

FEDERAL RESERVE BANK OF SAN FRANCISCO

WORKING PAPER SERIES

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July 2021

Working Paper 2020-14

<https://www.frbsf.org/economic-research/publications/working-papers/2020/14/>

Suggested citation:

Liu, Zheng, Mark M. Spiegel, Jingyi Zhang. 2021. “Capital Controls and Income Inequality,” Federal Reserve Bank of San Francisco Working Paper 2020-14.

<https://doi.org/10.24148/wp2020-14>

The views in this paper are solely the responsibility of the authors and should not be interpreted as reflecting the views of the Federal Reserve Bank of San Francisco or the Board of Governors of the Federal Reserve System. This paper was produced under the auspices of the Center for Pacific Basin Studies within the Economic Research Department of the Federal Reserve Bank of San Francisco.

CAPITAL CONTROLS AND INCOME INEQUALITY

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ABSTRACT. We examine the implications of capital flows and capital account policy for income distribution in a small open economy with heterogeneous agents and financial frictions. Banks engage in costly intermediation between household savings and entrepreneur investment. Our model predicts that inflow surges disproportionately raise entrepreneur income, exacerbating inequality, while transitory increases in outflows reduce inequality. Instrumental variable estimation with a panel of gross and net private capital flows for 87 emerging market economies provides robust support for the model's predictions. We further show that, under capital-skill complementarity, capital account liberalization that induces net capital inflows raises both the skill wage premium and overall income inequality.

Date: July 2, 2021.

Key words and phrases. Capital flows, income distribution, heterogeneous agents, capital-skill complementarity, financial frictions, small open economy.

JEL classification: D63, F32, F38

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I. INTRODUCTION

Surges in capital inflows driven by changes in global economic conditions can have adverse impacts on emerging market economies (EMEs) [e.g. Ghosh et al. (2014) and Ghosh et al. (2016)]. In the short run, capital inflows can benefit the destination economy by reducing the cost of financing domestic consumption and investment. Over time, however, capital flow reversals can cause painful sudden stops [e.g., Calvo (1998)], elevating the risks of domestic banking crises [e.g., Mendoza (2010) and Caballero (2016)]. Policymakers have acknowledged the potential adverse effects of excessive capital flows. For example, while the IMF advocated capital account openness, it has become more amenable in recent years to the use of capital account restrictions as a “... part of the policy toolkit to manage inflows” (Ostry et al., 2010).

Recent studies suggest that capital flows may also influence the distribution of income. In periods with inflow surges, the benefits of the inflows disproportionately accrue to agents who are more adept at capitalizing on them, exacerbating the skewness of the distribution of income. When capital flow reversals occur, the burdens are likely to fall disproportionately on the poor [e.g. de Haan and Sturm (2016)]. Furceri and Loungani (2018) document evidence that episodes of capital account liberalization are associated with increased inequality measured by the Gini coefficient. Furceri et al. (2019) obtain similar results using cross-country industry-level data.

Theoretical explanations of the link between capital account policies and income inequality are limited in the literature. Such links are likely to be complicated by the presence of other distortions, such as financial frictions. Thus, understanding the general equilibrium impact of capital account liberalization on income distributions requires a coherent theoretical framework that incorporates the relevant frictions. In this paper, we construct a small open economy framework with heterogeneous agents and financial frictions to examine the relation between capital account policies and income inequality.

I.1. Model features. Our model features overlapping generations with two types of agents: households and entrepreneurs. Households work, consume, and save for retirement when they are young; and consume their accumulated wealth when they are old. Entrepreneurs consume, invest, and borrow to finance their spending when they are young, and consume their accumulated wealth after debt repayments when they are old. The households save in domestic banks and, depending on the capital outflow policy, they may choose to save in foreign banks as well. The entrepreneurs borrow from domestic banks and, depending on the capital inflow policy, they may

also borrow from foreign investors. Foreign borrowing requires a risk premium that depends on the size of the external debt (Neumeyer and Perri, 2005; Uribe and Yue, 2006). Competitive and risk-neutral domestic banks take deposits from the households and extend loans to the entrepreneurs. Financial intermediation costs generate a spread between deposit and lending interest rates, as in Cúrdia and Woodford (2016). The government imposes taxes on both capital inflows and outflows, and rebates the tax revenues to domestic households and entrepreneurs.

