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OPTIMAL CAPITAL ACCOUNT LIBERALIZATION IN CHINA

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Abstract. China maintains tight controls over its capital account. Its prevailing regime also features financial repression, under which banks are often required to extend a fraction of funds to state-owned enterprises (SOEs) at below-market interest rates. We incorporate these features into a general equilibrium model. We find that capital account liberalization under financial repression incurs a tradeoff between aggregate productivity and inter-temporal allocative efficiency. Along a transition path with a declining SOE share, the second-best policy calls for a rapid removal of financial repression, but gradual liberalization of the capital account.

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I. Introduction

The Chinese government has implemented many domestic reform policies since the early 1980s, but it has maintained tight controls over its capital account. Under these controls, domestic citizens are restricted from investing abroad while foreign investors are also restricted from accessing China's financial markets. In recent years, the Chinese government has signaled its intention to liberalize capital controls, although the pace at which capital account liberalization will be pursued remains uncertain.

There is an active debate in the literature on the desirable pace of capital account liberalization. Some have argued for a gradual approach, since rapid removals of capital account restrictions might disrupt real and financial activity, especially in a country with a distorted domestic financial system.[1] In the case of China, domestic credit allocations are distorted by financial repression, primarily in the form of subsidized bank lending to state-owned enterprises (SOEs) and other heavy-industry firms favored by the government.[2] Chinese banks are required to extend a fraction of funds to SOE firms at below-market interest rates. Private firms have access to credit only at the market interest rates. Under this distorted financial system, it is plausible that capital account liberalization may exacerbate resource misallocation. However, despite its logical plausibility, the recent survey by Wei (2018) points out that "there is a lack of formal theories that articulate this link."

To help fill this gap in the literature, we build a theoretical model to evaluate optimal capital account liberalization policy under China's distorted financial system. We examine this issue in a small open economy model with overlapping generations. The model features financial repression and capital controls, similar to the prevailing policy regime in China.

In the model, households live for two periods—young and old. When they are young, they work, consume, and accumulate assets; when they are old, they retire and consume savings. To save, a young household can make deposits in domestic banks or purchase foreign bonds. The government restricts capital outflows by imposing a

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[1]Examples include Eichengreen et al. (2011), Eichengreen and Leblang (2003) , Chinn and Ito (2006), Ju and Wei (2010), and Aoki et al. (2009). See Wei (2018) for a survey.

[2]While some heavy industry firms are not state-owned, Chang et al. (2015) find that the share of SOEs in capital-intensive industries has increased steadily since the late 1990s reforms. In practice, large private firms have little difficulty obtaining funds from China's commercial banks. But these firms typically do not rely on bank funding, and instead, they raise funds in bond and equity markets. This leaves SOEs the primary beneficiaries of China's financial repression. Throughout the paper, we use the term "SOE" as a metaphor for all sectors that receive favorable credit treatments.

tax on foreign asset earnings. This capital outflow restriction drives a wedge between domestic deposit rates and the world interest rate.

Final consumption goods are produced using a composite of intermediate inputs from monopolistically-competitive SOEs and competitive private firms (POEs). In each sector, production requires capital and labor as inputs, and firms need to borrow to finance their working capital. Consistent with empirical evidence, we assume that SOEs are on average less productive than POEs (Hsieh and Klenow, 2009). Firms can borrow from both domestic banks and foreign investors. The government restricts capital inflows by imposing a tax on repatriated earnings to foreign investors. In addition, foreign debt requires a risk premium which is increasing in the size of external debt.[3] The capital inflow restrictions and the risk premium drive a wedge between domestic lending rates and the world interest rate.

Financial repression in our model takes the form of directed lending. Banks are required to extend a fraction of their loans to SOEs at below-market interest rates. In contrast, POEs do not have access to such directed lending and they can borrow only at the market interest rate. SOEs have the option to borrow beyond the level dictated by directed lending, but they need to pay the market interest rates on these additional loans. Since directed lending is unprofitable, banks can remain solvent only if they pay low interest rates on household deposits and charge high interest rates on market lending. Thus, financial repression drives a wedge between domestic deposit rate and market lending rate.

The presence of both financial repression and capital controls leads to misallocation of resources, both across sectors and across time. Subsidized bank loans to SOEs encourage the expansion of SOE activity at the expense of more productive POE activity. Facing high domestic funding costs, POEs would benefit from borrowing from foreign investors, but capital inflow taxes reduce the desirability of this funding channel. The misallocation across sectors depresses aggregate productivity. At the same time, banks pass through the cost of directed lending to the households by paying low deposit rates. Households would benefit from the opportunity of saving abroad, but capital outflow taxes discourage this activity as well, distorting household inter-temporal consumption-savings decisions.

[3]The dependence of the risk premium on the size of the external debt can be interpreted as stemming from an upward-sloping supply curve of foreign funds. As individual firms do not internalize the effects of their borrowing levels on the risk premium, our decentralized equilibrium features "over-borrowing," or spillovers from the external debt of other firms, similar to that studied by Bianchi (2011) among others.

We evaluate a calibrated version of our model to examine the implications of liberalizing capital account controls in the presence of financial repression. Our analysis highlights a tradeoff between aggregate productivity and intertemporal allocative efficiency, both in the steady state and along a transition path.

The steady-state tradeoff implies an interior optimum of capital account restrictions on both inflows and outflows. For example, consider a one-way liberalization of capital outflow controls. Reducing capital outflow taxes enables households to obtain higher earnings on their savings and thus mitigates distortions to their intertemporal consumption-savings decisions. However, the relaxation of capital outflow controls also raises the domestic deposit interest rate faced by banks, who respond by raising their market lending rate. This response in turn raises the relative funding costs for POEs and shifts resources from POEs to less productive SOEs, exacerbating misallocation across sectors and reducing aggregate productivity.

Alternatively, consider a liberalization of capital inflow controls. A lower tax on capital inflows enhances POE access to foreign funding, and thus raises relative POE output and aggregate productivity. However, increased competition from foreign investors reduces the domestic market lending rate that banks can charge. Under directed lending, banks need to reduce deposit rates to remain solvent. The decline in the deposit rate exacerbates the distortions on the households' intertemporal consumption-savings decisions.[4]

Finally, when both inflow and outflow controls are liberalized, optimal capital control levels depend on the severity of financial repression (i.e., the fraction of bank funds that are earmarked for directed lending). More severe financial repression calls for stricter capital account controls for both inflows and outflows under second-best optimal policy. When we allow the planner to choose the degree of financial repression in addition to capital control taxes, we find that welfare is maximized at positive levels of both financial repression and capital control measures. Optimal policy requires some amount of financial repression because, without subsidies (through directed lending), SOE production would be inefficiently low under monopolistic competition in that sector.

The tradeoff between aggregate productivity and intertemporal allocative efficiency in the steady-state also carries over to analyzing optimal liberalization policies along the transition path when the economy goes through structural changes. To illustrate

[4]The benefit of relaxing capital inflow controls is also partly offset by the over-borrowing externality associated with the risk premium on foreign debt.

this point, we consider a structural change triggered by a decline in the expenditure share of SOE goods, as observed in the Chinese data.[5] We examine the welfare implications of alternative paces and depths of liberalizing the capital account and financial repression, taking into account the transition dynamics.

We find that optimal policy calls for gradual liberalization of capital account, and a relatively fast pace of financial reforms. In the presence of financial repression, liberalizing controls over either capital inflows or outflows incurs a tradeoff during transition. In particular, while relaxing outflow controls alone benefits households by raising domestic deposit rates, it also raises POE funding costs, and thus reduces aggregate productivity by reallocating resources to less productive SOEs. Alternatively, while relaxing inflow controls alone reduces POE funding costs and improves aggregate productivity, the increased competition from foreign investors pushes down domestic lending rates and forces banks to cut domestic deposit rates, further distorting households' intertemporal consumption-savings decisions. In addition, the increased foreign debt also raises the risk premium, exacerbating the over-borrowing externality. When both capital controls are liberalized, optimal policy calls for a gradual relaxation of capital account restrictions. Finally, in the most general case where the planner is allowed to choose the pace of liberalizing both financial repression and capital controls, optimal policy calls for a rapid and radical reform of the domestic financial system, but a gradual and moderate liberalization of the capital account.

II. Related literature

Our paper contributes to the literature that studies the implications of capital account controls. Capital account restrictions have been criticized as distortionary to financial markets (Edwards, 1999; Jeanne et al., 2012). They can also distort trade, effectively mimicking an increase in tariffs (Wei and Zhang, 2007) or a real exchange rate devaluation (Jeanne, 2013). Nonetheless, concerns about surges in capital inflows have left policy makers open to the idea of welfare-enhancing temporary capital account restrictions (Ostry et al., 2010). Properly designed, capital account policies can serve as a complementary policy tool to mitigate the effects of external shocks [e.g. Farhi and Werning (2012), Unsal (2013), and Davis and Presno (2017)].

Capital controls can also constrain the central bank's ability to stabilize domestic inflation, especially when the cost of sterilized interventions rises, as in the case of

[5]Chen et al. (2017) show that China's SOE share in total industry revenue has steadily declined from about 50% in 2000 to about 20% in 2016.

China following the global financial crisis (Chang et al., 2015). However, the welfare implications of capital controls in monetary models is likely to depend on the exchange rate regime. Given a commitment to fixed exchange rates, capital controls raise the need for such costly sterilization, as in the model of Chang et al. (2015). But under a flexible exchange rate regime, capital account restrictions can ease the need for undertaking costly sterilization activity (Liu and Spiegel, 2015).

