Intermediate goods and labor are employed to produce final goods in the two countries,

$$Y_t = M^\alpha_t L^{(1-\alpha-\alpha')}_t (L^e_t)^{\alpha'}, \tag{26}$$

$$Y^*_t = (M^*)^\alpha_t (L^*_t)^{(1-\alpha-\alpha')}(L^{e*}_t)^{\alpha'}, \tag{27}$$

where M_t, L_t, and L^e_t denote aggregate inputs of intermediate goods, household labor, and entrepreneur labor in country H and M^*_t, L^*_t, and L^{e*}_t denote the corresponding variables in country F.[6] The inputs are priced by their marginal products in the two countries,

$$v_t M_t = \alpha Y_t, \tag{28}$$

$$w_t L_t = (1-\alpha-\alpha')Y_t, \tag{29}$$

$$w^e_t L^e_t = \alpha' Y_t, \tag{30}$$

$$v^*_t M^*_t = \alpha Y^*_t, \tag{31}$$

$$w^*_t L^*_t = (1-\alpha-\alpha')Y^*_t, \tag{32}$$

$$w^{e*}_t L^{e*}_t = \alpha' Y^*_t. \tag{33}$$

[6] As households and entrepreneurs are each of unit mass, the values of aggregate variables coincide with their per capita values.

International lending is overcollateralized by domestic assets in country H,

$$r_t^* z_t^* = \theta_t^k E_t q_{t+1} K + \theta_t^d r_t d_t, \tag{34}$$

and net exports of country H, NX_t, covers net interest payment on its foreign borrowing,

$$NX_t = r_{t-1}^* z_{t-1}^* - z_t^*. \tag{35}$$

Assumption 2. $\lim_{s\to\infty} E_t(\beta^s q_{t+s}) = 0$, *and* $\lim_{s\to\infty} E_t[(\beta^*)^s q_{t+s}^*] = 0$.

Assumption 2 helps rule out explosive land price bubbles in the two countries and the world economy converges to its steady state along a locally unique equilibrium path after a small policy shock. As there is no explosive land price bubbles in country H, the foreign loans backed by domestic assets in country H is sustainable. In this sense, country H, as a whole, is solvent and does not run into the problem of Ponzi games.

2.6 Market Equilibrium

The markets of land, intermediate goods, final goods, labor, and loans clear,

$$K = k_t + k_t^e, \tag{36}$$

$$K = k_t^* + k_t^{e*}, \tag{37}$$

$$M_t = H(k_{t-1}) + p^G R k_{t-1}^e, \tag{38}$$

$$M_t^* = F(k_{t-1}^*) + p^G R^* k_{t-1}^{e*}, \tag{39}$$

$$Y_t = c_t + c_t^e + a k_t^e + NX_t, \tag{40}$$

$$Y_t^* + NX_t = c_t^* + c_t^{e*} + a^* k_t^{e*}, \tag{41}$$

$$L_t^e = l_t^e = 1, \tag{42}$$

$$L_t^{e*} = l_t^{e*} = 1, \tag{43}$$

$$L_t = l_t, \tag{44}$$

$$L_t^* = l_t^*, \tag{45}$$

$$z_t^m = d_t, \tag{46}$$

$$z_t^{m*} = d_t^*, \tag{47}$$

$$z_t^* = z_t^{e,*} + z_t^{h,*} + z_t^{d,*}. \tag{48}$$

Definition 1. *Market equilibrium in the world economy is a set of allocations of households,* $\{k_t, l_t, z_t^{h,*}, z_t^{d,*}, c_t, k_t^*, l_t^*, z_t^*, c_t^*\}$*, and entrepreneurs,* $\{k_t^e, l_t^e, n_t, z_t^m, z_t^{e,*}, c_t^e, k_t^{e*}, l_t^{e*}, n_t^*, z_t^{m*}, c_t^{e*}\}$*, together with aggregate variables* $\{M_t, Y_t, NX_t, M_t^*, Y_t^*\}$ *and a set of prices* $\{v_t, q_t, w_t, w_t^e, r_t, \tilde{r}_t, R_t^m, v_t^*, q_t^*, w_t^*, w_t^{e*}, r_t^*, \tilde{r}_t^*, R_t^{m*}\}$ *in the two countries, satisfying equations* (2)- (3), (5)-(7), (9)-(11), (13)-(43)*, given the exogenous processes* $\{\theta_t^k, \theta_t^d\}$.

2.7 Calibration

We calibrate the model to fulfill certain conditions in the case of financial autarky ($\theta^k = \theta^d = 0$). The household project in country H takes the functional form, $H(k_t) = \frac{\epsilon K}{1+\lambda}\left[1-\left(1-\frac{k_t}{K}\right)^{1+\lambda}\right]$, and its marginal product, $H'(k_t) = \epsilon K\left(1-\frac{k_t}{K}\right)^{\lambda}$, is decreasing in the household land holding, where $\lambda = 8$. The household project in country F takes the similar functional form, $F(k_t^*) = \frac{\epsilon^* K}{1+\lambda}\left[1-\left(1-\frac{k_t^*}{K}\right)^{1+\lambda}\right]$.

We set $\beta = 0.98$ and $\beta^* = 0.99$ so that the annual interest rates in country H and in country F are 8% and 4% in the steady state, respectively. By convention, we set $\sigma = 1$ and $\psi = -5$. We set $\chi = 0.39$ and $\chi^* = 0.392$ so as to keep $l = l^* = \frac{1}{3}$, i.e., the households in the two countries work eight hours a day in the domestic production of final goods in the steady state. We set $\alpha = 0.36$ and $\alpha' = 0.00001$ so that the household wage income accounts for nearly 64% of aggregate output of final goods in each country and the entrepreneur wage income is negligible.