Entrepreneurs invest in capital and supply skilled labor to firms. Households do not have access to the capital accumulation technology and they supply unskilled labor. Firms produce final consumption goods using capital, skilled labor, and unskilled labor as input factors. The production technology features capital-skill complementarity in the spirit of Krusell et al. (2000).

In this model environment, changes in capital flows impact on income distributions through changes in capital returns and capital-skill complementarity. We use our model to study the implications of capital flow shocks and capital account policies for the distribution of income between households and entrepreneurs. We further examine the welfare implications of capital account liberalization policies under a range of Pareto weights in the social planner's welfare objective.

I.2. Model predictions. We solve the model based on parameters calibrated to data in emerging market economies. The model predicts that a shock that leads to a surge in capital inflows benefits entrepreneurs more than households, and therefore increases income inequality. In contrast, a shock that leads to an increase in capital outflows would reduce income inequality. Capital flow shocks in our model have impact not only on capital income distributions through affecting the relative returns on entrepreneurs' capital investment vs. households' savings, but also on labor income distributions through capital-skill complementarity.

For example, consider a shock that leads to a transitory surge in capital inflows. These flows reduce the financing costs for investment, boosting the value of capital (Tobin's q) and the entrepreneur's capital income. However, the shock has no direct effect on the domestic deposit interest rate, which is pinned down by the foreign interest rate and capital outflow taxes. Thus, the surge in capital inflows reduces the share of households' capital income. At the same time, the increased capital inflows boosts production and investment, raising the level of capital stock and thus the skill wage premium through capital-skill complementarity. This leads to a reduction in

the share of households' labor income as well. Overall, a positive capital inflow shock skews the income distribution in favor of entrepreneurs, raising income inequality.

In contrast, a shock that leads to an transitory increase in capital outflows skews the income distribution in favor of households. The shock boosts the returns on foreign deposits, raising the domestic deposit rate and households' capital income. Facing higher funding costs, banks increase the lending rate, depressing investment and lowering the relative price of capital. Thus, the shock raises the share of households' capital income. The decline in investment reduces the capital stock, lowering the skill wage premium through capital-skill complementarity. Although the shock reduces aggregate output and thus labor income for all agents, the share of households' labor income rises. Overall, a positive capital outflow shock reduces income inequality.

The model also predicts that a shock that induces *net* capital inflows (e.g., a decline in the foreign interest rate) would raise income inequality through the same channels.

1.3. Empirical support for model predictions. Our model's predicted relations between short-run capital flows and income inequality are supported by empirical evidence. We use a panel of 87 emerging market economies (EMEs) from 2001-2018 to examine the impact of changes in private capital flows—both inflows and outflows—on income inequality measured by year-over-year changes in the Gini coefficient. Since capital flows are potentially endogenous to changes in domestic conditions, we instrument private capital flows by changes in the two-year U.S. Treasury yields interacted with a measure of financial remoteness constructed by Rose and Spiegel (2009) based on the great-circle distance from New York City, the financial center of the United States.¹

Our empirical results indicate a significant impact of short-run changes in private capital flows on income inequality. Under our baseline specification, a one standard deviation increase in private capital inflows is associated on average with a 1.35 percentage point increase in the growth rate of a country's Gini coefficient, while a one standard deviation increase in private outflows is associated with a 1.56 percentage point decrease. We also find that increases in net inflows raise income inequality. Our point estimates indicate that a one standard deviation increase in net private inflows

¹Since our baseline specification includes both inflows and outflows, we need additional instrumental variables. We include three regional dummies—in addition to the financial remoteness measure—as instruments to capture regional disparities in capital flows. Moreover, our specification allows us to introduce a variety of conditioning variables in the second-stage regressions to capture other disparities across the countries in our sample.

is associated with a 1.80 percentage point increase in the growth rate of a country's Gini coefficient. These numbers are statistically and economically significant. Our results are robust to a wide variety of empirical specifications, measurements, and sample perturbations. We also show that splitting the sample by either saving rates or labor income shares yields results consistent with the predictions of the model.

I.4. Distributional effects of capital account policies. We use our model to examine the implications of capital account policies for income distributions. We do this based on both analytical characterizations of the steady-state equilibrium in a simplified version of the model and numerical simulations of the full dynamic model.

To obtain analytical solutions to the model's steady state, we abstract from capital-skill complementarity and focus on the special case with a Cobb-Douglas production function. In this case, the share of household labor income is a constant and invariant to capital flows. Changes in capital flows drive changes in income distributions only through their effects on relative capital income.