Our work is also related to the literature that examines the ambiguity surrounding the welfare implications of capital account liberalization under financial distortions. For example, Eichengreen et al. (2011) demonstrate that capital account liberalization can adversely impact countries with poorly-developed financial markets. Eichengreen and Leblang (2003) argue that, for a country with a distorted financial system that is conducive to excessive risk taking, opening the capital account may further increase leverage and thus raising the probability of a financial crisis. Similarly, Chinn and Ito (2006) argue that capital account liberalization can be detrimental in countries with insufficiently developed institutions. Ju and Wei (2010) show that capital account liberalization that would always improve welfare in advanced financial systems can have ambiguous effects under poorly-developed systems. Similarly, Aoki et al. (2009) demonstrate that with poorly-developed financial systems capital account liberalization can potentially lead to long-run stagnation or short-run drops in employment, both of which can leave the liberalization policy welfare-reducing. Those who do advocate for capital account liberalization often rely on potential "secondary improvements" or "discipline effects" for domestic institutions stemming from exposure to foreign competition and standards [e.g. Kose et al. (2009); Wei and Tytell (2004)].

Given the ambivalence about the welfare implications of capital account liberalization in the literature, some have argued that China should undertake domestic financial reform prior to liberalizing its capital account [e.g. Hsu (2016)].[6] In a recent survey of this literature, Wei (2018) notes that the logic of the argument that capital account liberalization may exacerbate resource misallocation under a distorted financial system in a developing country seems plausible, but "there is a lack of formal theories that articulate this link." Our theoretical framework articulates a new trade-off between aggregate productivity and intertemporal allocative efficiency for capital account liberalization in the presence of financial repression.[7]

[6]Similar arguments were made much earlier concerning the proper order of liberalizing the current and capital accounts of an emerging market economy. For example, see Edwards (1984).

[7]Wang et al. (2015) derive a model in which financial distortions in China result in excessive savings by households and high rates of domestic returns on capital. Their model also yields the

Our study differs from earlier treatments of capital account liberalization in three dimensions: First, our consideration of a two-sector model is particularly (but not exclusively) relevant to the Chinese case, where capital account restrictions are motivated in part by the desire to maintain a minimal share of output in a favored but less productive sector (SOE) that would otherwise be unsustainable. Recent work by Liu et al. (2017) and Chang et al. (2018) also study the capital misallocation mechanism stemming from preferential credit treatment for SOEs, although they focus on closed economy models that are not designed to study issues on capital flows and capital control policies. Second, our use of an overlapping generations framework is conducive to modeling the implications of financial underdevelopment, as incomplete risk-sharing arises naturally across different generations. This incomplete risk-sharing helps to "close the small open economy model" in the spirit of Schmitt-Grohé and Uríbe (2003). Third, we examine both the implications of gradual policy liberalization and the implications of liberalizing the financial sector along with the capital account. Our analysis therefore sheds light on the merits (and the pitfalls) of the gradualist approach that is likely to be a feature of capital account liberalization in China.

III. The model

We consider a small open economy model with overlapping generations. There is a continuum of households, each living for two periods—young and old. When young, the household works, consumes, and saves for retirement. When old, the household consumes the accumulated savings. The final consumption good is a composite of intermediate goods produced by firms in two sectors—one sector with state-owned enterprises (SOEs) and the other sector with private firms (POEs). SOEs face monopolistically competitive product markets, whereas POEs operate in perfectly competitive markets. Consistent with empirical evidence, SOEs have lower average productivity than POEs. Firms in both sectors rely on bank loans to finance wage payments and they face working capital constraints.

Banks operate in a perfectly competitive market, taking as given the interest rates on deposits and lending. The government provides favorable credit treatment to SOEs by directing banks to lend a minimum share of their available funds to SOEs at below-market interest rates. Banks can lend their remaining funds at market interest rates to

prediction that two-way capital flows, in the form of purchases of foreign assets by Chinese households alongside increased borrowing by Chinese firms, follows financial liberalization. They do not study the implications of capital account liberalization, which is the focus of our paper.

SOEs or POEs. Under its capital control policy regime, the government also imposes taxes on both capital inflows and outflows.

III.1. **The households.** Each household lives for two periods, young in the first period and old in the second. Young households work for firms and receive labor income. They consume a part of their labor income and save the rest for retirement. Old households are retired and consume their accumulated savings.

A representative household born in period t has the utility function

$$\max_{C_t^y, C_{t+1}^o} \mathrm{E}\left\{\ln(C_t^y) - \Psi_h \frac{H_t^{1+\eta}}{1+\eta} + \beta \ln(C_{t+1}^o)\right\}, \tag{1}$$

where C_t^y denotes consumption of the household when young, C_{t+1}^o denotes consumption when old, and H_t denotes hours worked when young.

The household chooses consumption, bank deposits, foreign investment, and capital investment to maximize the utility function (1) subject to the budget constraints

$$C_t^y + D_t + B_{ft}^d + q_t^k K_t^o + I_t + \frac{\Omega_k}{2}\left(\frac{I_t}{K_t^o} - \frac{\bar{I}}{\bar{K}^o}\right)^2 K_t^o = w_t H_t + T_t + \Gamma_t, \tag{2}$$

$$C_{t+1}^o = R_t D_t + (1-\tau_d) R_t^* B_{ft}^d + d_{t+1} + \left[q_{t+1}^k (1-\delta) + r_{t+1}^k\right](K_t^o + I_t) - \Gamma_{t+1}. \tag{3}$$

When young, the household consumes C_t^y, saves bank deposits D_t and foreign investments B_{ft}^d, purchases existing capital from the then old generation (denoted by K_t^o) at the price q_t^k, and makes new investment I_t subject to the quadratic adjustment costs. In addition to receiving wage income $w_t H_t$ from firms, the young household also receives a lump-sum transfer T_t from the government.[8] In addition, the young household also receives bequest income Γ_t from the previous old generation, which is a constant fraction Γ of the wealth held by the old. Specifically, the amount of bequest income is given by

$$\Gamma_t = \Gamma\left\{R_{t-1} D_{t-1} + (1-\tau_d) R_{t-1}^* B_{f,t-1}^d + d_t + \left[q_t^k (1-\delta) + r_t^k\right](K_{t-1}^o + I_{t-1})\right\}. \tag{4}$$

When old, the household consumes the asset holdings, which consist of interest earnings on deposits $R_t D_t$, after-tax earnings on foreign investment $(1-\tau_d) R_t^* B_{ft}$, dividend income d_{t+1} from firms that the household owns, and the returns from capital investment. The old household also leaves bequests Γ_{t+1} to the then-young generation. Here, the term R_t denotes the risk-free deposit rate, R_t^* denotes the world interest rate, r_{t+1}^k denotes the capital rental rate, and δ denotes the capital depreciation rate. The term τ_d is a tax on foreign investment earnings (i.e., capital outflows).

[8] Equilibrium outcomes are invariant to whether lump-sum transfers are made to the young or the old.

The optimizing conditions are summarized by the following equations:

$$\Lambda_t^y = \frac{1}{C_t^y}, \tag{5}$$

$$\Lambda_t^o = \frac{1}{C_t^o}, \tag{6}$$

$$w_t = \frac{\Psi H_t^\eta}{\Lambda_t^y}, \tag{7}$$

$$1 = \mathrm{E}_t \beta R_t \frac{\Lambda_{t+1}^o}{\Lambda_t^y}, \tag{8}$$

$$1 = \mathrm{E}_t \beta (1-\tau_d) R_t^* \frac{\Lambda_{t+1}^o}{\Lambda_t^y}, \tag{9}$$

$$q_t^k + \frac{\Omega_k}{2}(\frac{I_t}{K_t^o} - \frac{\bar{I}}{\bar{K}^o})^2 - \Omega_k(\frac{I_t}{K_t^o} - \frac{\bar{I}}{\bar{K}^o})\frac{I_t}{K_t^o} = \mathrm{E}_t \beta [q_{t+1}^k (1-\delta) + r_{t+1}^k] \frac{\Lambda_{t+1}^o}{\Lambda_t^y}, \tag{10}$$

$$1 + \Omega_k(\frac{I_t}{K_t^o} - \frac{\bar{I}}{\bar{K}^o}) = \mathrm{E}_t \beta [q_{t+1}^k (1-\delta) + r_{t+1}^k] \frac{\Lambda_{t+1}^o}{\Lambda_t^y},. \tag{11}$$

where Λ_t^y and Λ_t^o denotes the Lagrangian multiplier for the two budget constraints. Equations (8) and (9) imply the no-arbitrage condition that

$$R_t = (1-\tau_d)R_t^*. \tag{12}$$

A positive tax rate τ_d captures capital outflow controls. Thus, capital outflow controls drive a wedge between the domestic deposit rate and the world interest rate.

Denote by K_t the aggregate stock of physical capital available at the end of period t. Then,

$$K_t = K_t^o + I_t, \tag{13}$$

and

$$K_t^o = (1-\delta)K_{t-1}. \tag{14}$$

These relations imply the law of motion for the aggregate capital stock

$$K_t = (1-\delta)K_{t-1} + I_t. \tag{15}$$

III.2. **The final good sector.** Final goods are produced using intermediate goods supplied from the two sectors: SOE and POE. The production function is given by

$$Y_t = Y_{st}^{\phi_t} Y_{pt}^{1-\phi_t}, \tag{16}$$

where Y_t denotes the final good output, Y_{st} and Y_{pt} denote the intermediate input produced in the SOE sector and POE sector, respectively, and the term $\phi_t \in (0,1)$ measures the expenditure share of SOE goods used in final goods production. We allow the SOE share to be time varying because we would like to study the implications of capital account liberalization when the economy is going through structural changes. We focus the structural change associated with a steady decline in the SOE share, as observed in China's data.

