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A Welfare Analysis of Capital Account Liberalization

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Abstract

We develop a model of a small open economy with credit market frictions of the Holmstrom-Tirole type to analyze the consequences of capital account liberalization. We show that financial opening facilitates the inflows of cheap foreign funds and improves production efficiency. Reforms increasing labor market flexibility can further improve such efficiency gains. However, capital account liberalization also has important distributional consequences. Specifically, it may be impossible to use public transfers to fully compensate the loss of those negatively affected by capital account liberalization. This explains why financial opening often meets fierce opposition even though it leads to efficiency gains for the economy as a whole. From a practical perspective, capital controls should be lifted gradually for a smooth transition.

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1   Introduction

We address three related questions on capital account liberalization in a small-open-economy model with financial frictions. How does capital account liberalization affect production efficiency? Who benefits from capital account liberalization in the long run and in the short run? How should capital account liberalization be implemented?

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 as well as to reduce risk via international portfolio diversification. 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. Furthermore, firms will undervalue international collateral and choose excessive dollar liabilities. Caballero, Farhi, and Gourinchas (2006) analyze the effects of different structural shocks on global capital flows, portfolio shares and interest rates. The three papers do not compare the efficiency and welfare under financial opening and financial autarky. Gourinchas and Jeanne (2006) show that conventionally measured welfare gains from financial integration appear relatively limited for emerging economies. The welfare gain from shifting from financial autarky to perfect integration is roughly equivalent to a 1% permanent increase in domestic consumption.

During the past two decades, many countries have deregulated financial markets and lifted capital controls. Global capital flows have achieved record highs relative to global income. However, capital account liberalization has unequal or even opposite welfare implications to different individuals. As Gourinchas and Jeanne (2006) use a representative agent model, they do not discuss the distributional effect on different agents. Francisco (2005) shows in a two-country real business cycle model with heterogeneous agents that capital account liberalization makes low-wealth agents better off in the long run since increases in their income compensate the changes in volatility associated with capital flows. 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 negatively on the degree of capital controls. In the case of capital inflow, all agents benefit from capital account liberalization in the long run. However, Das and Mohapatra (2003) show empirically that liberalization increases inequality. Be specific, they analyze the dynamics of the shifts in income distributions in a sample of 11 countries that undertook extensive economic reforms between 1986 and 1995; they show a positive coefficient between liberalization and the highest income quintile's share of mean income, and a negative coefficient between liberalization and the middle class income share.

In addition, efficiency gains from capital account liberalization may also depend on

other market institutions, e.g., the labor market. Acemoglu (2001) and Wasmer and Weil (2004) analyze how credit market imperfections can influence unemployment and aggregate economic activity. However, there may be repercussion from labor market to credit market in the sense that the labor market flexibility may influence the output effect of capital account liberalization. Therefore, the coordination of liberalization in credit market and labor market should be taken into consideration. This point has not yet been made explicitly in the current literature on capital account liberalization.

The proper sequencing and implementation are of great importance for the overall success of capital account liberalization. Bacchetta and van Wincoop (1998) and Iacoviello (2002) provide some empirical evidence on financial liberalization and asset price overshooting. The asset price booms may lead to lending booms and then huge amount of non-performing loans ex post, as observed before the East Asian financial crises.

Our main results are as follows. First, financial opening facilitates the inflows of cheap foreign funds and improves production efficiency. Second, due to endogenous asset reallocation, the more productive agents benefit while the less productive agents lose from capital account liberalization. It may be impossible to use public transfers to fully compensate the loss of those negatively affected by capital account liberalization. This explains why financial opening often meets fierce opposition even though it leads to efficiency gains for the economy as a whole. Third, reforms increasing labor market flexibility can further improve such efficiency gains. Fourth, although some agents lose in the long run, their conditional welfare actually rises during the transitional process. Fifth, from a practical perspective, capital controls should be lifted gradually for a smooth transition.

The intuitions behind our results can be briefly shown as follows. Consider a small open economy with two types of domestic agents: households and entrepreneurs. Both have projects to produce intermediate goods using a durable physical asset, e.g., land. The project that entrepreneurs choose in equilibrium is expected to be more productive than the household project. As households are risk averse and the entrepreneurs' project is subject to idiosyncratic risk, mutual funds emerge as financial intermediaries in equilibrium: they collect deposits from households and lend to entrepreneurs. Due to unobservable project choice à la Holmstrom and Tirole (1997), entrepreneurs cannot fully pledge the project outcomes for loans. As a result, some of the land stock is inefficiently allocated to households. Given that land has a fixed total supply, production efficiency can be measured by the entrepreneurs' fraction of the total land stock. Domestic agents have labor endowment. Final goods are produced from intermediate goods and labor.

Foreign lenders are risk neutral and supply funds at a constant interest rate lower than the domestic rate. Foreign lenders are less informed of the domestic projects and less familiar with the domestic market institutions than the mutual funds. Thus, they do not lend directly to domestic individuals but make deposits at the mutual funds.

In consideration of financial security and financial stability, the public regulator controls capital flows.[1] We model capital controls as the upper limit on the foreign fraction of total deposits at the mutual funds. Thus, capital account liberalization is the process in which the public regulator raises the limit permanently. The public regulator can choose either the big bang strategy or the gradualism strategy. The former refers to an announcement of an immediate increase in the limit, while the latter refers to an announcement of a policy path for the limit gradually approaching the new level over time.

Our first result says that capital account liberalization enables mutual funds to get more foreign deposits at a lower interest rate. As the weighted average of the domestic and foreign deposit rates, the domestic loan rate declines when capital controls are lifted. Although entrepreneurs cannot borrow directly abroad, they benefit from the decline in the loan rate. Thus, more land is allocated towards entrepreneurs and production becomes more efficient in the long run. Note that the size of the efficiency gains from capital account liberalization is determined by the interest rate differential between domestic and foreign deposits. Given a constant domestic deposit rate, efficiency gains are smaller in the case of a higher foreign interest rate.

Our second result says that the more productive agents (entrepreneurs) benefit strictly from the favorable asset reallocation; while, due to the substitution of cheap foreign deposits for domestic deposits and the unfavorable asset reallocation, the less productive agents (households) may lose in the long run. Intuitively, capital account liberalization enables foreign lenders to get an interest payment from the domestic economy. If the foreign interest rate is not too small, the net interest paid to foreign lenders may exceed the efficiency gains from capital account liberalization. In this case, given that entrepreneurs benefit strictly from asset reallocation, households are worse off than under international financial autarky. In order to compensate the loss of households, the public regulator may consider a transfer to households which is financed by tax on entrepreneurs. However, such taxes reduce the borrowing capacity of entrepreneurs ex ante and have negative effects on production efficiency. Given that the tax on entrepreneurs does not make entrepreneurs worse off than under international financial autarky, public transfers cannot fully compensate the loss of households. This result holds in our model as long as the net foreign interest rate is positive. In this sense, capital account liberalization increases inequality in the country with capital inflows and may be undesirable from the welfare perspective. Our prediction on the relationship between capital account liberalization and inequality is in line with the empirical evidence provided by Das and Mohapatra (2003).

Our third result says that efficiency gains are larger if the household labor supply is more flexible. On the one hand, capital account liberalization has the negative effect on household wealth. On the other hand, the reallocation of land towards entrepreneurs

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[1]Neely (1999) gives an introduction to the purposes and types of capital controls.

raises aggregate output of intermediate goods. Given that final goods are produced from labor and intermediate goods in a Cobb-Douglas fashion, the rise in one input pushes up the price of the other input. Thus, the wage rate rises. In countries with more flexible labor market, the labor supply elasticity is higher and a rise in wage rate pushes up the household labor supply in a larger magnitude than in other countries. Thus, the negative wealth effect and the positive wage effect from capital account liberalization induce households to increase their labor supply. At the same time, the rise in the household labor supply also pushes up the price of intermediate goods and the external value of the entrepreneurs' projects increases, too. Thus, entrepreneurs can acquire more loans and invest more land in their projects. In this sense, capital account liberalization has an indirect positive output effect via the channel of the household labor supply. From the efficiency perspective, capital account liberalization should be accompanied with reforms increasing labor market flexibility.

Our fourth result says that households finance extra consumption using their deposits substituted by the cheap foreign funds in the initial periods of financial opening. Thus, households benefit in the short run, although they lose in the long run.