Our analytical solution demonstrates that a permanent reduction in either capital inflow taxes or outflow taxes can raise the household share of capital income and thus reduce income inequality. Reducing outflow taxes directly raises the deposit interest rate facing the household and therefore increases household capital income. Banks pass through a part of the increase in the deposit rate to the lending rate faced by the entrepreneurs. However, since a fraction of the household savings is diverted abroad following the decline in outflow taxes, the domestic loan-to-output ratio declines, reducing the credit spread. Thus, the lending rate rises by a smaller proportion than does the deposit rate. In the steady state, Tobin's q is one and the rate of return on entrepreneurs' capital investment equals the lending rate. Thus, the increase in capital returns is smaller than that in the deposit rate. As a result, the ratio of household income to entrepreneur income rises, leading to a reduction in income inequality.

Perhaps more surprisingly, a permanent reduction in capital inflow taxes also raises the steady-state share of household income and thus reduces inequality. In the steady state equilibrium, the domestic deposit rate is pinned down by the foreign interest rate and the outflow tax rate, and is thus invariant to changes in inflow taxes. Reducing the inflow tax pushes down the domestic lending rate, lowering the entrepreneur's capital returns, but it has no effect on the domestic deposit rate and thus does not affect the household's return on savings. As a result, the share of household capital income rises, reducing inequality.

In the more general case with capital-skill complementarity, we solve the steady-state equilibrium numerically. Unlike the Cobb-Douglas case, changes in capital account policies can affect income distributions by driving changes in both capital and labor income. A permanent reduction in capital inflow taxes reduces the domestic lending rate, without affecting the domestic deposit rate. Thus, the share of households' capital income rises. The increase in capital inflows also raises the level of the capital stock in the domestic economy, raising the skill wage premium through capital-skill complementarity and reducing the share of households' labor income. Thus, the reduction in capital inflow taxes can have ambiguous effects on overall income inequality. With sufficiently strong capital-skill complementarity (as in our calibration), the labor income effect dominates the capital income effect, and income inequality rises following capital inflow liberalization.

In contrast, a permanent reduction in capital outflow taxes unambiguously reduces income inequality. As in the Cobb-Douglas case, outflow liberalization increases the share of households' capital income. Under capital-skill complementarity, outflow liberalization also raises the share of households' labor income. The increase in outflows raises domestic lending rate, reducing investment and capital, and lowering the skill wage premium. Overall, capital outflow liberalization increases the share of both household capital and labor income, reducing inequality.

We further solve for optimal capital account policies for a planner with a range of Pareto weights over the two types of agents' welfare, conditional on a transitory shock to the foreign interest rate. A decline in the foreign interest rate induces capital inflows and discourages outflows. Under capital-skill complementarity, increased inflows raise the skill wage premium whereas increased outflows reduce it. We find that, under our calibration, a planner who assigns a larger weight on household welfare responds to a decline in the foreign interest rate by tightening inflow controls or relaxing outflow controls more aggressively.

II. RELATED LITERATURE

Our paper contributes to the literature on the macroeconomic implications of capital account policies. Capital account restrictions can distort domestic financial markets (Edwards, 1999; Jeanne et al., 2012). They can also distort international trade, effectively mimicking an increase in tariffs (Wei and Zhang, 2007; Costinot et al., 2014) or a devaluation of the real exchange rate, although there is limited evidence that capital controls themselves inhibit growth (Jeanne, 2013). Chang et al. (2015) argue that,

following the sharp declines in foreign interest rates during the 2008-09 global financial crisis, China's costly sterilized intervention program needed to maintain its closed capital account constrained its central bank's ability to stabilize domestic inflation. By limiting the pressure for capital inflows, capital account restrictions help ease the need for undertaking such costly sterilization activity (Liu and Spiegel, 2015). Davis et al. (2020) show that, in the presence of frictions in foreign bond trading, optimal sterilized foreign exchange interventions are equivalent to optimal time-varying capital flow taxes. Ostry et al. (2010) argue that temporary capital account restrictions can help stabilize large fluctuations in capital inflows. However, the welfare effects of such capital flow taxes depend on whether or not policy commitment is available (Devereux et al., 2018). Properly designed, temporary capital account policies can serve as a useful tool to mitigate the effects of external shocks (Farhi and Werning, 2012; Unsal, 2013; Davis and Presno, 2017). Studies in the development literature suggest that liberalizing capital account can adversely impact an economy with poorly-developed financial markets (Eichengreen et al., 2011; Eichengreen and Leblang, 2003; Ju and Wei, 2010). Some have argued that relaxing capital account restrictions can lead to potential "secondary improvements" or "discipline effects" for domestic institutions stemming from exposures to foreign competition and standards (Kose et al., 2009; Wei and Tytell, 2004).²