Denote by p_{st} and p_{pt} the relative price of SOE products and POE products, respectively, both expressed in final consumption good units. Cost-minimizing by the final good producer implies that

$$Y_{st}p_{st} = \phi_t Y_t, \quad Y_{pt}p_{pt} = (1-\phi_t)Y_t. \tag{17}$$

The zero-profit condition in the final good sector implies that

$$1 = \left(\frac{\phi_t}{p_{st}}\right)^{\phi_t} \left(\frac{1-\phi_t}{p_{pt}}\right)^{1-\phi_t}. \tag{18}$$

III.3. **The intermediate good sectors.** Intermediate goods are produced in both the SOE sector and the POE sector. We focus on describing the optimizing decisions of a representative firm in each sector $j \in \{s, p\}$, where s denotes SOE and p denotes POE.

A firm in sector j produces a homogeneous intermediate good Y_{jt} using capital K_{jt} and labor H_{jt} as inputs, with the production function

$$Y_{jt} = A_{jt}(K_{jt})^{1-\alpha}(H_{jt})^{\alpha}, \tag{19}$$

where A_{jt} denotes a sector-specific productivity facing all firms in sector j, and the parameter $\alpha \in (0,1)$ is the labor input elasticity in the production function.

Productivity A_{jt} contains a deterministic trend g^t that is common for both sectors and a stationary component A^m_{jt} that is specific to section j. In particular, we assume that $A_{jt} = g^t A^m_{jt}$. The stationary component A^m_{jt} follows the stochastic process

$$\ln A^m_{jt} = (1-\rho_j)\ln \bar{A}_j + \rho_j \ln A^m_{j,t-1} + \epsilon_{jt}, \tag{20}$$

where $\bar{A}_j$ is the steady-state level of A^m_j, $\rho_j \in (-1,1)$ is a persistence parameter, and the term ϵ_{jt} is an i.i.d. innovation and follows the log-normal distribution $N(0,\sigma_j)$.

Firms face working capital constraints. In particular, they need to pay a fraction θ of wage bills and capital rental costs before production takes place. Firms finance working capital payments through bank loans B_{jt} at the interest rate R_{jt}, and the working capital loans are repaid at the end of the period when production is completed. The working capital constraint for a firm in sector $j \in \{s, p\}$ is given by

$$B_{jt} = \theta(w_t H_{jt} + r^k_t K_{jt}). \tag{21}$$

We assume that firms in the SOE sector face perfectly competitive input markets but monopolistically competitive product markets, while firms in the POE sector face perfect competition in both input and product markets. Denote by ϵ_j as the elasticity of substitution between products produced by different firms within the sector j. Our assumption of the market structure implies that the elasticity is finite for the SOE sector, but infinite for the POE sector.

Given the market structures, a firm's cost-minimizing decisions in sector j imply the conditional factor demand functions

$$w_t H_{jt}(1-\theta+R_{jt}\theta) = \alpha Y_{jt} p_{jt} \frac{\epsilon_j - 1}{\epsilon_j} \tag{22}$$

and

$$r_t^k K_{jt}(1-\theta+R_{jt}\theta) = (1-\alpha) Y_{jt} p_{jt} \frac{\epsilon_j - 1}{\epsilon_j}. \tag{23}$$

Since SOE firms face monopolistic competition, the term $\frac{\epsilon_s}{\epsilon_s - 1} > 1$ represents the price markup. Since POE firms face perfect competition, the elasticity is infinity, and there is no markup pricing.

Both SOE firms and POE firms are owned by the household. Since the POE sector is perfectly competitive, the profit is zero. But SOE firms earn positive profits, which are paid out to the household in the form of dividends. The dividend payments are given by

$$d_{jt} = Y_{jt} p_{jt} - w_t H_{jt} - r_t^k K_{jt} + B_{jt} - R_{jt} B_{jt}. \tag{24}$$

Using the binding working capital constraints in Eq. (21) and the cost-minimizing conditions (22) and (23), it is straightforward to show that

$$d_{st} = \frac{1}{\epsilon_s} p_{st} Y_{st}, \quad d_{pt} = 0. \tag{25}$$

Thus, aggregate dividend payments received by the representative household is $d_t = d_{st}$.

III.4. **Banks.** There is a continuum of competitive banks with free entry in the banking sector. The representative bank takes deposits from households at the deposit interest rate R_t and lends to firms in the SOE and POE sectors. To capture financial repression in China, we assume that the government requires the bank to lend a minimum fraction of its loanable funds to SOEs at a below-market interest rate, which we normalize to zero. The bank can lend the remaining funds to domestic firms at the market loan rate R_{lt}.

Denote by B_{gt} the amount of directed lending to SOEs and B_t the remaining funds that the bank can lend at the market interest rate. Under the directed lending policy, we have

$$B_{gt} \geq \gamma_t(B_{gt} + B_t), \tag{26}$$

where the parameter $\gamma \in [0, 1)$ denotes the share of directed lending, which also indicates the severity of financial repression.

The representative bank maximizes the profit

$$B_{gt} + R_{lt}B_t - R_t D_t \tag{27}$$

subject to the constraint (26) and the flow of funds constraint

$$D_t \geq B_{gt} + B_t. \tag{28}$$

Since banks are risk neutral and there is free entry, the representative bank earns zero profits in equilibrium. The zero-profit condition leads to

$$R_t = \gamma + (1 - \gamma)R_{lt}. \tag{29}$$

Thus, $R_{lt} > R_t$ if and only if $\gamma > 0$. Under financial repression, the bank needs to charge a loan interest rate R_{lt} that is higher than the deposit interest rate R_t to break even. Financial repression thus drives a wedge between the loan rate and the deposit rate.

III.5. **Foreign investors.** Foreign investors can lend to Chinese firms at the market loan rate R_{lt}.[9] Assume that foreign investors are subject to an investment income tax τ_l, so that their after-tax return on loans to Chinese firms is $(1 - \tau_l)R_{lt}$. Furthermore, we assume that external debt requires a risk premium. Under these assumptions, no arbitrage implies that

$$(1 - \tau_l)R_{lt} = R_t^* \Phi\left(\frac{B_{ft}^l}{Y_t} - \frac{B_t^l}{Y}\right). \tag{30}$$

where B_{ft}^l denotes the amount of firm loans granted by foreign investors and $\Phi\left(\frac{B_{ft}^l}{Y_t}\right)$ denotes the risk premium, which depends on the external debt to output ratio and is

[9] In principle, foreign investors could also access China's financial market by depositing funds at Chinese banks. However, under capital outflow controls, the deposit interest rate lies below the world interest rate (see Eq. (12)). Thus, foreign investors have no incentive to deposit funds at Chinese banks.

given by

$$\Phi\left(\frac{B^l_{ft}}{Y_t}-\frac{B^l_t}{Y}\right)=\exp\left[\Phi_b\left(\frac{B^l_{ft}}{Y_t}-\frac{B^l_{ft}}{Y}\right)\right]. \tag{31}$$

The dependence of the risk premium on the relative size of external debts implies a spillover externality that leads to over-borrowing. Since individual firms take the loan interest rate (inclusive of the risk premium) as given, they do not internalize the effects of collective borrowing on the risk premium. The presence of the capital inflow tax and the risk premium drives a wedge between domestic loan interest rate and the world interest rate.

III.6. **Market clearing and equilibrium.** An equilibrium consists of sequences of allocations $\{C^y_t, C^o_t, I_t, K^o_t, Y_t, K_{st}, K_{pt}, H_{st}, H_{pt}, K_t, H_t, B_{st}, B_{pt}, B_{gt}, B_t, B^l_{ft}, NX_t\}$ and prices $\{w_t, R_t, q^k_t, r^k_t, p_{st}, p_{pt}, R_{st}, R_{pt}, R_{lt}\}$ that solve the optimizing problems for the households, the firms, and the banks. In the equilibrium, the markets for the loanable funds, capital, labor, and goods all clear.

The loan market clearing condition is given by,

$$B_{st}+B_{pt}=B_{gt}+B_t+B^l_{ft}, \tag{32}$$

where B_{gt} and B_t denote the directed lending and the unrestricted lending originated from domestic banks, respectively, and B^l_{ft} denotes the loans from foreign investors.

Capital and labor are both perfectly mobile across sectors, so that the labor market and the capital market clearing implies that

$$H_t=H_{st}+H_{pt}, \tag{33}$$

and

$$K_{t-1}=K_{st}+K_{pt}. \tag{34}$$

Final goods market clearing implies that the trade surplus is given by

$$NX_t=Y_t-C^y_t-C^o_t-I_t-\frac{\Omega_k}{2}\left(\frac{I_t}{K^o_t}-\frac{\bar{I}}{\bar{K}^o}\right)^2K^o_t. \tag{35}$$

In addition, by summing up all sectors' budget constraints, we obtain the balance of payments condition

$$NX_t+(R^*_{t-1}-1)B^d_{f,t-1}-\left[R^*_{t-1}\Phi\left(\frac{B^l_{f,t-1}}{Y_{t-1}}\right)-1\right]B^l_{f,t-1}=(B^d_{ft}-B^l_{ft})-(B^d_{f,t-1}-B^l_{f,t-1})+\Delta_t. \tag{36}$$

Note that the last term $\Delta_t=(R_{st}B_{st}+R_{pt}B_{pt}-R_{s,t-1}B_{s,t-1}-R_{p,t-1}B_{p,t-1})$ emerges because banks receive repayments on their working capital loans at the end of the same period, whereas they repay deposits to the households at the beginning of the next period.