Our fifth result says that due to financial frictions, the land price overshoots in the short run and macroeconomic fluctuations are large if capital controls are lifted hastily. Thus, from a practical perspective, capital account should be liberalized gradually to avoid asset price overshooting and its undesired consequences.

The rest of this paper is organized as follows. Section 2 describes the model. Section 3 discusses the long-run efficiency and welfare implications of capital account liberalization. Section 4 analyzes the transitional dynamics of capital account liberalization under two implementation strategies. Section 5 concludes with some final remarks.

2   The Model

Consider a small, open, real economy with infinite time horizon. There are a continuum of foreign lenders, a public regulator, and two types of domestic agents: households and entrepreneurs, each of unit mass. A durable domestic asset (land) has a fixed total supply, K. There are two perishable goods: an intermediate good, a final good. Intermediate goods are only used for domestic production and not subject to foreign trade, while final goods can be consumed, invested, or traded. We choose the final good as the numeraire.

Households are risk averse and infinitely lived. They have a safe backyard project to produce intermediate goods using land as the only input. Entrepreneurs are risk neutral and each has a constant probability of survival, π. 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. Each entrepreneur has two available projects to produce

intermediate goods using both land and final goods as inputs. Projects are subject to idiosyncratic risk: they 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 projects. Land does not depreciate, while the final goods invested fully depreciates in production. Households and entrepreneurs have labor endowment each period. Final goods are produced using intermediate goods and labor contemporaneously.

The project that entrepreneurs choose in equilibrium is expected to be more productive than that of households. As households are risk averse and the entrepreneurs' project is subject to idiosyncratic risk, mutual funds emerge as financial intermediaries. They collect deposits from households and r_t^d denotes the gross deposit rate. Given the time length of the entrepreneurs' project, mutual funds give one-period loans to entrepreneurs and r_t denotes the gross loan rate.[2] Foreign lenders supply funds inelastically at a constant interest rate lower than the domestic loan rate, $r^* < r_t$. The public regulator controls capital inflows, as described in subsection 2.1. In addition, the public regulator taxes entrepreneurs and makes lump-sum transfer to households.

Land is traded at the spot market. Let v_t, q_t, w_t, and w_t^e denote the prices of intermediate goods and land, and the wage rates of households and entrepreneurs, respectively.

2.1 International Capital Flows

The mutual funds have the exclusive technology to perfectly verify the project outcomes of domestic agents and liquidate at no discount the land stock of domestic agents in default. Given the interest rate differential, $r_t > r^*$, domestic agents prefer to borrow abroad for the cheap foreign funds. However, lack of required technologies and less familiar with the domestic economy, foreign lenders prefer to make deposits at the mutual funds instead of lend directly to domestic agents.

2.1.1 Capital Controls

Financial stability and financial security are among the arguments for capital controls in many developing economies.[3] Let Z_t denote aggregate loans provided by mutual funds. The public regulator allows mutual funds to finance their domestic loans using foreign funds without exceeding the upper limits of $z_t^* = \theta_t Z_t$, where $\theta_t \in [0, 1]$ denotes the

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[2]The domestic deposit rate r_t^d and the loan rate r_t are same under international financial autarky; otherwise, they are different. See subsection 2.4 for details.

[3]We analyze the implications of capital account liberalization instead of why capital controls exist and why capital account liberalization happens. Capital account liberalization may result from domestic and foreign pressures. It is not a day-to-day business but an unexpected regime change. Eichengreen (2001) surveys the literature on the usage of capital controls and the motives of capital account liberalization.

degree of capital controls. The mutual funds finance the rest of their domestic loans using domestic deposits, $d_t = (1 - \theta_t)Z_t$. The break even condition of mutual funds implies that the loan rate r_t is the weighted average of the domestic and foreign deposit rates,

$$r_t Z_t = r^* \theta_t Z_t + r_t^d (1 - \theta_t) Z_t, \quad \text{or} \quad r_t = r^* \theta_t + r_t^d (1 - \theta_t). \tag{1}$$

Given $r_t^* < r_t^d$ in the neighborhood of the steady state, the loan rate is between the domestic and foreign interest rates and declines in $\theta \in (0, 1)$.

2.1.2 Capital Account Liberalization

In order to analyze how capital account liberalization can affect production efficiency, social welfare, and macroeconomic fluctuations, we simply assume that the public regulator has full control over θ_t. For the long-run analysis of capital account liberalization, we investigate the steady state features of production efficiency and social welfare under various degrees of capital controls in section 3.

For the short-run dynamics, we model capital account liberalization as the process in which θ_t keeps constant and the economy is in its initial steady state before the public regulator announces an increase in θ_t at the beginning of period 0. Normally, the liberalization policy is first announced before it is implemented so that domestic agents have time to adapt to the new policy environment. In other words, θ_t does not jump in the period of announcement. However, the public regulator still can choose to lift capital controls either in the big-bang strategy or in the gradualism strategy. According to the big-bang strategy, the public regulator raises θ in period 1 immediately to the new level. According to the gradualism strategy, the public regulator announces a policy path for θ gradually rising to its new level from period 1 on. The two strategies can be modeled as the following process,

$$\log \theta_t = \log G_t - \log J_t,$$
$$\log G_t = \log G_{t-1} + \varepsilon_t,$$
$$\log J_t = \rho \log J_{t-1} + \varepsilon_t,$$

where $\rho \in [0, 1)$ determines the speed of θ reaching the new level. The one-time policy change ε_t does not have immediate impact on θ in period 0, but θ rises to the new level from period 1 on. See Gilchrist and Leahy (2002) for the modeling approach. Figure 1 shows the time path of θ specified in the two strategies, given a 1% positive policy change in period 0. A larger ρ implies that it takes longer for θ to reach the new level. In section 4, we model the big bang (gradualism) strategy by setting $\rho = 0$ ($\rho = 0.95$) and compare the transitional dynamics under the two strategies.
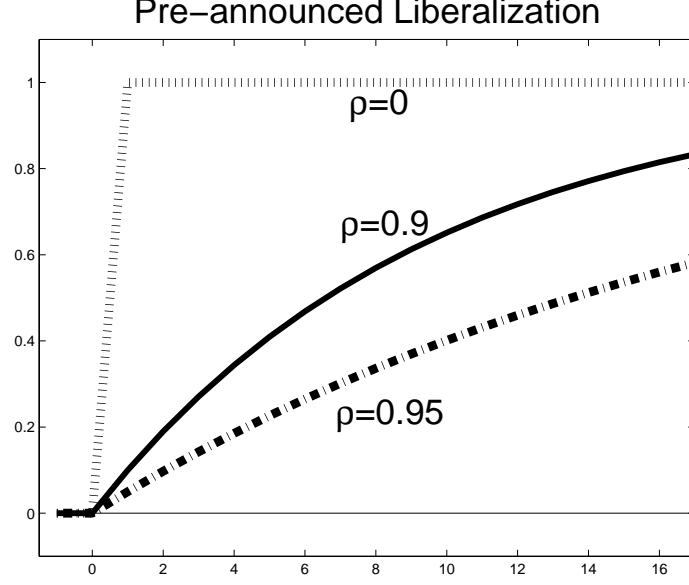
Figure 1: The Policy Path of Two Strategies

2.2 Households

Households have preference over consumption and leisure,

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

where $\beta \in (0,1)$ denotes the time discount factor; c_t, $\bar{L}$, and l_t denote household consumption, labor endowment, 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 the sales revenues amount to $v_t H(k_{t-1})$. Given that households deposited d_{t-1} units of final goods at the mutual funds in period $t-1$, their deposit return is $r_{t-1}^d d_{t-1}$ in period t. Their wage income is $w_t l_t$. Households get lump-sum transfers from the public regulator, Λ_t, and the transfers of any profits or losses from mutual funds, Π_t. At the end of period t, households invest k_t units of land in their projects, deposit d_t at the mutual funds, and consume c_t. As the loan rate is smaller than the deposit rate, $r_t < r_t^d$, households prefer to borrow from the mutual funds and deposit at a higher rate. Due to debt enforcement problem, they are subject to collateral constraints, i.e., their total liabilities cannot exceed the collateral value of their land stock in period $t+1$. The household collateral constraints and flow-budget constraints are binding in equilibrium,

$$r_t z_t^h = E_t q_{t+1} k_t,$$

$$q_t(k_t - k_{t-1}) + d_t + c_t + r_{t-1} z_{t-1}^h = v_t H(k_{t-1}) + r_{t-1}^d d_{t-1} + z_t^h + w_t l_t + \Pi_t + \Lambda_t,$$

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where z_t^h denote the household land-backed loan from the mutual funds in period t. The optimization over $\{c_t, l_t, d_t, k_t\}$ gives the following equilibrium conditions,

$$c_t^{-\sigma} w_t = \chi(\bar{L} - l_t)^{-\psi}, \tag{2}$$

$$1 = \beta r_t^d E_t \left(\frac{c_{t+1}}{c_t} \right)^{-\sigma}, \tag{3}$$

$$q_t - \frac{E_t q_{t+1}}{r_t} = \beta E_t \left(\frac{c_{t+1}}{c_t} \right)^{-\sigma} v_{t+1} H'(k_t). \tag{4}$$

Households deposit d_t and borrow z_t^h against their land stock. Thus, their net deposits at the mutual funds are $d_t - z_t^h$. Under international financial autarky, the loan rate coincides with the deposit rate, $r_t^d = r_t$. In this case, it does not matter whether they deposit d_t and borrow z_t^h or they finance the project investment using own funds and then deposit $d_t - z_t^h$ at the mutual funds. Essentially, their deposits d_t can be regarded as their gross saving which consists of the saving in the form of land stock and the saving in the form of lending to entrepreneurs via mutual funds. In the case of financial opening, households take advantage of the interest rate differential between deposits and loans.