Our work is also related to the theoretical literature on capital account liberalization in the presence of financial frictions. Aoki et al. (2009) study a small open economy model with collateralized debts. They show that liberalizing the capital account is not necessarily beneficial if the domestic financial system is under-developed, because it can reduce long-run total factor productivity (TFP) or lower short-run employment and wages. Liu et al. (2019) examine the optimal capital account liberalization policy in the context of China. They consider a two-sector small open economy model with financial repression and capital controls over both inflows and outflows. In their model, state-owned enterprises (SOEs) are less productive than private firms, but they receive subsidized bank loans under prevailing government policy. Banks finance the subsidies on SOE loans by depressing the deposit interest rates for households and elevating the market loan rates faced by private firms. Capital account liberalization leads to a tradeoff between production allocative efficiency stemming from reallocations between

²See Wei (2018), Erten et al. (2019), and Rebucci and Ma (2019) for recent surveys of the literature on capital controls.

the two sectors and intertemporal allocative efficiency stemming from the households' consumption-savings decisions.

The distributional implications of capital account policies have also been considered by Bumann and Lensink (2016), who examine restrictions on *net* capital flows in a two-period model with heterogeneous agents and financial intermediation. In their model, liberalization of the domestic banking sector through a reduction in reserve requirements raises capital inflows. However, the distributional impacts of this policy change depend on the depth of financial sector development. With low depth, financial deepening effects dominate, and income distribution becomes less skewed. However, with an already-deep financial sector, the reduced costs of intermediation dominate, increasing the skewness of income distribution. In contrast, our analysis considers the implications of liberalization of *gross* capital flows. We show that changes in capital inflows and outflows can have quite different implications for income distributions, and the long-run distributional impact of capital flows is different from the short-run impact. Our analysis thus suggests that adopting distinct inflow and outflow policies can be important for achieving the desired distributional outcomes.

III. THE MODEL

We consider a small open economy model with overlapping generations and two types of agents: entrepreneurs and households. We normalize the population size to one and assume that the share of households is $\theta \in (0, 1)$. There is a homogeneous consumption good produced by competitive firms using capital and labor supplied by the two types of agents. Entrepreneurs supply skilled labor to firms and accumulate capital. They can borrow from domestic banks and foreign investors, subject to credit constraints. Households supply unskilled labor to firms, but they do not have access to capital investment technology. Households can save in domestic and foreign banks.

Entrepreneurs and households both live for two periods—young and old. The representative household works, consumes, and saves for retirement when young and consumes the accumulated savings when old. The representative entrepreneur works, consumes, accumulates capital and borrows when young, and consumes the accumulated capital assets net of debt when old. The old cohorts, both entrepreneurs and households, transfer a fraction of their wealth to the next generation.³ Young entrepreneurs finance the acquisition of capital through labor income, borrowing, and the transfers received from the old generation.

³This assumption is made to facilitate our numerical solutions, and drives none of our results.

Domestic banks operate in a perfectly competitive market, taking as given the market interest rates on deposits and loans. Banks face financial intermediation costs, which give rise to a credit spread, driving a wedge between the deposit and lending interest rates. The government implements capital account restrictions by taxing earnings on both capital inflows and outflows.

III.1. Households. In each period, the economy has a continuum of identical households with measure θ . We focus on the optimizing decisions of a representative household. The representative household born in period t has the utility function

$$U_{ht} = \ln(C_{ht}^y) + \beta \ln(C_{h,t+1}^o), \quad (1)$$

where C_{ht}^y denotes consumption of the household when young, $C_{h,t+1}^o$ denotes consumption of the household when old.