IV. Calibration

We illustrate the tradeoffs incurred by liberalizing the capital account under financial repression based on numerical solutions to the model with calibrated parameters shown in Table 1. Where possible, we calibrate our model based on values from the Chinese economy.

We set the subjective discount factor to $\beta = 0.665$, which implies an annualized discount factor of 0.96 since we interpret a period in our model as 10 years. We set $\eta = 2$, implying a Frisch labor supply elasticity of 0.5, which lies in the range of empirical studies. We calibrate $\Psi_h = 38$ such that the steady state value of labor hour is about one-third of total time endowment (which itself is normalized to 1). For the parameters in the capital accumulation process, we calibrate $\delta = 0.651$, implying an annual depreciation rate of 10%. We set the capital adjustment cost parameter to $\Omega_k = 1$, which lies in range of the empirical estimates in DSGE models. We set the foreign interest rate to $R^* = 1.629$, implying an annualized rate of 5%. We calibrate the steady-state value of Γ, the share of old-age income bequested to the young generation to 0.75, implying an annual household consumption to net worth ratio $\frac{C^y+C^o}{10(D+B_f^d+q_k K)}$ of 7%, consistent with the 2011 China Household Finance Survey.

For the parameters related to intermediate goods producers, we calibrate the labor income share to $\alpha = 0.5$ based on the empirical evidence documented by Brandt et al. (2008) and Zhu (2012). We set the elasticity of substitution between differentiated products produced by SOE firms to $\epsilon = 20$, implying an average gross output markup of 5%, which is consistent with the average spread in profit margins between SOEs and POEs. We normalize the scale of SOE total factor productivity (TFP) to $A_s = 1$ and calibrate the scale of POE TFP parameter to $A_p = 1.42$, consistent with the TFP gap estimated by Hsieh and Klenow (2009). In our transition analysis, we vary the expenditure share of SOE goods ϕ to capture structural changes in China. We set $\phi = 0.5$ in the initial steady state and consider a lower value of $\phi = 0.3$ for the new steady state. These values of ϕ are broadly in line with the observed declines in the SOE share in China's industrial output from 2000 to 2010, as documented by Chen et al. (2017).

For the policy parameters, we set the share of directed lending $\gamma = 0.5$ as a baseline. According to China's Industrial Survey conducted by the National Bureau of Statistics, the share of SOE current liabilities in all industrial firms was about 60% in 2000. At that time, most of the bank loans to SOEs were directed lending at subsidized interest rates, so a value of $\gamma = 0.5$ seems plausible. In the baseline case, we set the capital outflow tax rate to $\tau_d = 16.62\%$. This value implies that $\frac{B^d_{ft}}{Y_t} = 0.06$ in the initial steady state, consistent with the average ratio of domestic private holdings of foreign assets to aggregate output in the Chinese data for the period from 2004 to 2017. We set the capital inflow tax rate to $\tau_l = 5.09\%$, so that the model implies that the steady-state ratio of foreign debt to aggregate output is $\frac{B^l_{ft}}{Y_t} = 0.04$. This ratio is consistent with the Chinese data. In particular, according to the 2016 Annual Report of the State Administration of Foreign Exchange (SAFE) of China, the ratio of China's foreign liabilities to its annual GDP stayed roughly constant, and averaged about 40% from 2006 to 2016.[10]

For the parameters related to external debt, we set the risk premium parameter on foreign debt to $\Phi_b = 3$, which is consistent with the elasticity of emerging market sovereign bond spread to external debt-to-GDP ratio estimated by Bellas et al. (2010).

V. Capital account liberalization: Comparative statics

We now use the calibrated model to examine the implications of liberalization policies for equilibrium allocations and welfare. Through this analysis, we highlight the tradeoff between aggregate productivity and intertemporal allocative efficiency when the capital account is liberalized under financial repression.

We first take financial repression as given, and consider three alternative capital account liberalization policies: (i) a one-way liberalization of capital outflows, (ii) a one-way liberalization of capital inflows, and (iii) liberalizing controls over both capital outflows and inflows. We then examine the implications of joint liberalization of both financial repression and capital controls. We focus on the steady state analysis throughout this section.

V.1. **Liberalizing capital outflow controls.** We begin by examining the steady-state implications of a one-way liberalization of controls on capital outflows by reducing the capital outflow tax rate τ_d, while holding the inflow tax rate τ_l and the financial repression parameter γ constant.

[10]See Table S3, "China's International Investment Position, 2004-2016" in the SAFE report.

To help develop intuition, we first consider the extreme case in which capital inflows are prohibited (by setting $\tau_l = 100\%$). Figure 1 shows the relation between steady-state equilibrium variables (the vertical axis in each panel) and the capital outflow tax rate τ_d (the horizontal axis). By construction, foreign debt is always zero (because no foreign investors will lend to domestic firms given the prohibitive inflow taxes). If τ_d is sufficiently high, households will not invest abroad either, so that the economy would be in a financial autarky. When τ_d is sufficiently low, households would choose to invest a fraction of their savings abroad, raising foreign asset holdings while reducing domestic bank deposits. No arbitrage implies that domestic deposit interest rate needs to rise. The increase in returns on savings alleviates distortions to the households' consumption-savings decisions.

However, under financial repression (i.e., a positive γ), banks respond to the increase in the deposit interest rate by raising the market lending interest rate in order to remain solvent. The increase in the marketing lending rate has a larger impact on POE firms than on SOE firms, because SOEs have access to direct lending at a below-market interest rate, whereas POEs do not. Thus, liberalizing capital outflow controls reallocates resources from POEs to less productive SOEs, exacerbating misallocation and reducing aggregate TFP, as shown in the Figure.

Therefore, while relaxing capital outflow controls improves intertemporal allocative efficiency (for consumption-savings decisions), it exacerbates the misallocation across sectors and reduces aggregate productivity. If the initial outflow tax is high (i.e., if the economy is close to financial autarky), easing outflow controls improves welfare because the improvement in intertemporal allocations dominates the misallocation effect. If the initial outflow tax is sufficiently low, then the oposite is true, and further liberalizing capital outflow controls reduces welfare as the misallocation effect dominates. There is therefore an interior second-best capital control policy with a positive τ_d that maximizes steady-state welfare. Under our calibration (and assuming $\tau_l = 100\%$), the optimal outflow tax rate is $\tau_d^* = 9\%$, as shown in the last panel of the figure.

In the more general case where we also allow capital inflows to adjust (with a calibrated tax of $\tau_l = 5.09\%$ instead of the prohibit tax of $\tau_l = 100\%$), our qualitative results remain the same. These results are shown in Figure 2. Because a reduction in τ_d raises the domestic market lending rate, foreign investors have the incentive to lend to domestic firms (subject to capital inflow taxes and the risk premium). Thus, both foreign assets and foreign debts increase as τ_d falls. As shown in Figure 2, we still observe a tradeoff between the positive intertemporal allocative effect and the negative misallocation effect associated with relaxing controls on capital outflows, and thus there is still an interior second-best capital outflow tax. The difference is that, when capital inflows are allowed, we get a smaller decline in aggregate TFP and a higher welfare at the optimal capital outflow tax rate than that under the prohibitive inflow taxes. In this case, the ability of POE firms to access foreign funds mitigates the misallocation effect of liberalizing capital outflows. With a sufficiently low capital outflow tax rate, further liberalization of capital outflow controls would indeed reverse the TFP decline, as the increase in domestic market interest rate attracts sufficiently high capital inflows. Overall, in the more general case with capital inflows allowed, the tradeoff between aggregate productivity and intertemporal efficiency still results in a an interior optimum for capital outflow taxes.

V.2. **Liberalizing capital inflow controls.** Consider now the effects of liberalizing capital inflow controls by reducing the tax rate τ_l on foreign investors' earnings. Again, we illustrate the mechanism using the special case in which no capital outflows are allowed (by setting $\tau_d = 1$). We then consider the more general case with τ_d set at its calibrated values.

Figure 3 displays the relations between the steady-state capital inflow tax (τ_l) and several macroeconomic variables in the case without capital outflows (with $\tau_d = 100\%$). If the inflow tax rate is sufficiently high, then foreign investors would not enter the domestic market and the country would be in financial autarky. Liberalizing inflow controls raises foreign investors' after-tax returns, eventually leading them to invest in China. The entry of foreign investors introduces competition with Chinese banks in the loan markets, which reduces the market interest rate that banks can charge. Since banks are required to lend a fraction of their funds to SOEs at below-market rates, they must reduce the deposit interest rate to remain solvent. These declines in the deposit rate exacerbates the distortions to the intertemporal consumption-savings decisions, leading to welfare losses.

On the other hand, capital inflows disproportionately benefit POEs by reducing the market loan rate.[11] As a result, POE activity expands relative to that of SOEs, improving aggregate productivity by reallocating resources from SOEs to more productive POEs.

[11]If SOEs are borrowing beyond the directed lending levels, then capital inflows also reduce the costs on that portion of their borrowing. However, because the cost of directed lending remains unchanged, capital inflows have greater effects on the funding costs for POEs than for SOEs.

This positive reallocation effect, however, is partly offset by the over-borrowing externality, because the risk premium on foreign debt increases with the relative size of the debt and individual borrowers do not internalize the equilibrium effects of their collective actions on the risk premium.

Overall, liberalizing capital inflow controls improves aggregate productivity, but it also exacerbates intertemporal misallocations and the over-borrowing externality. The net effect on welfare is thus ambiguous. Figure 3 shows a hump-shaped relation between welfare (steady-state utility) and the capital inflow tax τ_l, with welfare maximized at $\tau_l^* = 13\%$, as shown in Figure 3.