As shown in equation 4, households pay $q_t - \frac{E_t q_{t+1}}{r_t}$ units of final goods for a unit of land invested in their project in period t. After repaying their liability in period $t + 1$, households get the marginal return, $v_{t+1} H'(k_t)$.

In section 3, we analyze the long-run efficiency and welfare implications of capital account liberalization. In order to explicitly show the efficiency gains due to asset reallocation, we first assume that households do not care about leisure, $\chi = 0$. Thus, they supply all their labor endowment to the production of final goods, $l_t = \bar{L}$, which is called the case of the fixed household labor supply. Then, we set $\chi > 0$ and show that how the endogenous supply of household labor can reinforce the asset reallocation and enhance efficiency gains. Equation 2 holds in the case of the endogenous household labor supply but not in the case of the fixed household labor supply.[4]

2.3 Entrepreneurs

Each entrepreneur can choose one of two projects: "Good" and "Bad", 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.[5] Projects produce R units of

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[4]It is a little bit abuse of terminology. Even in the case of $\chi = 0$, the household labor supply, $l_t = \bar{L}$, is still endogenously determined.

[5]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 domestic final goods to reduce the leverage ratio of entrepreneurs to the reasonable level, e.g., 2.

intermediate goods per unit of the land invested in the case of succeeds; there is no output in the case of failure. Projects provide entrepreneurs with safe, nonpecuniary private benefits during the project process.[6] For convenience of aggregation, we assume that private benefits are proportional to the amount of land invested. Let $(p^H, 0)$ and (p^L, b) denote the success probability and private benefits per unit of land invested in the two projects, respectively. The assumption of $0 < b$ and $0 < p^L < p^H < 1$ implies that project "Bad" is riskier but yields higher private benefits than project "Good".

As each entrepreneur has a probability of death and the project invested is subject to idiosyncratic risk, entrepreneurs differ in their end-of-period wealth. Due to the linear nature of preference and technologies, the entrepreneurs' project investment and loans are proportional to their end-of-period wealth, as shown below. In other words, only the first moment of their end-of-period wealth matters for the aggregate economic activities in the entrepreneurial sector. Therefore, we focus only on the behavior of an "average" entrepreneur instead of trace the economic decisions of each individual entrepreneur.[7]

The "average" entrepreneurs who stays in the economy to the next period has linear preferences over consumption and private benefits,

$$E_0 \sum_{t=0}^{\tilde{T}} \beta^t \left(c_t^e + \mathcal{B} k_{t-1}^e \right),$$

where $\tilde{T}$ is the stochastic time of death and $\mathcal{B} \in \{0, b\}$ denotes private benefits per unit of land invested in the two project. c_t^e denotes his consumption in period t and k_{t-1}^e denotes his land stock invested in period $t - 1$.

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

$$E_t \frac{p^H R v_{t+1} + q_{t+1}}{r_t} > q_t + a > E_t \frac{p^L R v_{t+1} + q_{t+1}}{r_t}.$$

Therefore, only project "Good" should be financed in equilibrium. In addition, project "Good" is expected to be always more productive than that of households,

$$\frac{E_t[p^H R v_{t+1} + q_{t+1}]}{q_t + a} > \frac{E_t[v_{t+1} H'(0) + q_{t+1}]}{q_t}.$$

The entrepreneur invests k_t^e units of land and $a k_t^e$ units of final goods into either project "Good" or project "Bad", using his own funds, n_t, and loans from mutual funds,

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[6]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 divergent objectives between project owners and outside financiers. Our set-up resembles the principal-agent setting in Holmstrom and Tirole (1997).

[7]See von Hagen and Zhang (forthcoming) for detailed description.

z_t^e. Thus, $n_t = (q_t + a)k_t^e - z_t^e$ is his net worth in the project. As shown in Holmstrom and Tirole (1997), the contract between the entrepreneur and the mutual funds resembles the standard loan contract. Be specific, the entrepreneur borrows z_t^e units of final goods from the mutual funds in period t; he promises to repay $R_t^m k_t^e$ units of final goods to mutual funds in period $t+1$ if the project succeeds; if the project fails in period $t+1$, he simply hands over his land stock to the mutual funds and is exempted from debt repayment. As the mutual funds can perfectly verify the project outcomes, the entrepreneur always repays the promised amount if he is able to do so. In addition, the public regulator taxes entrepreneurs with successful projects in period $t+1$. As entrepreneurs differ in their wealth, it is impossible to levy lump-sum tax. We assume that tax is proportional to the entrepreneurs' project investment in the previous period, τk_t^e. In order to induce the entrepreneur to choose project "Good", the mutual funds must choose a proper R_t^m and give him enough incentives,

$$\left\{ p^H E_t[Rv_{t+1} + q_{t+1} - R_t^m - \tau] \right\} k_t^e \geq \left\{ p^L E_t[Rv_{t+1} + q_{t+1} - R_t^m - \tau] + b \right\} k_t^e.$$

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

$$R_t^m = E_t[Rv_{t+1} + q_{t+1}] - \tilde{b} - \tau, \quad \text{where} \quad \tilde{b} \equiv \frac{b}{p^H - p^L} > 0. \tag{5}$$

Each unit of land invested in project "Good" in period t has an expected after-tax value of $E_t[p^H(Rv_{t+1} - \tau) + q_{t+1}]$ in period $t+1$. Any promise to repay more than $R_t^m k_t^e$ to the mutual funds in the case of success is not credible. Thus, the entrepreneur can pledge $p^H R_t^m + (1 - p^H)E_t q_{t+1}$ per unit of land invested to the mutual funds in period t. $E_t[p^H(Rv_{t+1} - \tau) + q_{t+1}]$ and $p^H R_t^m + (1 - p^H)E_t q_{t+1}$ are defined as the expected after-tax full value and external value per unit of the land invested in project "Good", respectively. The difference between the two values, $p^H \tilde{b}$, is used to motivate the entrepreneur to choose project "Good" despite the lower private benefits it promises, $0 < b$.

If the mutual funds could perfectly observe the project choice of entrepreneurs, entrepreneurs would choose project "Good" and pledge the project outcome to mutual funds for loans; entrepreneurs would not have to put own funds in the project and would not get any pecuniary reward. In this sense, it is unobservable project choice that makes aggregate production inefficient. As project "Good" has a higher expected rate of return than that of households, a simple shift of the land stock from households to entrepreneurs increases aggregate output of intermediate goods. Thus, production efficiency is measured here by the fraction of the entrepreneurs' land stock over the aggregate land stock.

The mutual funds are expected to break even in period t, $r_t z_t^e = [p^H R_t^m + (1 - p^H)E_t q_{t+1}]k_t^e$. It implies a credit constraint for the entrepreneur,

$$z_t^e = \Gamma_t n_t, \quad \text{where} \quad \Gamma_t \equiv \frac{\frac{p^H(RE_t v_{t+1} - \tilde{b} - \tau) + E_t q_{t+1}}{r_t}}{(q_t + a) - \frac{p^H(RE_t v_{t+1} - \tilde{b} - \tau) + E_t q_{t+1}}{r_t}}. \tag{6}$$

Γ_t is the 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_t, loans are proportional to the entrepreneur's net worth and so are their project investment, k_t^e. Note that the credit multiplier is negatively related with the wealth tax rate, τ. Intuitively, the ex post wealth tax reduces the ex ante pledgable value of the entrepreneurs' project in the case of success. Ceteris paribus, the entrepreneur' ex ante borrowing capacity is reduced and so is their land stock in period t. In this sense, the wealth tax on entrepreneurs has a negative effect on production efficiency.