We set $p^G = 0.99$, implying a quarterly failure rate at 1 percent (Carlstrom and Fuerst, 1997). The surviving probability of entrepreneurs is set at $\pi = \frac{2}{3}$, implying that one-third of entrepreneurs have to exit from the economy each period in two countries. $\{R = 655, \tilde{b} = 1.92, \epsilon = 60, a = 1.53, R^* = 653, \tilde{b}^* = 1.93, \epsilon^* = 30, a^* = 1.54\}$ are calibrated jointly to satisfy the following conditions in two countries in the steady state: the aggregate land stock and the land price in each country are normalized at unity, $K = 1$ and $q = q^* = 1$; the land stock of entrepreneurs is three times as much as that of households, $\frac{k^e}{K} = \frac{k^{e*}}{K} = 0.75$; the leverage ratio, $\Omega = \Omega^* = 2$, implies that entrepreneurs finance half of the their project investments using own funds, as in Bernanke, Gertler, and Gilchrist (1999).

3 The Long-Run Effects of Financial Liberalization

3.1 Deregulating Deposit-Backed Foreign Borrowing

Figure 2 shows the steady state values of some endogenous variables in the world economy against θ^d, given $\theta^k \in \{0, 0.5, 1\}$, respectively. The horizontal axis denotes $\theta^d \in [0, 1]$. Agg, FG, EN, and HH denote aggregate, final goods, entrepreneurs, and households, respectively. (H) and (F) refer to the variables in country H and country F, respectively.

Consider the case in which land-backed foreign borrowing is not allowed in country H, $\theta^k = 0$. See the dotted line. The external funds of entrepreneurs in country H, $z^m = d$, consist of net deposits of domestic households, $d - z^{d,*} = (1 - \frac{\theta^d r}{r^*})d$, and deposit-backed

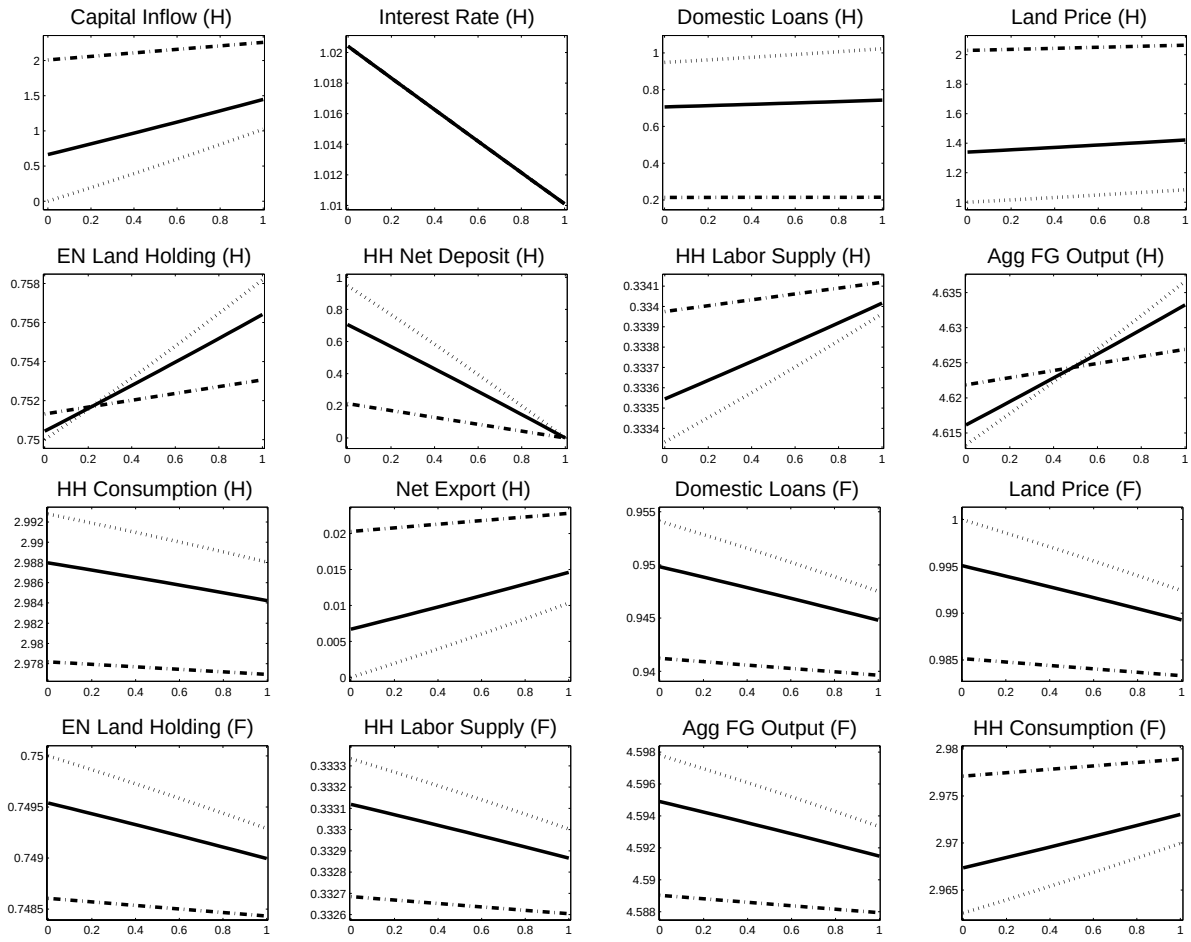

Figure 2: Deregulating Deposit-Backed Foreign Borrowing

foreign funds, $z^{d,*} = \frac{\theta^d r}{r^*} d$. According to equation (6), the rate of return on household net deposits in country H, $\frac{1-\theta^d}{\frac{1}{r}-\frac{\theta^d}{r^*}} = \frac{1}{\beta}$, is independent of θ^d. The rise in θ^d results in the substitution of cheap foreign funds for household net deposits. In the case of $\theta^d = 1$, households in country H fully pledge their deposits to the foreign investors and domestic lending to entrepreneurs in country H are indeed provided by the foreign investors only.