In the more general case with capital outflows allowed (by setting τ_d to its calibrated value of 16.62%), the qualitative results are similar, as shown in Figure 4. At sufficiently high tax rates on capital inflows ($\tau_l \geq 10\%$), the domestic deposit rate is high relative to the after-tax returns on investing abroad. Thus, there are no capital outflows. With a sufficiently low tax rate on capital inflows (with $\tau_l < 10\%$), however, increased foreign competition in the loanable funds market reduces the market lending rate and forces domestic banks to cut the deposit rate to remain solvent. Households respond to the decline in deposit rate by purchasing more foreign bonds, leading to increases in capital outflows. Overall, liberalizing capital inflow controls incurs the same tradeoff between improvements in aggregate productivity and further distortions to intertemporal allocations along with the over-borrowing externality. As shown in Figure 4, when capital outflows are allowed, the representative household's steady-state welfare has a hump-shaped relation with τ_l and reaches its maximum at $\tau_l^* = 2\%$. Furthermore, the maximum welfare level is higher than in the case with prohibitive capital outflow taxes shown in Figure 3.

V.3. **Two-way capital account liberalization.** We next examine the steady-state implications of liberalizing capital controls for both inflows and outflows, taking financial repression as given. Specifically, we explore how optimal steady-state capital control policies (parameterized by τ_d and τ_l) depend on the financial repression policy (γ).

Figure 5 displays the optimal tax rates on capital inflows and outflows for different degrees of financial repression. The figure shows that, under optimal capital account policy, more severe financial repression (with a higher value of γ) requires tighter restrictions on both capital inflows and outflows (i.e., higher values of both τ_d and τ_l). An increase in γ pushes up the market lending rate and thus raises POE funding costs. This results in reallocation from the POE sector to the less productive SOE sector, lowering TFP. The planner raises the capital outflow tax τ_d to partly undo this misallocation effect, because a more restrictive capital outflow control helps keep household deposits within the domestic economy and thus contains the rise in domestic deposit and lending interest rates.

Facing a higher loan rate in the domestic market, firms have incentive to increase borrowing from abroad. Increased foreign debt, however, leads to a rise in the risk premium. Since individual firms do not internalize the effects of their borrowing on the risk premium, this exacerbates the over-borrowing externality, raising inefficiency. The planner can partly undo that inefficiency by raising the capital inflow tax rate τ_l, as shown in Figure 5.

Under optimal steady-state capital control policies, there is a hump-shaped relation between welfare and the degree of financial repression, as shown in the Figure. When the share of directed loans is high, lowering that share increases aggregate TFP through reallocation across sectors. Reducing the share of directed loans also benefits the household because they can receive higher returns on their savings at domestic banks. In addition, the planner optimally lowers the taxes on capital inflows and outflows. Thus, when γ is initially at a high level, reducing financial repression raises welfare. However, if γ is initially at a low level, reducing γ further may lower welfare because the SOE sector has monopolistic competition, implying that the equilibrium SOE output would be inefficiently low without subsidized loans from banks. These frictions together gives rise to a hump-shaped welfare with respect to the financial repression parameter γ, as shown in the Figure.

VI. Capital account liberalization: Transition dynamics

The Chinese economy has gone through large structural changes over the past two decades. One remarkable structural change is the steady decline in the share of SOE output in total industrial revenues, which went from about 50% in 2000 to about 30% in 2010, and further down to about 20% by 2016 (Chang et al., 2015). In this section, we investigate the optimal path for transition under these structural changes by considering a counterfactual experiment in which the share of SOE input ϕ falls from $\phi_0 = 0.5$ in period zero (the initial steady-state value) to $\phi_1 = 0.3$ in period $t = 1$ and stays at that level thereafter (the new steady-state value). In particular, we examine the optimal magnitude and speed of capital account liberalization that maximizes social welfare along the transition path.

To illustrate our counterfactual policy experiments, consider the case with capital outflow liberalization. Denote by τ_{d0} the pre-liberalization tax rate on capital outflows; that is, the tax rate in the initial steady state with the high level of the SOE expenditure share. Denote by τ_{d1} the post-liberalization tax rate on capital outflows. We assume that the government pursues its liberalization policy at a pace measured by $\alpha_d \in [0, 1]$. The transition path of the capital outflow tax rate is then given by

$$\tau_{dt} = \begin{cases} \tau_{d0}, & \text{if } t = 0, \\ \tau_{d0} + (\tau_{d1} - \tau_{d0})[1 - (1 - \alpha_d)^t] & \text{if } t \geq 1. \end{cases} \tag{37}$$

Similarly, we denote the pre- and post-liberalization capital inflow tax rates by τ_{l0} and τ_{l1}, respectively, and the pace of capital inflow liberalization by α_l. We also denote the pre- and post-liberalization financial repression by γ_0 and γ_1 respectively, and the pace of financial liberalization by α_γ.

Given these notations, we define the transition welfare as

$$V_1(\tau_{d1}, \tau_{l1}, \gamma_1; \alpha_d, \alpha_l, \alpha_\gamma) = \sum_{t=1}^{\infty} \beta^t \left(\ln(C_t^y) - \Psi_h \frac{H_t^{1+\eta}}{1+\eta} + \ln(C_t^o) \right), \tag{38}$$

where C_t^y and C_t^o denote the consumption of the young and old, and H_t the labor supply of the young generation, along the transition path. The transition welfare V_1 depends on both the magnitude of the new policy parameters $(\tau_{d1}, \tau_{l1}, \gamma_1)$ and the pace of liberalization $(\alpha_d, \alpha_l, \alpha_\gamma)$.

To help illustrate the tradeoff incurred by alternative paths of capital account liberalization, we first consider one-way liberalization of the capital account, and then examine the general case with both inflows and outflows liberalized.

VI.1. **Special case I: closed capital inflows.** We fist consider the special case in which no capital inflows are allowed (by setting $\tau_{l0} = \tau_{l1} = 1$). We set the initial value of the capital outflow tax to $\tau_{d0} = 15.41\%$ such that the foreign asset to GDP ratio equals 0.06, consistent with the Chinese data. We keep the other parameters at their calibrated values.

We then examine how the optimal capital-outflow liberalization paths depend on the speed of liberalization for financial repression (α_γ). In particular, for a given value of α_γ within the range between 0.2 and 1, we optimize over the three parameters (τ_{d1}, α_d, γ_1) to maximize the transition welfare V_1. Figure 6 displays the numerical results.

Figure 6 shows that the optimal second-best policy calls for gradual capital outflow liberalization (i.e., $\alpha_d < 1$). Moreover, the slower the speed of financial liberalization, the slower should capital outflows be liberalized (i.e., α_d increases with α_γ). For sufficiently slow financial liberalization, some positive capital outflow taxes are also necessary. In contrast, the transition welfare is maximized if instantaneous liberalization of financial repression is implemented (i.e., $\alpha_\gamma = 1$).

Along the transition path as the SOE output share declines, efficiency calls for reallocation of resources from SOEs to POEs. However, under financial repression, immediate liberalization of capital outflows would raise domestic deposit interest rate. Banks pass through these increases in the deposit rate to the market interest rate, raising the relative funding costs of POEs, and reallocating some resources to less productive SOEs. This reallocation slows down the transition to the new steady state with a smaller SOE share, and also reduces aggregate productivity. To mitigate these misallocations, the planner slows down the pace of capital outflow liberalization before financial liberalization is complete.

VI.2. **Special case II: closed capital outflows.** We next consider the special case in which no capital outflows are allowed (by setting $\tau_{d0} = \tau_{d1} = 1$). We set the initial value of capital inflow tax to $\tau_{l0} = 4.51\%$ such that the foreign debt to GDP ratio equals 0.04, consistent with Chinese data. We keep the other parameters at their calibrated values.

We then examine how the optimal capital-inflow liberalization paths depend on the pace of financial liberalization (α_γ). In particular, given a value of α_γ within the range between 0.1 and 1, we optimize over the three parameters (τ_{l1}, α_l, γ_1) to maximize the transition welfare V_1. Figure 7 displays the numerical results.

Figure 7 shows that the planner desires to remove capital inflow controls by setting $\tau_{l1} = 0$ to maximize welfare under transition, regardless of the speed of financial liberalization. However, the planner pursues a faster pace of capital inflow liberalization only if the pace of financial liberalization is faster (i.e., α_l increases with α_γ). The planner also wants to maintain some positive level of directed lending (with a positive γ_1) since the monopolistic competition in the SOE sector is needed to correct for inefficiently low levels of activity. Furthermore, instantaneous liberalization of financial repression maximizes welfare under transition.

The monotonic relation between the optimal speed of liberalizing capital inflows and the speed of lifting financial repression again reflects the tradeoff between misallocation and distorted intertemporal household decisions. With a slow speed of financial liberalization (i.e., a small α_γ), rapid liberalization of capital inflows and the resulting increased competition from foreign investors would force banks to cut the domestic deposit rate, further distorting the households' intertemporal decisions. Increases in capital inflows would also exacerbate the externalities from the risk premium. On the other hand, increased inflows reduce the relative funding costs for the more productive POEs and result in an efficiency-enhancing reallocation towards that sector, raising aggregate TFP. This tradeoff implies that gradual easing of capital inflow controls is consistent with second-best policy.