Suppose that entrepreneurs finance their project investment using own funds and loans in period $t - 1$. At the beginning of period t, entrepreneurs of mass p^H have successful projects and the rest have failed projects. After repaying their liabilities, 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 $p^H(1 - \pi)$. 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 $(1 - p^H)(1 - \pi)$. 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. As the expected rate of return on their net worth exceeds their time preference rate, they supply their labor endowment inelastically $l_t^e = 1$ to the domestic production of final goods and their wage income is w_t^e. At the end of period t, the entrepreneur maximizes his expected utility function, subject to his credit constraints specified in equation (6) and period-budget constraints as follows,

$$(q_t + a)k_t^e = n_t + z_t^e, \quad \text{where} \quad n_t \equiv \mathcal{N}_t - c_t^e, \tag{7}$$

$\mathcal{N}_t$ denotes his end-of-period wealth. The newcomers and entrepreneurs who have failed projects and survive to the next period are of mass $(1 - \pi) + (1 - p^H)\pi$ and their end-of-period wealth is $\mathcal{N}_t = w_t^e$; entrepreneurs who have successful projects and survive to the next period are of mass $p^H \pi$ and their end-of-period wealth is $\mathcal{N}_t = w_t^e + (Rv_t + q_t - R_{t-1}^m - \tau)k_{t-1}^e$. As the marginal rate of return on project "Good" exceeds their time preference rate, entrepreneurs put all end-of-period wealth into their project, borrow to

the limit, and postpone consumption to the period of death. In the aggregate, per capita consumption and net worth of entrepreneurs are

$$c_t^e = (1 - \pi)p^H(Rv_t + q_t - R_{t-1}^m - \tau)k_{t-1}^e, \tag{8}$$

$$n_t = \pi p^H(Rv_t + q_t - R_{t-1}^m - \tau)k_{t-1}^e + w_t^e. \tag{9}$$

In the steady state, per capita consumption of entrepreneurs is linear in their land stock, $c^e = (1 - \pi)p^H \tilde{b} k^e$. As mentioned above, the wealth tax reduces the external value of project "Good". Thus, the entrepreneurs' borrowing capacity declines in the wealth tax and so does their land stock, k^e. Therefore, the wealth tax has an indirect negative effect on the entrepreneurs' consumption and net worth.

2.4   Mutual Funds

The mutual funds finance their aggregate lending to domestic agents,

$$Z_t = z_t^h + z_t^e = \frac{E_t[q_{t+1}K + p^H(Rv_{t+1} - \tilde{b} - \tau)k_t^e]}{r_t}, \tag{10}$$

in period t using foreign deposits $z_t^* = \theta_t Z_t$ and domestic deposits $d_t = (1 - \theta_t)Z_t$. At the beginning of period $t + 1$, the total repayment from successful entrepreneurs is $p^H R_t^m k_t^e$; failed entrepreneurs hand over their total land stock $(1 - p^H)k_t^e$ to the mutual funds. With the safe project, households repay their liabilities $r_t z_t^h$ as promised. The profit or loss of the mutual funds is affected by capital gains or losses on the land of failed entrepreneurs,

$$\Pi_{t+1} = [p^H R_t^m + (1 - p^H)q_{t+1}]k_t^e + r_t z_t^h - r_t^d d_t - r^* z_t^* = (1 - p^H)(q_{t+1} - E_t q_{t+1})k_t^e.$$

As shown in section 4, capital account liberalization results in an unexpected rise in the price of land in the period of announcement, $q_t > E_{t-1}q_t$ and households get a positive lump-sum profit transfer from the mutual funds in the period of policy announcement. According to our calibration, $1 - p^H = 0.01$, the transfer is tiny and does not affect our results very much.

2.5   Final Goods Production and Balance of Payment

Final goods are produced from intermediate goods and labor,

$$Y_t = M_t^\alpha L_t^{(1-\alpha-\alpha')}(L_t^e)^{\alpha'}, \tag{11}$$

where M_t, L_t, and L_t^e denote aggregate inputs of intermediate goods and labor of households and entrepreneurs. Productive inputs are priced at their marginal products,

$$v_t M_t = \alpha Y_t, \tag{12}$$

$$w_t L_t = (1 - \alpha - \alpha')Y_t, \tag{13}$$

$$w_t^e L_t^e = \alpha' Y_t, \tag{14}$$

As shown in subsection 2.3, the entrepreneurs' loan and project investment are proportional to their respective net worth. The assumption of the labor incomes of entrepreneurs is necessary because it ensures that each entrepreneur always has a positive level of net worth. In the meantime, we set α' very small and thus, the entrepreneurs' wage income is tiny. Therefore, the dynamics of their net worth is not driven by the wage income. Carlstrom and Fuerst (1997) take the same approach.

The net exports covers the net interest payment to foreign lenders,

$$NX_t = r^* z_{t-1}^* - z_t^*. \tag{15}$$

The public regulator transfers all tax revenues from entrepreneurs to households,

$$\Lambda_t = p^H \tau k_t^e.$$

Assumption 1. $\lim_{s \to \infty} E_t(\beta^s q_{t+s}) = 0$.

Assumption 1 helps rule out explosive land price bubbles and the economy converges to its steady state along a locally unique equilibrium path after a small policy shock.

2.6 Market Equilibrium

The markets of land, intermediate goods, final goods, and credit clear,

$$K = k_t + k_t^e, \tag{16}$$
$$M_t = H(k_{t-1}) + p^H R k_{t-1}^e, \tag{17}$$
$$Y_t = c_t + c_t^e + a k_t^e + NX_t, \tag{18}$$
$$z_t^* = \theta Z_t, \tag{19}$$
$$d_t = (1 - \theta) Z_t. \tag{20}$$

Definition 1. *Market equilibrium is a set of allocations of households, $\{k_t, l_t, c_t, d_t\}$, entrepreneurs, $\{k_t^e, n_t, z_t^e, c_t^e\}$, and aggregate variables $\{M_t, Y_t, NX_t, Z_t, z_t^*\}$, together with a set of prices $\{v_t, q_t, w_t, w_t^e, r_t, r_t^d, R_t^m\}$, satisfying equations (1)-(20), given the exogenous processes of the policy parameter $\{\theta_t\}$.*

For the welfare analysis, we define the welfare of households and entrepreneurs by their respective conditional life-time utility,

$$V_t = \log(c_t) + \chi \frac{(\bar{L} - l_t)^{1-\psi} - 1}{1 - \psi} + \beta E_t V_{t+1}, \tag{21}$$
$$V_t^e = c_t^e + \beta E_t V_{t+1}^e. \tag{22}$$

2.7 Calibration

As our paper intends to provide a conceptual framework to think about the efficiency and welfare implications of capital account liberalization, we focus here more on its qualitative results instead of its quantitative relevance. As an analytical solution is not obtainable, we use a numerical example to show the intuition explicitly. We calibrate the model to fulfill certain steady-state conditions under international financial autarky ($\theta = 0$).

The aggregate land stock is normalized at unity, $\bar{K} = 1$. The household project is decreasing-return-to-scale, $H(k_t) = \frac{\epsilon}{1+\lambda}\left[1 - (1 - k_t)^{1+\lambda}\right]$ and $H'(k_t) = \epsilon(1 - k_t)^{\lambda}$, where $\lambda = 8$. We set $\beta = 0.97$ implying that the domestic deposit rate are 12% per annum. The foreign interest rate is set at $1 \leq r^* < \frac{1}{\beta}$. For the case of the fixed household labor supply, we set $\chi = 0$ and $\bar{L} = 1$ so that households supply all their labor endowment, $l = \bar{L}$; for the case of the endogenous household labor supply, we set $\bar{L} = 3$ and χ is calibrated to make $l = \frac{\bar{L}}{3}$ for $\psi \in \{0, 1, 5\}$, respectively. In both cases, households have the same labor supply, $l = 1$, and the economy has the same 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 and the entrepreneur wage income is tiny.