The interest rate in country H is $r = \frac{1}{\beta+\theta^d\left(\frac{1}{r^*}-\beta\right)}$. As θ^d rises from 0 to 1, r declines from $\frac{1}{\beta}$ to $r^* = \frac{1}{\beta^*}$. Given $\theta^k = 0$, entrepreneurs in country H cannot borrow directly abroad. However, the decline in the domestic interest rate enables them to benefit indirectly from cheap foreign funds. In this sense, households in country H act as financial intermediaries to channel cheap foreign funds into country H. Entrepreneurs in country H can expand their domestic borrowing and project investment. Given the fixed aggregate land stock, the rise in the their land demand pushes up the land price in country H. Their leverage ratio rises and so does their land holding. As project "Good" is more productive than the household project, the reallocation of land towards entrepreneurs in country H improve

production efficiency and aggregate output of intermediate goods in country H rises.

The rise in θ^d has three negative long-run wealth effects on households in country H: the return on their net deposit $(1-\theta^d)rd$ declines in θ^d and so do their land stock and sales revenues of intermediate goods. According to equation (4), the negative wealth effects induce them to increase labor supply. The increases in household labor and aggregate output of intermediate goods raise aggregate output of final goods in country H.

The increase in the wage income of households in country H cannot fully offset the decline in their wealth. Thus, their consumption declines in θ^d and so does their welfare, defined as the sum of the discounted utility from consumption and leisure, $\frac{1}{(1-\beta)}\left[\frac{c^{1-\sigma}}{1-\sigma}+\chi\frac{(1-l)^{1+\psi}}{1+\psi}\right]$. The consumption of entrepreneurs in country H, $c^e = (1-\pi)p^G\tilde{b}k^e$, is proportional to their land holding. Thus, entrepreneurs in country H benefit strictly from the favorable land reallocation, while household in country H lose strictly in country H.

The rise in θ^d also enables households in country F to lend more abroad and capital outflow reduces domestic funds available for entrepreneurs in country F. Entrepreneurs in country F have to reduce their land stock and the land price declines in country F. In this sense, deregulating deposit-backed foreign borrowing in country H worsens production efficiency in country F, because more land is allocated into the less productive projects (the household project). Aggregate output of intermediate goods declines in country F.

According to equation (8), the land reallocation in country F has three long-run wealth effects on households in country F: first, the decline in the land price and the rise in the household land holding leads to the fall in their land value; second, the increase in the household land holding raises their sales revenues of intermediate goods; third, the substitution of foreign loans for domestic loans increases the return on household financial assets (the sum of domestic deposit and foreign lending). The overall wealth of households in country F increases in θ^d. The positive wealth effect induces them to reduce labor supply and increase consumption. As a result, aggregate output of final goods in country F declines. The consumption of entrepreneurs in country F, $c^{e*} = (1-\pi)p^G\tilde{b}^*k^{e*}$, is proportional to their land holding. Thus, entrepreneurs in country F lose strictly from the unfavorable land reallocation, while households in country F benefit strictly.

Similar patterns can be found in the cases of $\theta^k = 0.5$ and $\theta^k = 1$. In this sense, due to domestic financial frictions, deregulating deposit-backed foreign borrowing in country H has the opposite implications to production efficiency in the two countries and it also has opposite welfare implications to households and entrepreneurs in each country.

3.2 Deregulating Land-Backed Foreign Borrowing

Figure 2 shows the steady state values of some endogenous variables in the world economy against θ^k, given $\theta^d \in \{0, 0.5, 1\}$, respectively. The horizontal axis denotes $\theta^k \in [0, 1]$.