VI.3. **The general case with two-way capital flows.** We next consider the general case where both types of capital flows are allowed. We examine one-sided liberalization of capital flows. To highlight the importance of transition dynamics for evaluating alternative liberalizing policies, we compare optimal liberalization policy that maximizes the transition welfare V_1 defined in Eq (38) to an alternative optimal policy that maximizes steady-state welfare

$$V_f(\tau_{d1}, \tau_{l1}, \gamma_1) = \ln(\bar{C}^y) - \Psi_h \frac{\bar{H}^{1+\eta}}{1+\eta} + \ln(\bar{C}^o), \tag{39}$$

where $\bar{C}^y$, $\bar{C}^o$, and $\bar{H}$ denotes young-age consumption, old-age consumption, and labor supply in the new steady state after the transitions are complete.

The steady-state welfare measure V_f does not take into account transition dynamics. Thus, it is a function of the magnitude of the policy parameters $(\tau_{d1}, \tau_{l1}, \gamma_1)$ in the new steady state, but independent of the speeds of liberalization (α_d, α_l, α_γ).

VI.3.1. *Liberalizing capital inflows.* We first consider optimal liberalization of capital inflow policies $\{\tau_{l1}, \alpha_l\}$ while keeping the outflow tax fixed at the calibrated value. Table 2 shows the policy parameters and the welfare effects under five alternative liberalization paths for capital inflows relative to the benchmark regime (Case 0), where the policy parameters and the SOE share parameter are all fixed at their initial steady state levels.

In the first 3 liberalization regimes (Cases 1-3), the capital inflow tax τ_{l1} is chosen to maximize the new steady-state welfare V_f following the decline in SOE share, holding the financial repression parameter γ and the capital outflow taxes at the initial steady-state levels. These cases differ only in the ad hoc speed of capital inflow liberalization, from relatively fast ($\alpha_l = 0.9$) to moderate ($\alpha_l = 0.5$), and to relatively slow ($\alpha_l = 0.1$). The Table shows that liberalizing the capital inflow tax to a level that maximizes the new steady-state welfare does not necessarily increase welfare if the transition dynamics are taken into account. In particular, liberalization that calls for a reduction of τ_l from 5.09% to 2% improves steady-state welfare by 1.11% of consumption equivalent. However, the same policy leads to welfare losses if the transition dynamics are taken into account. Nevertheless, the losses are smaller if the speed of inflow liberalization is slower.

In the fourth liberalization regime (Case 4), the magnitude and the speed of inflow liberalization (τ_{l1} and α_l) are jointly chosen to maximize the transition welfare V_1. Again, we keep the financial repression and capital outflow taxes at their initial steady-state levels. It turns out that the constrained optimal inflow tax rate is higher than that in the initial steady state. This result is somewhat surprising. It reflects the need for a higher capital inflow tax to offset the distortions originated from financial repression during the transition period. When the share of SOE output falls, efficiency requires a reduction in directed lending. However, in this counterfactual policy regime, directed lending is fixed at $\gamma = 0.5$. Thus, banks need to cut the deposit interest rate when they face competition in the lending markets from foreign investors. To mitigate the distortions in the households' intertemporal decisions during transition, the planner optimally *increases* the tax rate on capital inflows. For similar considerations, the planner also chooses a relatively slow speed of capital inflow liberalization ($\alpha_l = 0.36$).

Despite the higher capital inflow tax rate, the new steady-state welfare is higher than the initial steady-state welfare, with a gain of about 0.69% of consumption equivalent. This result reflects that, in the new steady state, the share of SOE output is much smaller than in the initial steady state (0.3 vs. 0.5), so that aggregate TFP is higher. Although the capital inflow tax is higher, the new steady-state welfare still exceeds that in the initial steady state, which has a greater SOE share. Note that the welfare level in Cases 1-3 is greater than that in Case 4 (1.11% vs. 0.69%). This would be expected since the value of τ_{l1} in Cases 1-3 is optimally chosen to maximize the new steady-state welfare.

In the fifth liberalization regime (Case 5), the planner can implement joint liberalizations of capital inflows and financial repression to maximize transition welfare V_1. The planner chooses to ease financial repression significantly from $\gamma_0 = 0.5$ to $\gamma_1 = 0.1521$, and to implement the financial reform immediately ($\alpha_\gamma = 1$). As we have discussed, the presence of monopoly power in the SOE sector implies an interior optimum for γ. With financial repression eased, the planner sets the new capital inflow tax rate (τ_{l1}) to a near-zero level, but chooses to implement the inflow tax reduction gradually ($\alpha_l = 0.5542$). Furthermore, with financial liberalization, the wedge between the domestic market lending rate and the deposit rate shrinks, lessening the incentive for firms to seek funding abroad and reducing the spillover effects from external debt. The joint liberalization of financial repression and capital inflow controls leads to sizable welfare gains both in the new steady state and along the transition path.

VI.3.2. *Liberalizing capital outflows.* We now turn to the liberalization of capital outflows. Table 3 shows the policy parameters and the welfare effects under five alternative liberalization regimes of capital outflows relative to the benchmark regime (Case 0).

In Cases 1-3, the planner chooses the capital outflow tax rate τ_{d1} to maximize the new steady-state welfare V_f, while keeping the policy parameters γ and τ_{l1} at their initial steady-state levels. These 3 policy regimes differ only in the speed of liberalizing capital outflows, from relatively fast ($\alpha_d = 0.5$) to moderate ($\alpha_d = 0.5$) and to relatively slow ($\alpha_d = 0.1$). The table shows that the capital outflow tax rate that maximizes the new steady-state welfare is significantly lower than that in the benchmark (10.79% vs. 16.62%), and that the welfare in the new steady state is much higher than that in the initial steady state (with a welfare gain of about 53.47% of consumption equivalent). The welfare gains obtained under the new steady state reflect both the decline in the SOE share of output and the reduction in capital outflow taxes. Easing capital outflow controls raises the returns on household savings and alleviates the intertemporal distortions from financial repression. However, the increased capital outflows raise the POE funding costs and exacerbate misallocation across sectors along the transition path, thereby slowing down the transition to the new lower SOE share steady state. Thus, when transition dynamics are taken into account, the welfare gains are substantially reduced relative to the new steady-state welfare.

In Case 4, the planner chooses the magnitude and the speed of liberalizing capital outflows (i.e., τ_{l1} and α_l) to maximize the transition welfare V_1, taking as given the inflow taxes and financial repression. The second-best policy in this case features a relatively aggressive reduction in the capital outflow tax rate (to $\tau_{d1} = 0.0584$ from 0.1662) and a relatively slow pace of liberalization ($\alpha_d = 0.1511$). This liberalization policy leads to greater gains in the transition welfare but smaller gains in the steady-state welfare compared to the first 3 cases.

Finally, in Case 5, we allow the planner to choose the magnitude and speed of liberalization for both capital outflows and financial repression, holding the capital inflow tax rate fixed at its initial steady-state level. The planner's objective is to maximize the transition welfare. The second-best policy in this case features an elimination of capital outflow taxes, but with a moderate speed of reform ($\alpha_d = 0.5847$); it also features a large reduction in the share of directed lending to SOEs ($\gamma_1 = 0.0309$), with a relatively fast speed of reform ($\alpha_\gamma = 0.8843$). The planner does not choose to instantaneously liberalize financial repression because doing so would reduce capital outflows and thus lower households' earnings on their savings. The table shows that the joint liberalization of capital outflows and financial repression leads to large welfare gains both for the new steady state and along the transition path.

VII. Conclusion

China's current policy regime features both financial repression and capital controls, but officials have expressed interest in liberalizing both policies. In this paper, we study the optimal paths of capital account liberalization under financial repression in a small open economy model with overlapping generations. We show that, unless financial repression is lifted, easing capital controls raises a tradeoff between the efficiency of resource allocations (i.e., aggregate TFP) and distortions to households' inter-temporal choices. Financial repression drives a wedge between market lending rates and deposit rates because banks are required to make directed lending to low-productivity SOEs at below-market interest rates. Since productive private firms can borrow only at market rates, financial repression leads to the misallocation of resources.

In this environment, easing capital inflow controls helps to attract foreign funds to finance domestic production, reducing private firms' funding costs and enhancing aggregate TFP. However, banks respond to inflow-induced decline in market lending rates by lowering deposit rates, and thus further distorting household savings decisions. On the other hand, easing capital outflow controls improves the returns on household savings, but also pushes up domestic market lending rates, increasing funding costs for private firms and reducing TFP.

Our findings provide an argument for moderation in both the pace and the degree of capital account liberalization under financial repression. However, it is important to stress that these results are second-best, based on a given level of financial repression. Liberalizing domestic financial markets prior to opening the capital account mitigates the transition costs encountered during the capital account liberalization process. Thus, our analysis suggests that domestic financial reforms and capital account liberalization are complementary and should be pursued jointly.