Following Carlstrom and Fuerst (1997), we set $p^H = 0.99$, implying a quarterly failure rate at 1 percent. We also normalize the land price at unity. The rest of parameters are set as $\{\pi = \frac{2}{3}, R = 64, a = 1.29, \epsilon = 10, \tilde{b} = 1.74\}$ so that entrepreneurs finance half of the their project investments using own funds (Bernanke, Gertler, and Gilchrist, 1999), and project "Good" is expected to be always more productive than the household project.

3 Long-Run Efficiency and Welfare Implications

We analyze here how capital controls affect production efficiency and social welfare in the long run. By assuming that households do not care about leisure, $\chi = 0$, we identify the pure asset allocation effects of capital controls in subsection 3.1. We then show in section 3.2 how endogenous labor supply of households reinforces the efficiency gains from capital account liberalization.

3.1 Capital Controls and Asset Allocation

Figure 2 shows how capital controls affect some endogenous variables, given the gross foreign interest rate $r^* = \{1, 1.00001, 1.01\}$, respectively. The steady state values of endogenous variables $X = X(\theta, \tau)$ are functions of two policy parameters: the degree of capital controls and the wealth tax rate. We first consider the case without the wealth tax on entrepreneurs, $\tau = 0$. HH and EN are abbreviations for households and entrepreneurs. The horizontal axis denotes $\theta \in (0, 1)$, and the vertical axes show the percentage difference

of the relevant variables under different degrees of capital controls in comparison with the case of international financial autarky, $\hat{x} = \left[\frac{X(\theta \in (0,1), \tau=0) - X(\theta=0, \tau=0)}{X(\theta=0, \tau=0)} \right] 100$. Given $\chi = 0$, households supply all their labor endowment, $l = \bar{L} = 1$, to the final goods production.
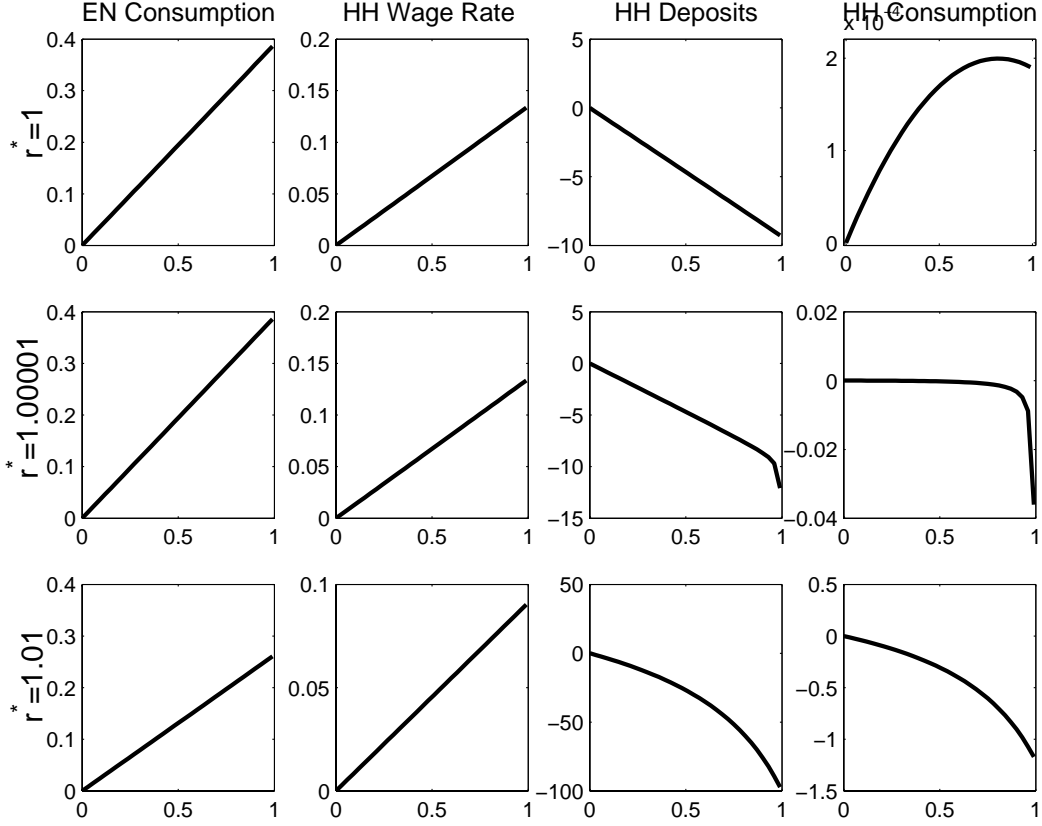

Figure 2: The Long-Run Welfare Effects of Capital Account Liberalization

Aggregate lending of the mutual funds, $Z = d + z^*$, consists of the deposits of households and foreign lenders. According to equation (3), the rate of return on household deposits, $r^d = \frac{1}{\beta}$, is independent of θ. The rise in θ results in the substitution of cheap foreign funds for domestic deposits. As a weighted sum of the foreign and domestic deposit rates, the loan rate declines in θ from $r^d = \frac{1}{\beta}$ to r^*. In the extreme case of $\theta = 1$, domestic loans are financed by foreign deposits only and the domestic loan rate coincides with the foreign deposit rate, $r = r^*$.

Although domestic agents cannot directly borrow abroad, capital account liberalization results in the decline in the loan rate and domestic agents can acquire more loans and invest more land in their projects. Given the fixed aggregate land stock, the rise in the land demand pushes up the land price. Given our calibration, the external value per unit of land invested in the entrepreneurs' project is larger than that in the household project which is the land price itself. Thus, a rise in θ results in the land reallocation towards entrepreneurs and aggregate production becomes more efficient.

According to equations (5) and (8), the entrepreneurs' consumption in steady state is proportional to their land stock, $c^e = p^G(1 - \pi)\tilde{b}k^e$. The increase in their land stock makes entrepreneurs benefit strictly from capital account liberalization in the long run.

Given that the marginal product of project "Good" exceeds that of the household project, asset reallocation towards entrepreneurs increases aggregate output of intermediate goods. As final goods are produced from intermediate goods and labor in the Cobb-Douglas fashion, the rise in aggregate input of intermediate goods raises the household wage rate.

Therefore, the rise in θ has one direct effect and two indirect effects on household wealth. First, the return on household deposits $r^d d = \frac{(1-\theta)Z}{\beta}$ declines in θ; second, due to the unfavorable asset reallocation, the sales revenues of households decline; third, the rise in the wage rate increases the household wage income. The first two effects are negative and the last is positive. The life-time utility of households depends only on their consumption. Whether households benefit from capital account liberalization in the long run depends on the relative magnitude of these three effects. Here, the size of the foreign interest rate plays an important role.

Consider an extreme case in which the net foreign interest rate is zero, $r^* = 1$. See the first row of figure 2. The rise in θ from 0 to 1 makes the loan rate decline from $\frac{1}{\beta}$ to 1. Such a dramatic decline in the loan rate facilitates asset reallocation and the entrepreneurs' land stock rises by 0.4%. At the same time, according to equation (4), the steady state value of the land price is negatively related to the loan rate. Aggregate loans are partially backed by the value of aggregate land stock, $Z = \frac{qK + p^G(Rv - \tilde{b})k^e}{r}$. Although the rise in θ reduces the relative weight of household deposits over total deposits, the dramatic increase in the land price partially offsets it. In all, the absolute value of household deposits does not decline so much. Altogether, the positive wage effect is large enough to dominate the two negative effects. Thus, capital account liberalization has the overall positive wealth effect on households and their consumption rises in this case.

Consider the case of $r^* = 1.01$ which implies a foreign interest rate at 4% per annum. See the third row of figure 2. As θ rises from 0 to 1, the loan rate declines in a smaller magnitude than that in the case of $r^* = 1$. The improvement in production efficiency is smaller and so is the rise in the wage rate. At the same time, the rise in the land price is smaller and the decline in the absolute value of household deposits is larger. Altogether, the positive wage effect is dominated by the negative deposit effects and the households' consumption declines in θ. This result is robust even for a very small net foreign interest rate, e.g., $r^* = 1.00001$. See the second row of figure 2.

The fact that households may lose in the long run can be understood alternatively as follows. As shown in figure 2, the efficiency gains are smaller if the foreign interest rate is higher. At the same time, by lending to mutual funds, the foreign lenders are entitled

with a fraction of domestic output in the form of the interest payment. Thus, if the foreign interest rate is higher, it is more possible that the efficiency gains are dominated by the interest paid to foreign lenders. In other words, final goods available for the consumption of domestic agents may decline in θ, given a high foreign interest rate. As the entrepreneurs' consumption is proportional to their land stock, entrepreneurs always benefit from the improvement in production efficiency. As a result, the consumption of households declines in θ. In other words, households lose strictly in the long run.