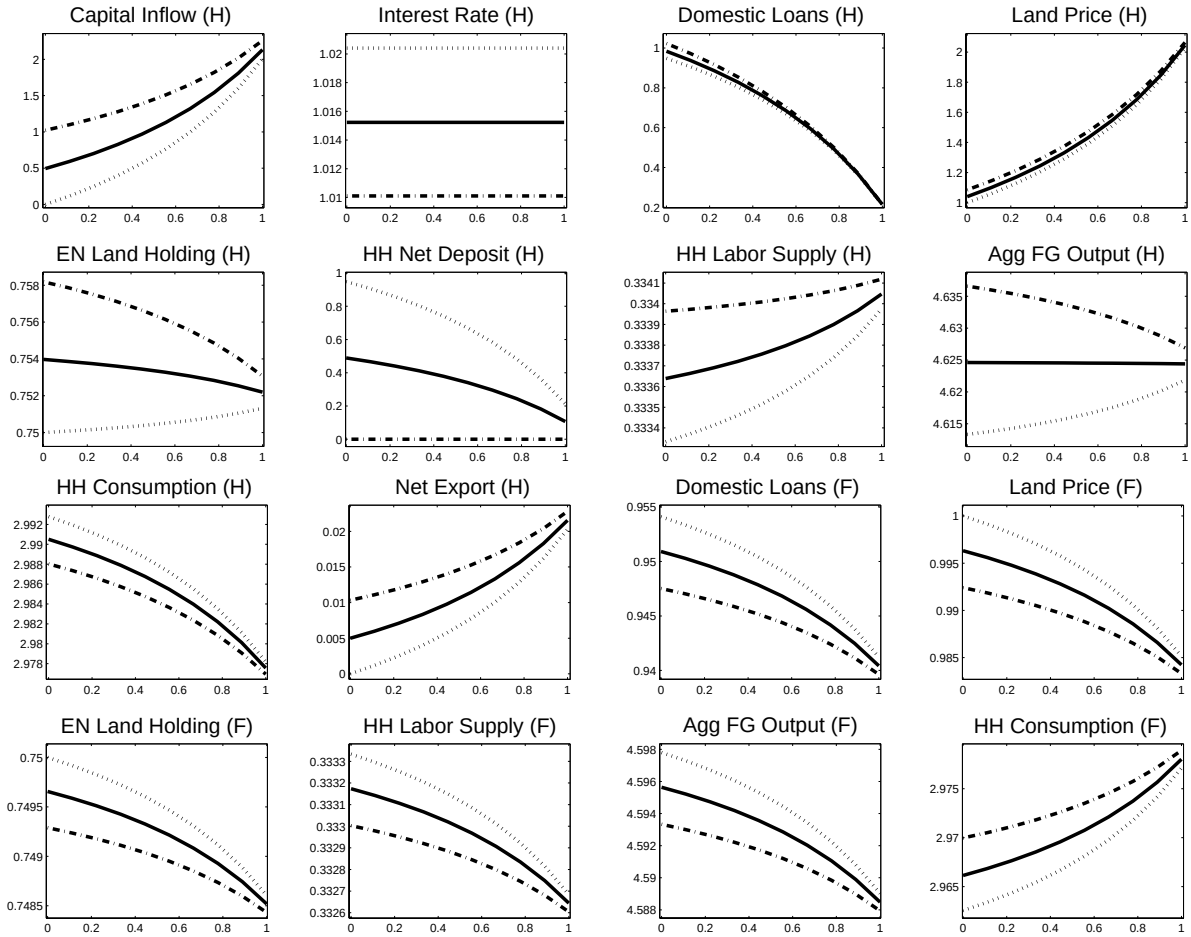

Figure 3: Deregulating Land-Backed Foreign Borrowing

Consider first the case in which deposit-backed foreign borrowing is not allowed in country H, $\theta^d = 0$. See the dotted line. Entrepreneurs in country H borrow from the domestic mutual funds at the interest rate larger than the foreign rate, $r = \frac{1}{\beta} > \frac{1}{\beta^*} = r^*$. Deregulating land-backed foreign borrowing, i.e., the rise in θ^k from 0 to 1, enables private agents in country H to borrow more abroad but it does not affect the interest rate differential. The decline in their unit down payments of land induces them to increase their land demand and the land price in country H rises. As a larger share of the external funds of entrepreneurs in country H is provided directly by the foreign investors at a rate lower than the domestic interest rate, the average cost of their external funds declines significantly in θ^k. Thus, their land holding rises and so does aggregate output of intermediate goods in country H. In addition, The land reallocation and the substitution of

foreign loans for domestic loans have negative wealth effects on households in country H. Due to capital outflow, the land price in country F declines in θ^k and land is reallocated towards households in country F. Similar as mentioned in subsection 3.1, deregulating land-backed foreign borrowing in country H improves (worsens) production efficiency and has opposite welfare implications to households and entrepreneurs in country H (F).

Consider now the extreme case in which household deposits in country H can be fully pledge to the foreign investors, $\theta^d = 1$. See the dash-dot line. There is no interest rate differential in the two countries, $r = r^* = \frac{1}{\beta^*}$ and households in country H actually make zero net deposits. In the case of $\theta^k = 0$, although entrepreneurs in country H cannot borrow abroad directly, all of their domestic loans are actually provided by the foreign investors via the household deposit-backed foreign borrowing. The rise in θ^k from 0 to 1 does not affect the cost of external funds of entrepreneurs in country H, while households in country H can acquire cheap foreign funds against their land stock and their land holding rises. In this case, deregulating land-backed foreign borrowing worsens production efficiency in country H and aggregate output of intermediate goods declines.

As the net land value of households in country H $(1 - \theta^k)qk$ declines in θ^k, they increase labor supply to partially offset the decline in their wealth. Despite the rise in household labor, their wealth still declines and so does their consumption. Therefore, both households and entrepreneurs in country H lose strictly in the long run. As the rise in household labor does not fully offset the decline in aggregate output of intermediate goods, aggregate output of final goods in country H declines in θ^k.

As mentioned above, capital outflow results in the decline in the land price in country F and land is reallocated towards households in country F. Thus, deregulating land-backed foreign borrowing in country H worsens production efficiency and has opposite welfare implications to households and entrepreneurs in country F.

In sum, financial liberalization in country H, as a multi-dimensional issue, involves deregulating deposit-backed and land-backed foreign borrowing. Interactions between the two components complicate the implications of financial deregulation to production efficiency and social welfare in country H. Whether deregulating land-backed foreign borrowing can improve production efficiency in country H depends on the regulation on deposit-backed foreign borrowing. In contrast, financial liberalization in country F, as a one-dimensional issue, simply implies more investment opportunity for households in country F. The capital outflow and the resulting asset reallocation in country F lead to unambiguous efficiency and welfare implications in country F.

4 The Implementation of Financial Liberalization

This section discusses how the two implementation strategies of financial liberalization in country H, i.e., the big-bang strategy and the gradualism strategy, can result in macroeconomic fluctuations in the two countries. Subsection 4.1 compares the model dynamics to the two strategies of raising θ^d permanently from 50% to 55%, given that the world economy is at its old steady state of $\theta^d = 50\%$ before period 0 and land-backed foreign borrowing is not allowed $\theta^k = 0$. Subsection 4.2 compares the model dynamics of the model economy to the two strategies of raising θ^k from 50% to 55%, given that the world economy is at its old steady state of $\theta^k = 50\%$ before period 0 and deposit-backed foreign borrowing is not allowed $\theta^d = 0$. Endogenous variables are approximated as the linear functions of the state variables in logarithms around the old steady state[7], which we solve using the MATLAB codes provided by Schmitt-Grohé and Uribe (2004).