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Table 1. Calibration

Parameter	Description	Value
β	Household discount rate	0.665
η	Inverse of labor supply elasticity	2
Ψ_h	Utility weight of labor	38
δ	Capital depreciation rate	0.651
Ω_k	Capital adjustment cost	5
r^*	Foreign interest rate	1.629
τ	Transfer from old to young	0.75
θ	Fraction of working capital	1
α	Labor income share	0.5
ϵ	Elasticity of substitution among SOE firms	20
A_s	SOE TFP	1
A_p	POE TFP	1.42
ϕ	Share of SOE output	0.5
γ	Share of directed lending	0.5
τ_d	Tax rate on foreign asset	16.62%
τ_l	Tax rate on foreign debt	5.09%
Φ_b	Elasticity of risk preimum to external debt-to-GDP ratio	3
$\frac{\bar{B^l_f}}{Y}$	Desirable foreign debt-to-output ratio	0.04

TABLE 2. Liberalization of Capital Inflows with a Permanent Fall in SOE Production Share

Case	0	1	2	3	4	5
τ_d	16.62%	16.62%	16.62%	16.62%	16.62%	16.62%
α_d	-	-	-	-	-	-
τ_l	5.09%	2.00%	2.00%	2.00%	14.65%	0.01%
α_l	-	90.00%	50.00%	10.00%	36.52%	55.42%
γ	50.00%	50.00%	50.00%	50.00%	50.00%	15.21%
α_γ	-	-	-	-	-	100.00%
Welfare evaluated at the beginning of the transition (V_1)						
Welfare gains	0.00%	-0.37%	-0.31%	-0.11%	0.36%	7.73%
Welfare evaluated at the final steady state (V_f)						
Welfare gains	0.00%	1.11%	1.11%	1.11%	0.69%	17.82%

Note: Welfare gains are expressed as in terms of consumption equivalent per period. Case 0 is the benchmark regime where all of the policy parameters are kept constant at its initial steady state level. In Case 1 to Case 3, the government keeps financial repression and capital outflow control as contant ($\gamma_1 = \gamma_0$, $\tau_{d1} = \tau_{d0}$) and chooses capital inflow policy $\tau_{l1} = \tau_{l1}^*$ to maximize welfare in the final steady state (V_f). In Case 4, policy coefficients on capital inflows (τ_{l1} and α_l) are chosen to maximize social welfare evaluated along the transition path, holding financial repression and capital outflow control as constant. In Case 5, policy coefficients on capital inflows and financial repression (τ_{l1}, α_l, γ_1, α_γ) are chosen to maximize social welfare evaluated along the transition path, holding capital outflow control as constant.

TABLE 3. Liberalization of Capital Outflows with a Permanent Fall in SOE Production Share

Case	0	1	2	3	4	5
τ_d	16.62%	10.79%	10.79%	10.79%	5.84%	0.00%
α_d	-	90.00%	50.00%	10.00%	15.11%	58.47%
τ_l	5.09%	5.09%	5.09%	5.09%	5.09%	5.09%
α_l	-	-	-	-	-	-
γ	50.00%	50.00%	50.00%	50.00%	50.00%	3.09%
α_γ	-	-	-	-	-	88.43%
Welfare evaluated at the beginning of the transition (V_1)						
Welfare gains	0.00%	1.01%	1.55%	1.07%	1.94%	11.26%
Welfare evaluated at the final steady state (V_f)						
Welfare gains	0.00%	53.47%	53.47%	53.47%	36.84%	58.91%

Note: Welfare gains are expressed as in terms of consumption equivalent per period. Case 0 is the benchmark regime where all of the policy parameters are kept constant at its initial steady state level. In Case 1 to Case 3, the government keeps financial repression and capital inflow control as contant ($\gamma_1 = \gamma_0$, $\tau_{l1} = \tau_{l0}$) and chooses capital outflow policy $\tau_{d1} = \tau_{d1}^*$ to maximize welfare in the final steady state (V_f). In Case 4, policy coefficients on capital outflows (τ_{d1} and α_d) are chosen to maximize social welfare evaluated along the transition path, holding financial repression and capital inflow control as constant. In Case 5, policy coefficients on capital outflows and financial repression (τ_{d1}, α_d, γ_1, α_γ) are chosen to maximize social welfare evaluated along the transition path, holding capital inflow control as constant.

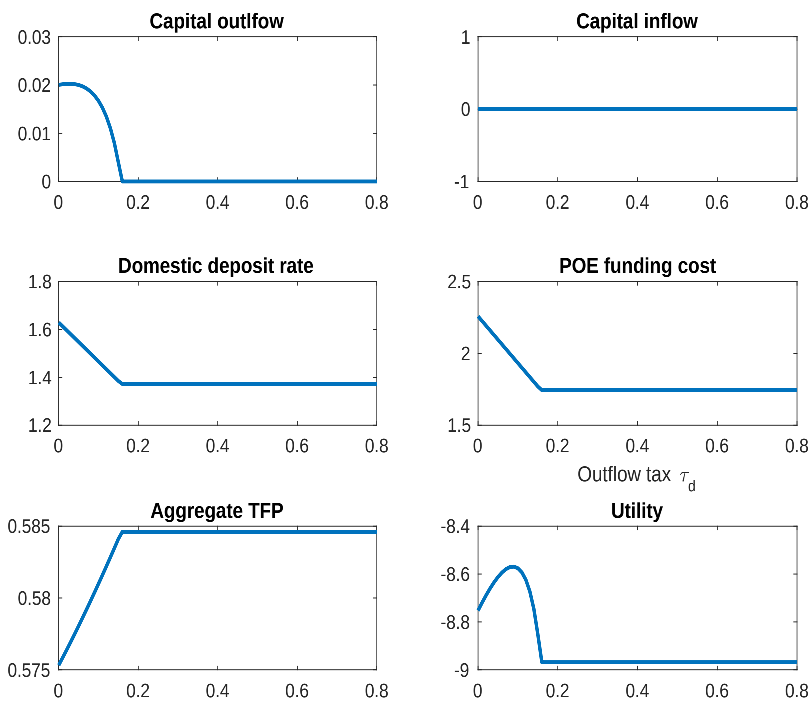

FIGURE 1. Steady-state implications of a one-way liberalization of capital outflow controls: the extreme case with no capital inflows allowed ($\tau_l = 100\%$). The horizontal axis shows the range of the capital outflow tax rate τ_d.

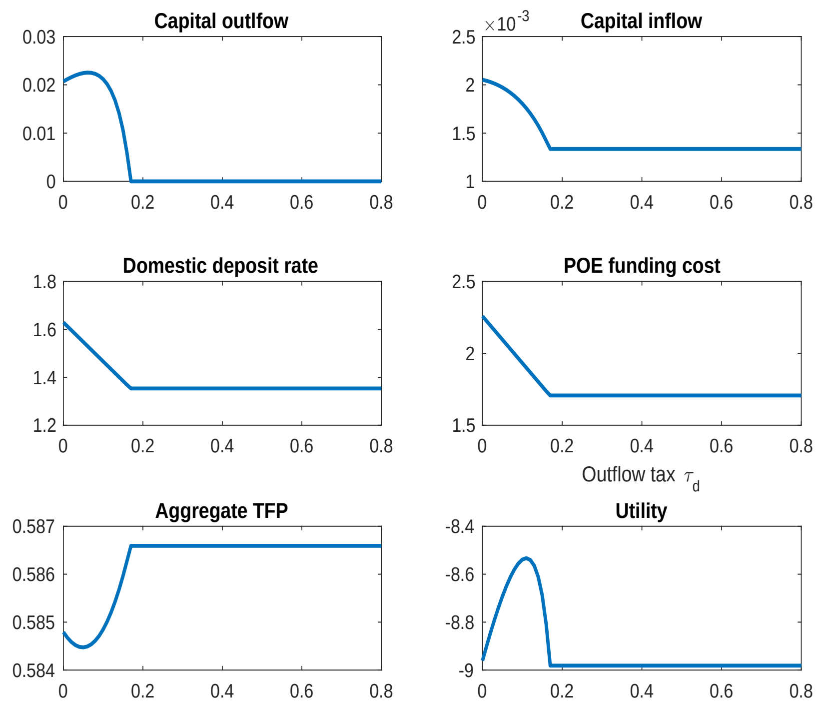

FIGURE 2. Steady-state implications of a one-way liberalization of capital outflow controls: the general case with capital inflows allowed ($\tau_l = 5.09\%$). The horizontal axis shows the range of the capital outflow tax rate τ_d.

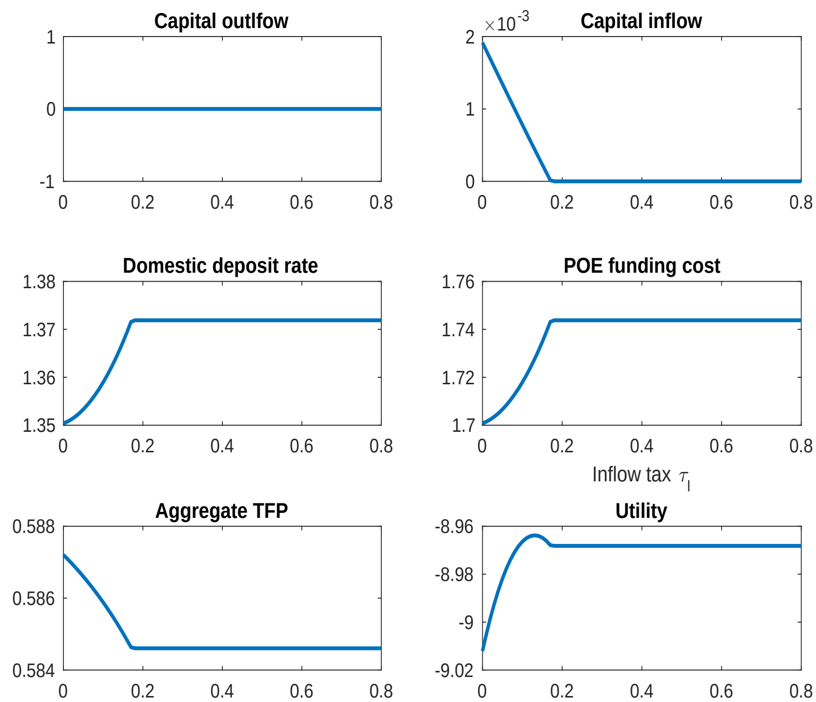

FIGURE 3. Steady-state implications of a one-way liberalization of capital inflow controls: the extreme case with no capital outflows allowed ($\tau_d = 100\%$). The horizontal axis shows the range of the capital inflow tax rate τ_l.