Given that capital account liberalization may have opposite long-run welfare implications to agents with different productivity, a relevant policy question may be whether public transfers from entrepreneurs to household can make both groups of agents better off than under international financial autarky. Figure 3 shows how the wealth tax affects the consumption of households and entrepreneurs, given $\theta = 0.99$. The horizontal axes denote $\tau \in (0, 0.005)$ and we scale it up by 10^3 for visuality. The vertical axes denote the percentage difference of relevant variables under different tax rates, in comparison with the case of international financial autarky without the wealth tax, $\hat{x} = \left[\frac{X(\theta=0.99,\tau) - X(\theta=0,\tau=0)}{X(\theta=0,\tau=0)} \right] 100$.
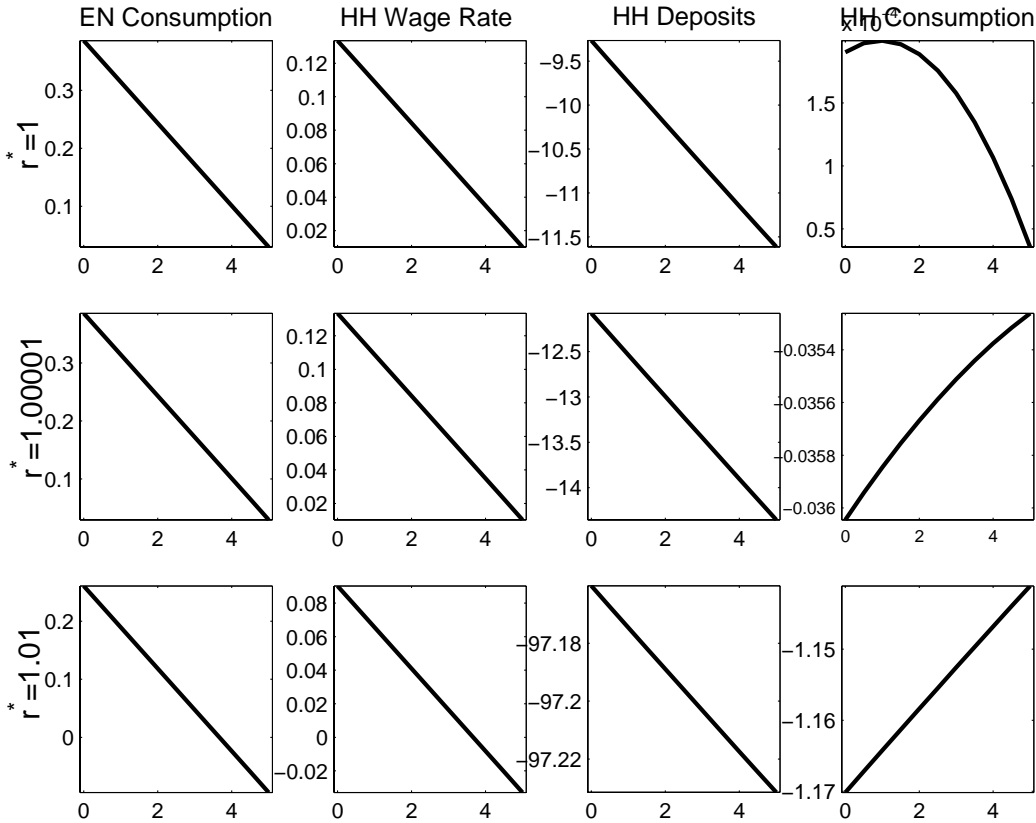
Figure 3: The Welfare Effects of Public Transfer: $\theta = 0.99$

According to equation (5), entrepreneurs must be rewarded for choosing project "Good" and their expected reward per unit of land invested, $p^H \tilde{b}$, is independent of the wealth

tax. The wealth tax reduces the expected after-tax external value per unit of land invested in project "Good" and has the negative effect on the entrepreneurs' borrowing and investment. Thus, the wealth tax reduces the efficiency gains from capital account liberalization. As a result, entrepreneurs lose strictly from the wealth tax and households benefit. However, the question is whether public transfers can fully compensate the loss of households in comparison with the case of international financial autarky, given that entrepreneurs are made no worse off than under international financial autarky. Figure 3 shows that even for a very small net foreign interest rate, e.g., $r^* = 1.00001$, the household consumption is still below its level under international financial autarky.

Intuitively, aggregate output of final goods is distributed among entrepreneurs, households, and foreign lenders. If public transfers make entrepreneurs just as well off as under international financial autarky, it implies that the entrepreneurs' land stock is exactly the same as under international financial autarky and so is aggregate output of final goods. Given a positive net interest payment to foreign lenders, the household consumption must be strictly smaller than under international financial autarky. In this sense, public transfer cannot fully compensate the loss of households if the net foreign interest rate is positive.

3.2 Endogenous Labor Supply and Efficiency Gains

Figure 4 compares the welfare effects of capital account liberalization in the cases of endogenous household labor supply (solid lines) and fixed household labor supply (dashed lines), given zero wealth tax on entrepreneurs, $\tau = 0$. The horizontal and vertical axes have the same meaning as those of figure 2. For the case of endogenous household labor supply, we first assume that households have linear preference on leisure, $\psi = 0$. We also set $\chi = 0.98$ so that the household labor supply is $l = 1$ under international financial autarky, given their labor endowment $\bar{L} = 3$. Thus, the steady states of the two cases are same under international financial autarky.

As shown in subsection 3.1, capital account liberalization reduces the loan rate and improves production efficiency. The increase in aggregate output of intermediate goods pushes up the wage rate. If households do not care about leisure $\chi = 0$, they supply all their labor endowment to the final goods production. Although capital account liberalization has negative effects on their wealth, households cannot further increase their labor supply. However, if households care about leisure, e.g., $\chi = 0.98$ and $\psi = 0$, they can adjust their labor supply to the change in the wage rate. Capital account liberalization has a positive wage effect and a negative wealth effect on households. Thus, households increase their labor supply and it may fully offset the negative wealth effects. In the cases of $r^* \in \{1.0001, 1.001, 1.01\}$, household consumption is strictly higher than under international financial autarky.
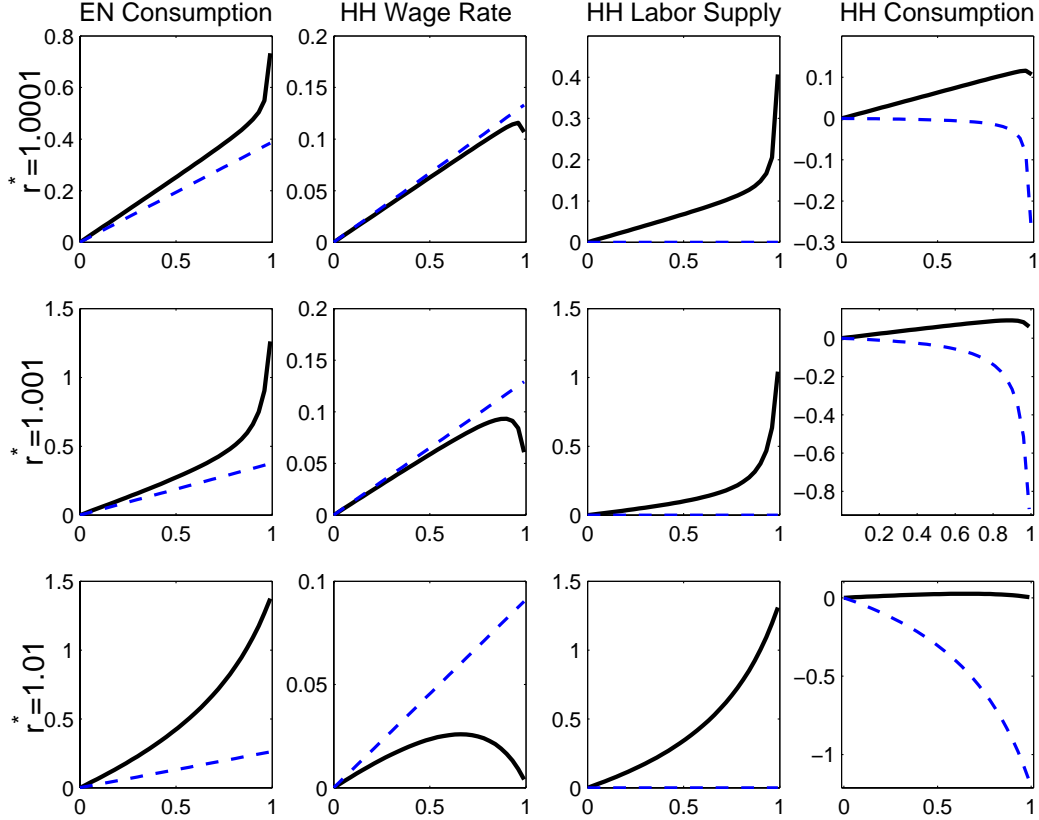
Figure 4: Fixed vs Endogenous Household Labor Supply

The increase in the household labor supply directly pushes up aggregate output of final goods. At the same time, it raises the price of intermediate goods. Thus, the external value of project "Good" increases and entrepreneurs can borrow and invest more. Land is allocated to entrepreneurs in a larger magnitude than in the case of the fixed household labor supply, $\chi = 0$. In this sense, the endogenous household labor supply has an indirect efficiency effect. In comparison with the case of the fixed household labor supply, entrepreneurs benefit more from capital account liberalization.