4.1 Deregulating Deposit-Backed Foreign Borrowing

Figure 4 shows the impulse responses of the model economy to the big-bang strategy (dashed line) and the gradualism strategy (solid line) with which the public financial regulator in country H raises θ^d permanently from 50% to 55%, keeping $\theta^k = 0$ constant.

Consider the big-bang strategy first. The public financial regulator in country H announces an immediate and permanent increase in θ^d from 50% to 55% in period 0, as show in figure 1. Households in country H can increase their deposit-backed foreign borrowing dramatically in period 0. On the one hand, the supply effect dominates in the credit market of country H in the sense that the interest rate in country H declines in period 0, due to the inflow of cheap foreign funds; on the other hand, the dramatic increase in capital outflow from country F pushes up the interest rate in country F.

As show in figure 2, a rise in θ^d leads to a higher land price in country H in the new steady state. Anticipating this, private agents in country H prefer to increase their land demand immediately and the land price in country H rises in period 0. The capital gains improve household wealth and entrepreneurial net worth in country H. In contrast, anticipating a lower land price in country F in the new steady state, private agents in country F prefer to reduce their land demand and the land price in country F declines.

[7]Section 3 shows that financial liberalization in the form of a permanent change in θ^j changes the steady state of the world economy. Thus, the dynamic analysis based on the log-linearization at the old steady state could be inaccurate. However, for a small change in θ^j, we can still use first-order approximations to analyze the transitional dynamics from the old steady state to the new steady state.

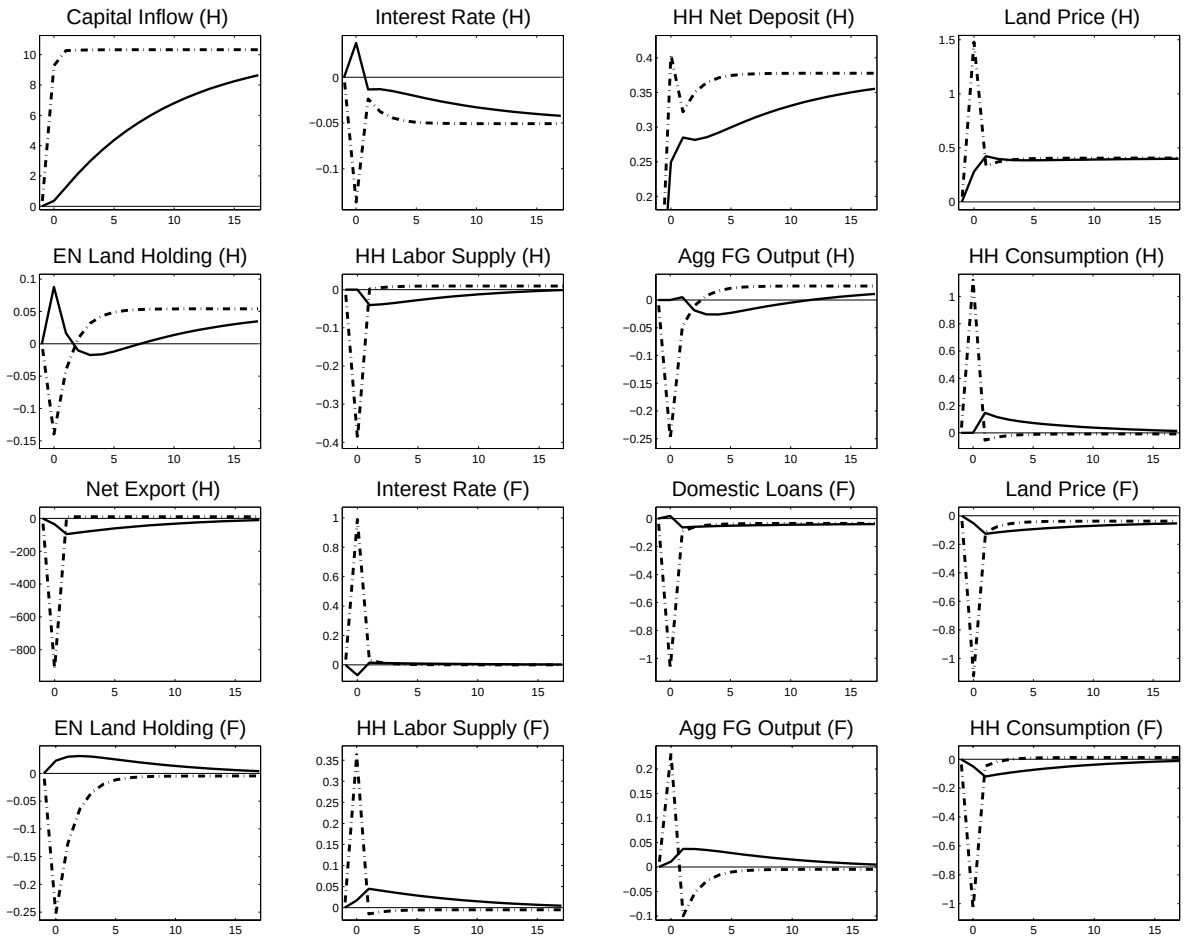

Figure 4: Deregulating Deposit-Backed FB: Big-Bang vs. Gradualism ($\theta^k = 0$)

The capital losses worsen household wealth and entrepreneurial net worth in country F.

The positive wealth effect and the decline in the domestic interest rate induces households in country H to increase consumption and reduce net deposits at the mutual funds in period 0. Anticipating a lower consumption in the new steady state, they prefer to smooth consumption by reducing their net deposits only by 7.9%, smaller than the 9.6% in the new steady state. As deposit-backed foreign borrowing rises by 8.4%, domestic loans available for entrepreneurs in country H rise by 0.5%, larger than the 0.4% in the new steady state. Thus, the interest rate in country H declines by 0.3%, larger than the 0.05% in the new steady state. The rise in the interest rate in country F induce households in country F to increase their financial assets (domestic deposits and foreign lending) and the capital losses force them to reduce consumption.