The household chooses consumption, domestic bank deposits (D_t), and foreign bank deposits (B_{ft}^d) to maximize the utility function (1) subject to the budget constraints

$$C_{ht}^y + D_t + B_{ft}^d = w_{ht}H_{ht} + \Gamma_{ht}, \quad (2)$$

and

$$C_{h,t+1}^o = R_t D_t + (1 - \tau_d)z_{dt}R_t^* B_{ft}^d + T_{h,t+1} - \Gamma_{h,t+1}. \quad (3)$$

When young, the household supplies H_{ht} units of unskilled labor to firms and earns labor income at the competitive unskilled wage rate w_{ht} . The young household finances consumption and saving using both labor income $w_{ht}H_{ht}$ and bequests Γ_{ht} from the previous old generation.

When old, the household consumes its asset holdings, consisting of interest earnings on domestic bank deposits $R_t D_t$ and after-tax earnings on foreign deposits $(1 - \tau_d)z_{dt}R_t^* B_{ft}^d$. Here, the term R_t denotes the domestic risk-free deposit rate, R_t^* denotes the world risk-free interest rate, τ_d denotes a tax on earnings from foreign assets (i.e., a tax on capital outflows), and $z_{dt} > 0$ denotes an exogenous shock to the pre-tax return on foreign deposits (i.e., a capital outflow shock). The old household also receives dividend income T_{ht} from domestic banks and leaves a bequest $\Gamma_{h,t+1}$ to the then-young generation. For simplicity, we assume that the bequest is a constant fraction Γ of the old household's wealth and is given by

$$\Gamma_{h,t+1} = \Gamma \{R_t D_t + (1 - \tau_d)z_{dt}R_t^* B_{ft}^d + T_{h,t+1}\}. \quad (4)$$

The interior optimizing decisions of the representative household imply the no-arbitrage condition

$$R_t = (1 - \tau_d)z_{dt}R_t^*. \quad (5)$$

A positive tax rate τ_d represents capital outflow controls. The shock z_{dt} captures exogenous changes in foreign financial conditions that affect incentives for capital outflows. Both τ_d and z_{dt} influence the wedge between the domestic deposit rate and the world interest rate.

III.2. Entrepreneurs. There is a continuum of identical entrepreneurs with measure $1 - \theta$. The representative entrepreneur born in period t has the utility function

$$U_{et} = \ln(C_{et}^y) + \beta \ln(C_{e,t+1}^o), \quad (6)$$

where C_{et}^y and $C_{e,t+1}^o$ denote the entrepreneur's consumption when young and old, respectively.

The entrepreneur chooses consumption, external borrowing B_{et} , and investment I_t to maximize the utility function (6) subject to the budget constraints

$$C_{et}^y + q_t^k K_t^o + I_t + \frac{\Omega_k}{2} \left(\frac{I_t}{K_t^o} - \frac{\bar{I}}{\bar{K}^o} \right)^2 K_t^o = w_{et} H_{et} + B_{et} + \Gamma_{et}, \quad (7)$$

$$C_{e,t+1}^o = [q_{t+1}^k (1 - \delta) + r_{t+1}^k] (K_t^o + I_t) - R_{lt} B_{et} + T_{e,t+1} - \Gamma_{e,t+1}. \quad (8)$$

When young, the entrepreneur consumes C_{et}^y , purchases existing capital from the then old generation (denoted by K_t^o) at the competitive price q_t^k , and makes new investment I_t subject to capital adjustment costs. The young entrepreneur is endowed with H_{et} units of skilled labor, which is supplied to firms at the competitive skilled wage rate w_{et} . In addition to wage income $w_{et} H_{et}$, the young entrepreneur finances spending using external debt B_{et} , along with bequest income Γ_{et} from the previous old generation.

When old, the entrepreneur receives the returns from capital holdings, including rental income from firms and capital gains net of depreciation. Here, r_{t+1}^k denotes the capital rental rate and $\delta \in [0, 1]$ denotes the capital depreciation rate. In addition, the old entrepreneur receives dividend income $T_{e,t+1}$ from domestic banks. The old entrepreneur use these sources of income to purchase consumption goods $C_{e,t+1}^o$, repays the outstanding debts at the competitive loan interest rate R_{lt} , and leaves bequests $\Gamma_{e,t+1}$ to the then-young generation. Similar to the case for the households, we assume that the bequest is a constant fraction Γ of the old entrepreneur's accumulated wealth and is given by

$$\Gamma_{e,t+1} = \Gamma \{ [q_{t+1}^k (1 - \delta) + r_{t+1}^k] (K_t^o + I_t) - R_{lt} B_{et} + T_{e,t+1} \}. \quad (9)$$