Frisch elasticity is defined as the elasticity of the labor supply with respect to wage, holding consumption constant, (Frisch, 1959). It is $\frac{\bar{L}-l}{\psi} > 0$ in our model. A larger ψ implies that households are less willing to increase their labor supply for a rise in the wage rate. Labor market institutions may affect Frisch elasticity. It may be smaller in countries with more sophisticated unemployment insurance and stronger labor union. For simplicity, we do not explicitly model labor market institutions but use ψ as a short cut to capture the labor market rigidity.[8]

Figure 5 compares the effects of capital account liberalization under different Frisch

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[8]As commonly criticized, the variation of aggregate labor supply is more related with the quantity of workers employed instead of the working hours of individual employees.

elasticities. The horizontal and vertical axes have the same meaning as those of figure 2. Agg and FG are abbreviations for aggregate and final goods, respectively. We consider three cases, $\psi = \{0, 1, 5\}$, and set $\chi = \{0.98, 1.96, 31\}$ accordingly to keep the household labor supply the same in all three cases under international financial autarky, $l = \frac{\bar{L}}{3} = 1$, given their labor endowment $\bar{L} = 3$.
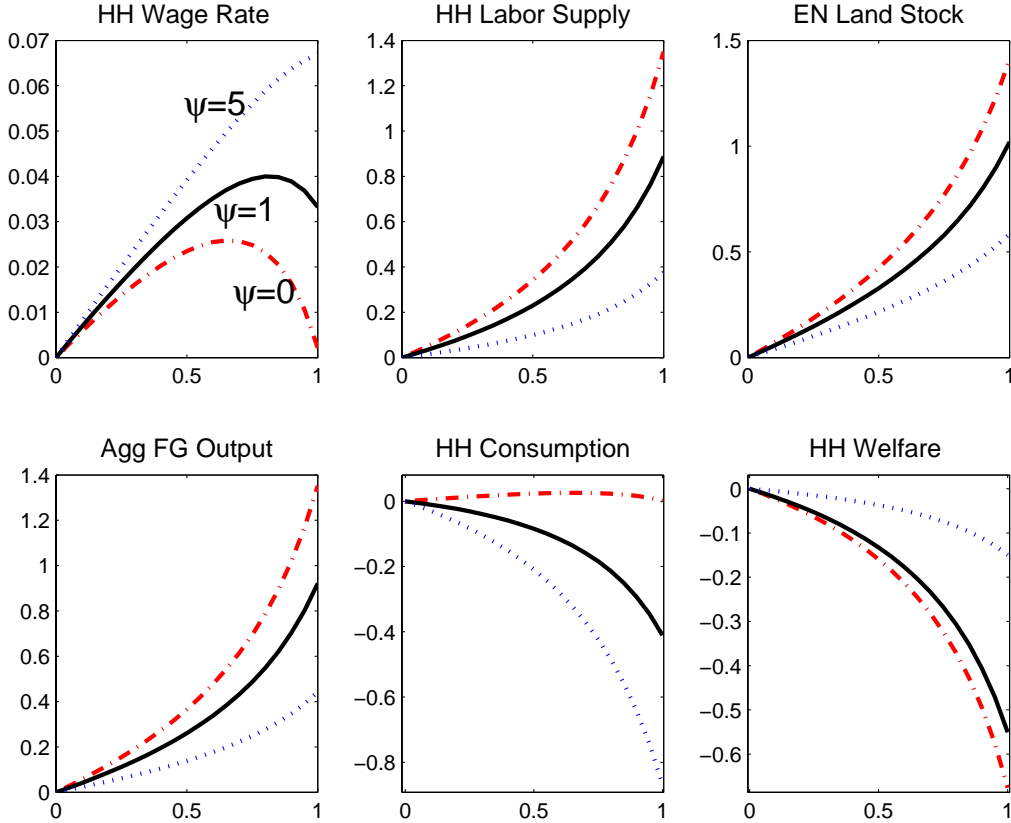
Figure 5: The Flexibility of Household Labor Supply and Efficiency Gains

In the case of relatively inelastic labor supply, e.g., $\psi = 5$ (dotted lines), the positive wage effect from capital account liberalization induces households to increase their labor supply in a smaller magnitude than in the case of more elastic labor supply, e.g., $\psi = 0$. The indirect efficiency gains via the household labor supply channel is smaller. The smaller increase in the entrepreneurs' land stock implies that entrepreneurs benefit from capital account liberalization in a smaller magnitude than in the case of $\psi = 0$. At the same time, the increase in the wage income cannot fully offset the negative wealth effects and households have to reduce their consumption.

In this sense, the efficiency gains from capital account liberalization can be affected by the flexibility of labor market. If the government intends to improve production efficiency, capital account liberalization should be accompanied with reforms increasing labor market flexibility. However, without explicitly modeling the labor market institutions and

unemployment, we cannot conduct the welfare analysis on such reforms.

Although the household consumption rises in θ in the case of $\psi = 0$, the rise in their labor supply has a negative effect on household welfare, as shown in figure 5. Overall, capital account liberalization has negative long-run welfare implications to households. This result also holds in the other two cases. It seems that households lose more in the case of more flexible labor market. As the household preference differs in the three cases, changes in the household welfare are not comparable.

4   Implementation Strategies and Model Dynamics

This section discusses how the two implementation strategies, i.e., the big-bang strategy and the gradualism strategy, can result in macroeconomic fluctuations as well as their welfare implications in the short run. Endogenous variables are approximated as the linear functions of state variables in logarithms around the old steady state[9], which we solve using the MATLAB codes provided by Schmitt-Grohé and Uribe (2004). In order to explicitly show aggregate fluctuations resulting from endogenous asset reallocation only, we set $\chi = 0$ so as to exclude the effect of changes in household labor supply. Thus, households supply inelastically their labor endowment to the final goods production $l = \bar{L} = 1$. We also set $\tau = 0$. Figure 6 shows the impulse responses of the model economy with respect to the big-bang strategy (dash-dotted lines) and the gradualism strategy (solid lines) with which the public regulator raises θ permanently from 50% to 55%.

Consider the big-bang strategy first. See the dash-dotted lines. The public regulator announces in period 0 that θ will be raised permanently from 50% to 55% in period 1. Anticipating a higher land price in the future, households and entrepreneurs increase their demand for land and thus, the land price rises in period 0. Capital gains on the entrepreneurs' land stock improve entrepreneurial net worth and entrepreneurs increase their loans and land stock. The demand effect dominates at the credit market in the sense that the loan rate increases dramatically in period 0. As θ is still unchanged in period 0, the rise in the loan rate also pushes up the deposit rate. Proportional to domestic loans, foreign deposits rise slightly.