The rise in entrepreneurial net worth and the decline in the interest rate in country H jointly amplify their land demand and the land price in country H rises further. The spiral process between the land price, the household wealth, the interest rate, entrepreneurial

net worth, and the entrepreneurs' demand for land continues in country H. The two-way reinforcing interactions between prices and quantities are the inherent feature of models with financial frictions. Altogether, the land price rises by 2% in period 0, much larger than the 0.42% in the new steady state. The phenomenon that the period-0 responses of the interest rate and the land price in country H exceed their respective new steady state values is similar as the exchange rate overshooting shown by Dornbusch (1976). However, the overshooting here results from financial frictions instead of price rigidity. Due to the land price overshooting, entrepreneurs in country H have to reduce their land holding in period 0. While, the decline in entrepreneurial net worth and the rise in the interest rate in country F force entrepreneurs in country F to reduce their demand for land and domestic loans. The land price declines further and the resulting capital losses further worsens entrepreneurial net worth. In equilibrium, the land price overshoots in the sense that it declines by 1.8%, much larger than the 0.06% its new steady state value.

The positive (negative) wealth effect induces households in country H (F) to reduce (increase) their labor supply and aggregate output of final goods in country H (F) declines (rises) in period 0, given that aggregate output of intermediate goods is predetermined by the projects invested in period -1. As θ^d is constant at its new steady state value since period 0, the land price and the interest rate in the two countries converge fast to their respective new steady state values and so do other macroeconomic aggregates.

As shown in figure 2, households in country H strictly lose from deregulating deposit-backed foreign borrowing in the long run. Given that the cheap foreign funds eventually substitute household net deposits, households in country H have to consume their extra net deposits. At the same time, they reduce their labor supply in period 0 due to the positive wealth effect. Thus, they benefit in period 0. In this sense, the overall welfare implications of deregulating deposit-backed foreign borrowing to households in country H should be evaluated with the consideration of both short-run and long-run effects. Similarly, the increase in capital outflow from country F results in asset reallocation and asset prices decline in country F. The capital losses have negative wealth effects on households in country F. Although they benefit from deregulating deposit-backed foreign borrowing in the long run, their period utility actually declines in period 0.

Consider now the gradualism strategy. The public financial regulator in country H announces a policy path of θ_t^d in period 0, as show in figure 1. Anticipating that the land price will rise to the new steady state value in the future, private agents in country H increase their land demand in period 0. Thus, the land price rises in period 0 and the capital gains improve household wealth and entrepreneurial net worth in country H.

As $\theta_0^d = 50\%$ is still at its old steady state value in period 0, the deposit-backed foreign borrowing does not increase much in period 0. Thus, the demand effect dominates in the credit market of country H in the sense that the interest rate rise instead of decline as in the case of the big bang strategy. Anticipating a smaller land price in the new steady state, private agents in country F reduce their land demand in period 0 and the land price declines in period 0. Anticipating an increasing demand for foreign funds in country H and the interest rate in country F will be above its steady state value from period 1 on, households in country F increase their financial assets in period 0 so as to take advantage of the favorable interest rate in period 1. Thus, the supply effect dominates in the credit market of country F in the sense that the interest rate declines instead of rise as in the case of the big bang strategy.

The capital gains and the rise in the domestic interest rate have opposite effects on the project investment of entrepreneurs in country H. In equilibrium, they increases their land stock by 0.08% and the land price in country H does not overshoot in period 0. The capital gains and the rise in the domestic interest rate also have opposite effects on household deposits, consumption, and labor supply in country H. In equilibrium, they reduce labor supply and increase net deposits and consumption slightly. Aggregate output of final goods decline slightly in period 0. The capital losses and the decline in the interest rate in country F have opposite effects on the project investment of entrepreneurs in country F. In equilibrium, they increase their land stock and the land price in country F does not overshoot in period 0. The capital losses force households in country F to reduce consumption and increase labor supply.

From period 1 on, θ^d rises gradually to the new steady state value. Due to the increase in the deposit-backed foreign borrowing, the interest rate in country H falls below the old steady state value in period 1 and converges to the new steady state value from then on. Thus, household consumption in country H rises above the old steady state value in period 1 and converges to the new steady state value that is lower than the old one. In the meantime, household labor supply in country H falls below the old steady state value in period 1 and converges to the new steady state value that is above the old one. The opposite short-run and long-run welfare implications to households in country H are similar as in the case of the big-bang strategy.

Due to the gradual increase in the deposit-backed foreign borrowing from country H since period 1, the interest rate in country F rises above its steady state value in period 1 and converge gradually to its steady state value from then on. In order to take advantage

of the favorable interest rate, households in country F further reduce their consumption and increase labor supply in period 1. Their consumption and labor supply converge gradually to their respective new steady state values from then on. In this sense, although households in country F benefit strictly in the long run, their period utility actually falls below its old steady state value during the transitional dynamics. In the meantime, as households in country F shift their investment from land to foreign lending, the land price in country F further declines in period 1 and gradually converge to its new steady state value. Although the interest rate in country F rises above its steady state value in period, the further decline in the land price enables entrepreneurs in country F to increase their land stock further in period 1. Although they lose strictly in the long run from the rise in θ^d, they actually benefit during the transitional process.

Output, labor, consumption, the interest rates and the land prices in the two countries respond in a much smaller magnitude to the gradualism strategy than to the big-bang strategy. Thus, the gradualism strategy helps achieve a smoother transition.

4.2 Deregulating Land-Backed Foreign Borrowing

Figure 5 shows the impulse responses of the world economy to the big-bang strategy (dashed line) and the gradualism strategy (solid line) with which the public financial regulator in country H raises θ^k permanently from 50% to 55%, keeping $\theta^d = 0$ constant.