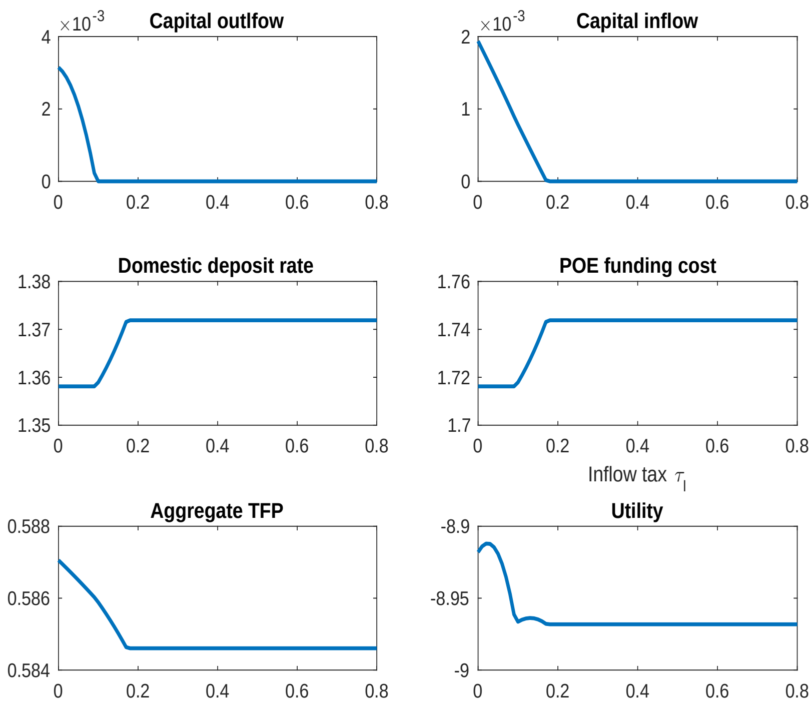

FIGURE 4. Steady-state implications of a one-way liberalization of capital inflow controls: the general case with capital outflows allowed ($\tau_d = 16.62\%$). The horizontal axis shows the range of the capital inflow tax rate τ_l.

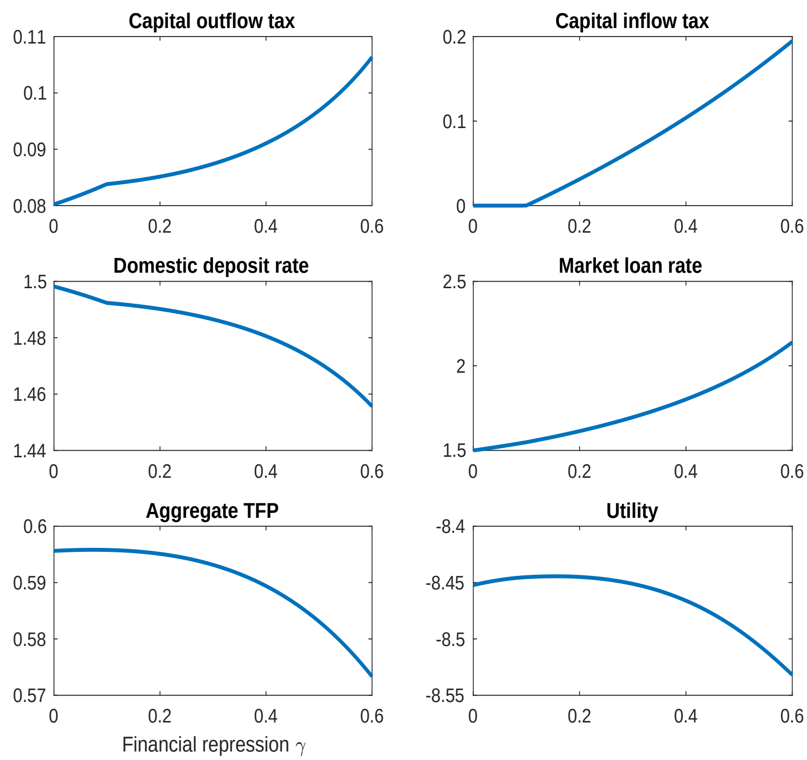

FIGURE 5. Optimal capital control policies under different degree of financial repression γ. The horizontal axis shows the range of the financial repression parameter γ.

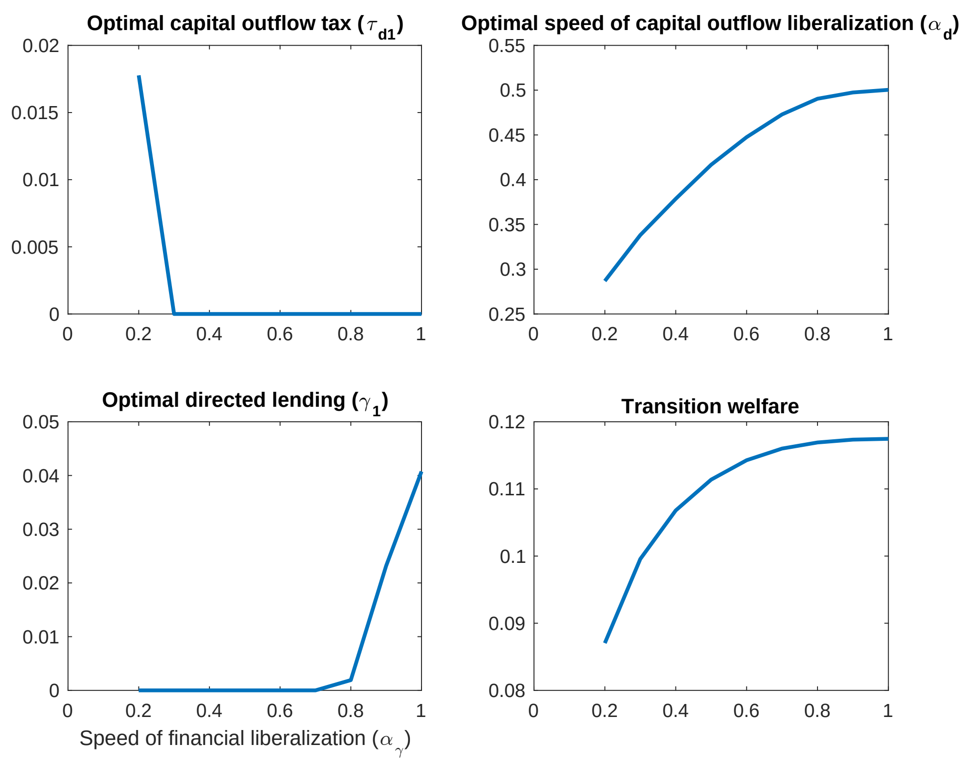

FIGURE 6. Transition dynamics and the optimal depth and pace of liberalizing capital outflow controls (special case with capital inflows closed). The horizontal axis shows the range of the pace of domestic financial liberalization measured by α_γ.

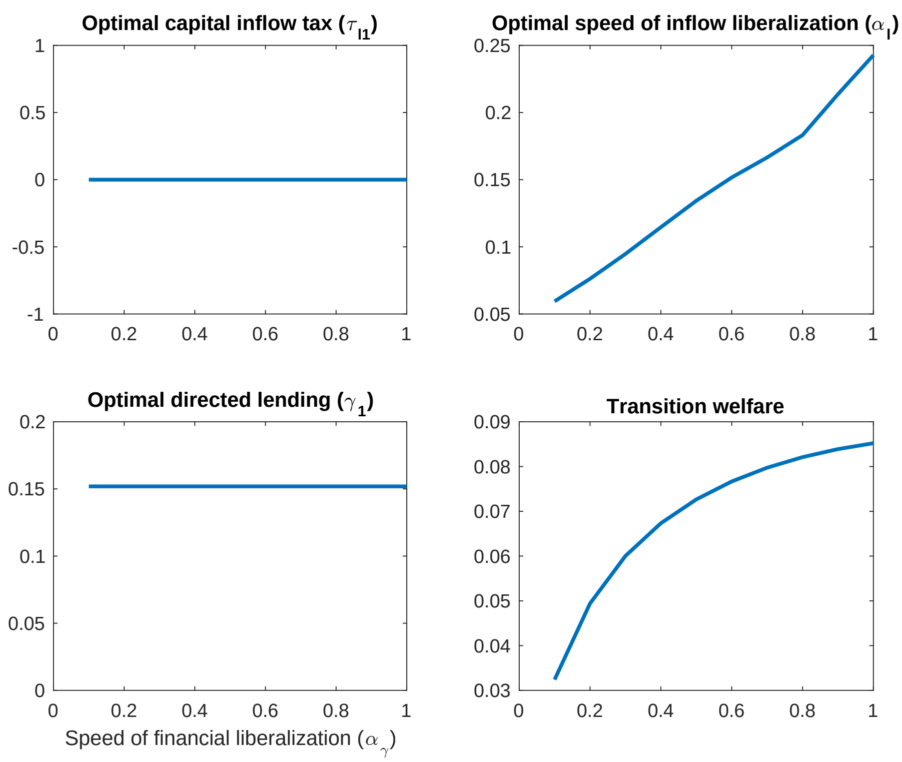

FIGURE 7. Transition dynamics and the optimal depth and pace of liberalizing capital inflow controls (special case with capital outflows closed). The horizontal axis shows the range of the pace of domestic financial liberalization measured by α_γ