Capital gains also have positive wealth effects on households. The dramatic rise in the deposit rate induces households to reduce consumption and increase deposits. Given that aggregate output of intermediate goods is predetermined by the project investment of households and entrepreneurs in the previous period, aggregate output of final goods

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[9]Section 3 shows that capital account liberalization in the form of a permanent change in θ changes the steady state of the 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, we can still use first-order approximations to analyze the transitional dynamics from the old steady state to the new steady state.
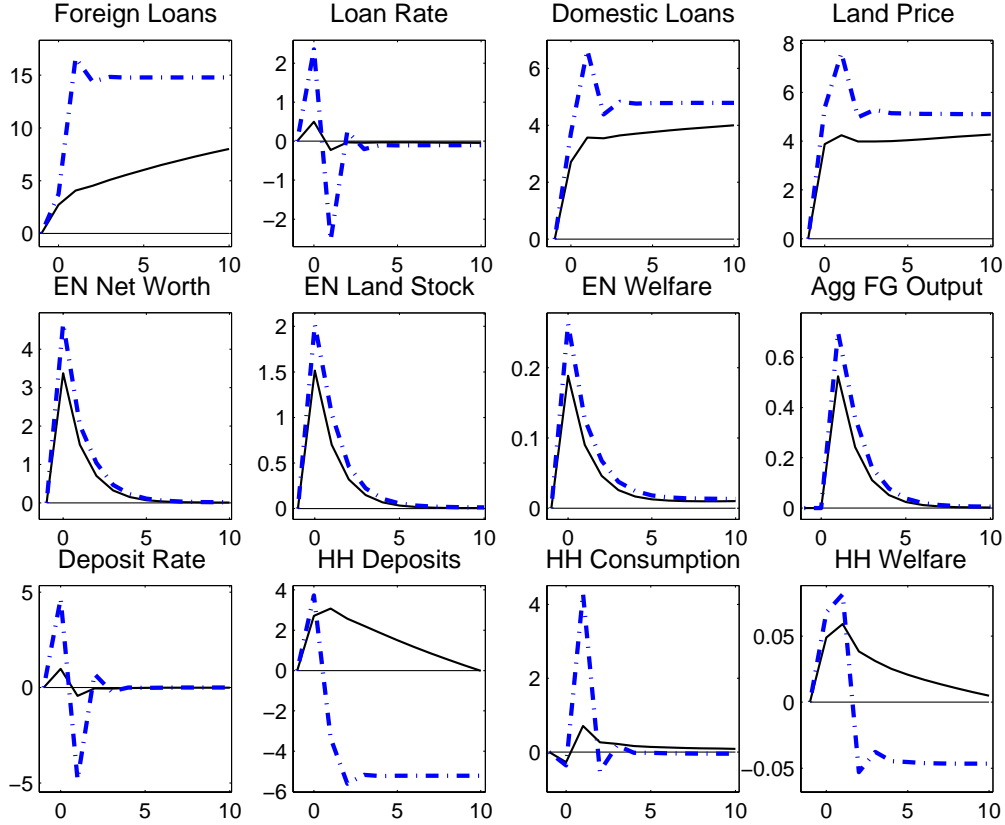
Figure 6: Big Bang Strategy vs. Gradualism Strategy

is unchanged in period 0.

Due to the period-0 reallocation of land in favor of entrepreneurs, aggregate output of intermediate goods rises in period 1. Given the fixed household labor supply, aggregate output of final goods rises in period 1, too. Proportional to aggregate output of final goods, the household wage income also rises in period 1.

The dramatic increase in θ in period 1 leads to a huge capital inflow and the supply effect dominates at the credit market in the sense that the loan rate falls. Thus, entrepreneurs can borrow more and demand more land. As a result, the land price rises by 7.6%, larger than the 5.1% in the new steady state. The fact that the period-1 response of the land price exceed its new steady state level 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 favorable deposit rate in period 0, the deposit return is large in period 1. The increase in the wage income also has a positive wealth effect on households. As mutual funds substitute cheap foreign funds for household deposits, the deposit rate has to fall. The positive wealth effect and the decline in the deposit rate induce households to increase consumption and reduce deposits. As θ is constant at its new level from period

1 on, the economy reaches its new steady state quickly.

Figure 2 shows that entrepreneurs benefit from capital account liberalization in the long run due to the favorable asset reallocation. In the short run, the entrepreneurs' land stock is strictly above the old steady state level and so is their conditional life-time utility. See the panel titled "EN Welfare". Therefore, entrepreneurs benefit strictly from capital account liberalization in the long run and in the short run.

Figure 2 shows that a rise in θ reduces household consumption in the long run. In other words, households lose strictly in the long run. However, their conditional life-time utility actually increases in the first two periods. See the panel titled "HH Welfare". Intuitively, capital gains on the households' land stock have positive wealth effects in period 0. In period 1, mutual funds substitute cheap foreign funds for household deposits. The substituted household deposits actually finance the extra consumption of households. Therefore, households benefit from capital account liberalization in the short run, although they lose in the long run.

Consider now the gradualism strategy. See the solid lines. The public regulator announces a policy path of θ_t in period 0. Different from the big bang strategy, θ gradually reaches the new level from period 1 on. Thus, the period-1 inflow of cheap foreign funds increase only slightly and the decline in the loan rate is also small. Compared to the case of the big bang strategy, entrepreneurs increase their demand for loans and land also in a smaller magnitude. The land price does not overshoot in the sense that it rises only by 4.2% in period 1, less than the 5.1% in the new steady state.

Anticipating a smaller increase in the land price in period 1, entrepreneurs can borrow only a smaller amount and the increase in their land demand is smaller in period 0. As a result, the land price does not increase as much as in the case of the big bang strategy in period 0. On the one hand, the smaller capital gains improve entrepreneurial net worth less dramatically and the increase in the loan demand of entrepreneurs is smaller, too. The loan rate rises in a smaller magnitude and so is the deposit rate. On the other hand, the smaller capital gains have smaller wealth effects on households. Due to consumption-smoothing motive, the rise in the deposit rate induces households to reduce consumption in a larger magnitude.

As θ is unchanged in period 0, foreign loans do not increase much. From period 1 on, θ rises gradually to the new steady state level. The loan rate and the deposit rate fall below the old steady state value in period 1. The period-1 wealth effects due to the return on deposits made in period 0 is smaller than in the case of the big bang strategy and so is the increase in the household period-1 consumption. The rise in the entrepreneurs' land stock in period 0 results in the increase in aggregate output of intermediate goods in period 1 and aggregate output of final goods rises, too. From period 1 on, θ rises gradually to the new level and the domestic economy also reaches its new steady state gradually.

Output, investment, consumption, loans, the interest rates, and the land price respond in a much smaller magnitude to the gradualism strategy than to the big-bang strategy. In this sense, the gradualism strategy helps achieve a smoother transition.

Compared to the case of the big bang strategy, the land price responds less strongly. The wealth effects resulting from capital gains are also smaller. It explains the fact that the responses of conditional welfare of households and entrepreneurs are smaller in the period of policy announcement. The conditional welfare of entrepreneurs is always below that in the case of the big bang strategy, while the conditional welfare of households is above that since period 2. Therefore, entrepreneurs strictly prefer the big bang strategy and households may prefer the gradualism strategy.

5   Final Remarks

This paper provides a theoretical model to consider the efficiency and welfare implications of capital account liberalization. We show that financial opening facilitates the inflows of cheap foreign funds and improves production efficiency. However, capital account liberalization also has important distributional consequences. Specifically, endogenous asset reallocation has opposite welfare implications to agents with different productivity and it may be impossible to use public transfers to compensate the loss of those negatively affected by capital account liberalization.

Efficiency gains from capital account liberalization are larger in countries with more flexible labor market. In order to further improve production efficiency, capital account liberalization should be accompanied with reforms increasing labor market flexibility.

Due to financial frictions, asset prices overshoot if capital controls are lifted hastily. Asset price booms lead to lending boom and then large amounts of non-performing loans if the financial system is underdeveloped which is not modeled here. Thus, from a practical perspective, capital account should be liberalized gradually for a smooth transition.

Similar as in Gourinchas and Jeanne (2006), efficiency gains from capital account liberalization are quantitatively small in our model. It results from some of our assumptions. First, it is the interest rate differential that drives capital inflows in our model economy and foreign lenders do not actively participate in the domestic credit market. Suppose that foreign lenders can actively monitor the projects of entrepreneurs. Thus, entrepreneurs can credibly choose more productive projects. The active monitoring of foreign lenders may further mitigate the information problems and the efficiency gains can be more significant. Second, in order to separate the growth effect and the asset reallocation effect of capital account liberalization, we do not consider economic growth in our model. If we introduce economic growth, the improvement in production efficiency may be more significant. Households may benefit in the absolute term, although entrepreneurs benefit

in a much larger magnitude. If that is true, we may calculate the threshold value of growth rate above which capital account liberalization is desirable from the perspective of both efficiency and welfare. Furthermore, it also implies that the government should focus more on economic growth instead of use public transfers to compensate those negatively affected. We are still working on it.

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