Consider first the big-bang strategy. The public financial regulator in country H raises θ^k from 50% to 55% from period 0 on and private agents in country H can immediately increase their land-backed foreign borrowing in period 0. On the one hand, the cheap foreign funds reduces the net cost of their project investment and the increase in their land demand pushes up the land price in country H; on the other hand, entrepreneurs in country H substitute foreign loans for domestic loans and the decline in the demand for domestic loans reduces the interest rate in country H. The dramatic increase in land-backed foreign funds in country H pushes up the interest rate in country F.

The capital gains improve entrepreneurial net worth and household wealth in country H. As entrepreneurs in country H increase their land demand over-proportionally, the land price rises further and the spiral process between the land price, entrepreneurial net worth, and the entrepreneurs' demand for land continues. Altogether, the land price overshoots by 3.46% in period 0, larger than its new steady state value 3.43%.

The capital gains and the decline in the domestic interest rate induce households in country H to increase consumption and reduce domestic deposits. Anticipating that a

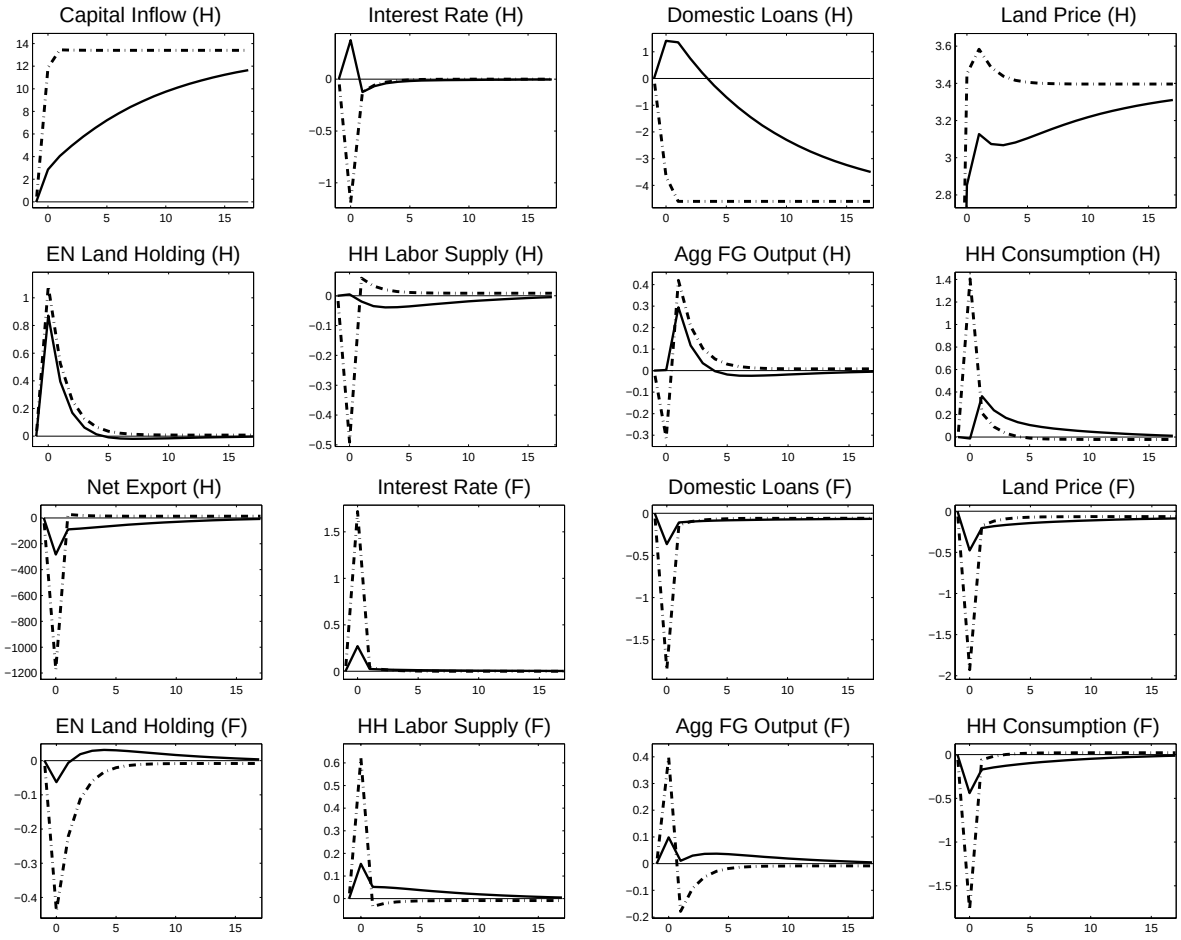

Figure 5: Deregulating Land-Backed FB: Big-Bang vs. Gradualism ($\theta^d = 0$)

lower consumption in the new steady state, households prefer to smooth consumption by reducing deposits by 3.1%, smaller than the 4.6% in the new steady state. Thus, the interest rate in country H declines by 1.8%. They also reduce labor supply and aggregate output of final goods in country H declines in period 0.

In contrast, the rise in the interest rate in country F forces entrepreneurs in country F to reduce their demand for land and domestic loans. The land price in country F declines to clear the market. The capital losses further worsen the net worth of entrepreneurs in country F and their land stock falls over-proportionally. In equilibrium, the land price declines by 2.8% in country F, much larger than the 0.1% in the new steady state.

Although the capital losses have negative wealth effects on households in country F, the rise in the interest rate in country F induces them to increase their overall financial assets and reduce consumption. They increase labor supply to take advantage of the high interest rate and thus, aggregate output of final goods in country F rises in period 0.

Suppose that there is no more policy shock from period 1 on. Macroeconomic aggre-

gates converge to their respective steady state values from period 1 on. Thus, the period utility of households in country H (F) is above (below) its old steady state value in period 0 and converges to its new steady state value very fast.

Consider now the gradualism strategy. The public financial regulator in country H announces a policy path for θ_t^k in period 0, as shown in figure 1. Anticipating a higher land price in the future, private agents in country H increase their land demand immediately in period 0 and the land price in country H rises. The capital gains improve the net worth of entrepreneurs in country H and they increase their demand for external funds and land. As the degree of land-backed foreign borrowing is still at its old value in period 0, $\theta_0^k = 50\%$, they cannot increase their land-backed foreign borrowing dramatically in period 0. Due to their excess demand for domestic loans, the interest rate in country H rises by 0.5% in period 0 instead of decline by 1.8% in the case of the big bang strategy. The increase in their land demand pushes up the land price by 2.74%. As the land price in country H is expected to be 3.16% above the old steady state value in period 1, the land-backed foreign borrowing rises in period 0. Accordingly, the interest rate in country F rises by 0.38%. The rise in the interest rates in both country actually curbs the excess demand of entrepreneurs in country H for external funds and land. As a result, the land price in country H does not overshoot and their land holding increases by 0.8% in period 0, smaller than the 1.1% in the case of the big bang strategy. The rise in the interest rate in country H induces domestic households to increase deposits. The capital gains and the rise in the interest rate in country H have opposite effects on their consumption and labor supply. In equilibrium, they slightly increase consumption and reduce labor supply in period 0. Thus, aggregate output of final goods declines slightly.

The rise in the interest rate in country F forces entrepreneurs in country F to reduce their demand for loans and land. The decline in the land price has negative wealth effects on entrepreneurs and households in country F. Entrepreneurs have to reduce their land holding over-proportionally in period 0. The rise in the interest rate and the capital losses in country F induce households in country F to increase their overall financial assets and reduce consumption. In the meantime, they increase labor supply so as to partially offset the negative wealth effect and take advantage of the high interest rate in period 0. As a result, aggregate output of final goods in country F rises.

As entrepreneurs in country H can pledge an increasingly larger fraction of their land value to the foreign investors from period 1 on, their demand for domestic loans declines and the interest rate in country H falls below the steady state value. The returns on the period-0 deposits improve household wealth in period 1. Thus, households in country H

increase consumption and reduce labor supply. The increase in the period-0 land stock of entrepreneurs in country H results in the rise in aggregate output of intermediate goods in period 1 and it overcompensates the decline in household labor supply. As a result, aggregate output of final goods in country H rises in period 1. Anticipating a lower consumption in the new steady state than in the old one, households in country H prefer to smooth consumption by further increasing their deposits despite a lower domestic interest rate in period 1. From then on, macroeconomic aggregates converge to their respective new steady state values.

During the rise in θ^k over time, entrepreneurs in country H are able to gradually substitute their land-backed foreign borrowing for domestic loans and thus, households in country H have to reduce domestic deposits eventually. In other words, the rise in household period utility in the first few periods actually results from the spending of these deposits. While, the gradual increase in the capital outflow from country F keeps the interest rate above its steady state value. In order to take advantage of the high interest rate, households in country F increase labor supply and reduce consumption in the short run. Thus, although they benefit in the long run from the rise in θ^k, their period utility actually falls below its old steady state level during the transitional process.

Similarly as in the case of deregulating deposit-backed foreign borrowing, macroeconomic aggregates respond to the gradualism strategy in a smaller magnitude than to the big-bang strategy. In this sense, the gradualism strategy avoids large macroeconomic fluctuations and helps achieve a smoother transition.

5 Final Remarks

We analyze macroeconomic implications of financial liberalization in a two-country model. Suppose that there is an interest rate differential in the two countries. Financial liberalization facilitates international capital flows. As financial liberalization is a multi-dimensional issue, the sophisticated interactions of its various components make the policy evaluation ambiguous. Whether the deregulation in one sector can improve production efficiency might depend on the regulation in other sector. Furthermore, due to domestic financial frictions in each country, the increase in international capital flow due to financial liberalization leads to the reallocation of productive assets among private agents with different productivity. Therefore, financial liberalization can have opposite welfare implications to different agents in the long run. The implementation strategy of financial liberalization is of great importance to the transitional dynamics. Due to financial

frictions, asset prices overshoot in the short run and the resulting macroeconomic fluctuations are large if financial liberalization is implemented hastily. If it is implemented gradually, private agents have time to adjust to the new policy environment and the resulting macroeconomic fluctuations are much smaller than the hasty implementation.

Due to some of our assumptions, the efficiency gains resulting from asset reallocation are quantitatively small. First, the interest rate differential in our model, for simplicity, results from the difference in the time discount factors of the two country and there is zero long-run productivity growth. Suppose that the discount factors in the two countries are same but the productivity in the two countries grows at the different rates. Interest rate differential may still arise. If this is the case, the efficiency gains due to asset reallocation can be rather significant. Second, the inflow of foreign funds into country H does not affect the total external value of the project of entrepreneurs in country H very much. Thus, the difference in the interest rates of domestic loans and foreign loans only induces entrepreneurs in country H to substitute foreign funds for domestic funds. Suppose that foreign investors do not just passively lend against domestic assets but actively monitor the projects of entrepreneurs in country H. Thus, entrepreneurs can credibly choose more productive projects. The active monitoring of foreign investors helps mitigate the information problems in country H and the efficiency gains can be significant even in the case of zero economic growth.

In our model, deregulating deposit-backed foreign borrowing increases the world output of final goods. As financial liberalization may has opposite welfare implications to different domestic agents in the each country in the long run, a related political issue is whether those suffering from financial liberalization can be compensated via public transfer. We put it on the future research agenda.

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