Denote by K_t the stock of capital at the end of period t . The beginning-of-period capital is given by $K_t^o = (1 - \delta) K_{t-1}$, which is the amount of capital that young

entrepreneurs purchased from the old. New investment I_t adds to the stock of capital, leading to the law of motion for the aggregate capital stock

$$K_t = (1 - \delta)K_{t-1} + I_t. \quad (10)$$

III.3. Firms. There is a continuum of firms with measure one, each facing perfectly competitive markets. The representative firm produces a homogeneous good Y_t using capital K_{t-1} , unskilled labor H_{ht} and skilled labor H_{et} . Following Krusell et al. (2000), we introduce capital-skill complementarity using a two-level CES production function,

$$Y_t = \left[(\alpha_u)^{\frac{1}{\sigma}} (H_{ht})^{\frac{\sigma-1}{\sigma}} + (1 - \alpha_u)^{\frac{1}{\sigma}} (V_t)^{\frac{\sigma-1}{\sigma}} \right]^{\frac{\sigma}{\sigma-1}}, \quad (11)$$

$$V_t = \left[(\alpha_k)^{\frac{1}{\rho}} (K_{t-1})^{\frac{\rho-1}{\rho}} + (1 - \alpha_k)^{\frac{1}{\rho}} (H_{et})^{\frac{\rho-1}{\rho}} \right]^{\frac{\rho}{\rho-1}}, \quad (12)$$

where the parameters $\alpha_u \in (0, 1)$ and $\alpha_k \in (0, 1)$ govern the income shares. The parameter $\rho > 0$ denotes the elasticity of substitution between capital and skilled labor, and the parameter $\sigma > 0$ denotes the elasticity of substitution between the capital-skill composite (V_t) and unskilled labor.

Cost-minimizing implies the conditional factor demand functions

$$w_{ht} H_{ht}^{\frac{1}{\sigma}} = (\alpha_u Y_t)^{\frac{1}{\sigma}}, \quad (13)$$

$$w_{et} H_{et}^{\frac{1}{\rho}} = ((1 - \alpha_u) Y_t)^{\frac{1}{\sigma}} (1 - \alpha_k)^{\frac{1}{\rho}} V_t^{\frac{\sigma-\rho}{\sigma\rho}}, \quad (14)$$

and

$$r_t^k K_{t-1}^{\frac{1}{\rho}} = ((1 - \alpha_u) Y_t)^{\frac{1}{\sigma}} (\alpha_k)^{\frac{1}{\rho}} V_t^{\frac{\sigma-\rho}{\sigma\rho}}. \quad (15)$$

The skill premium, measured by the ratio of the skilled wage and unskilled wage, is given by

$$\begin{aligned} \frac{w_{et}}{w_{ht}} &= \left(\frac{1 - \alpha_u}{\alpha_u} \right)^{\frac{1}{\sigma}} \frac{H_{ht}^{\frac{1}{\sigma}}}{H_{et}^{\frac{1}{\rho}}} (1 - \alpha_k)^{\frac{1}{\rho}} V_t^{\frac{\sigma-\rho}{\sigma\rho}} \\ &= \left(\frac{1 - \alpha_u}{\alpha_u} \right)^{\frac{1}{\sigma}} \frac{H_{ht}^{\frac{1}{\sigma}}}{H_{et}^{\frac{1}{\rho}}} (1 - \alpha_k)^{\frac{1}{\rho}} \left[(\alpha_k)^{\frac{1}{\rho}} (K_{t-1})^{\frac{\rho-1}{\rho}} + (1 - \alpha_k)^{\frac{1}{\rho}} (H_{et})^{\frac{\rho-1}{\rho}} \right]^{\frac{\sigma-\rho}{\sigma(\rho-1)}}. \end{aligned}$$

Note that if $\sigma > \rho$, the production function defined in Equations (11) and (12) exhibits capital-skill complementarity. In this case, an increase in the capital stock raises the marginal product of skilled labor more than the marginal product of unskilled labor.

For any given labor supply (H_{ht} and H_{et}), an increase in the capital stock (K_{t-1}) raises the skill premium, as in Krusell et al. (2000).⁴

III.4. Banks. There is a continuum of competitive banks with measure one. The representative bank takes deposits from households at the deposit interest rate R_t and lends to entrepreneurs at the lending interest rate R_{lt} .

Following Cúrdia and Woodford (2016), we assume that financial intermediation is costly. In the process of originating B_t units of loans, the bank needs to spend real resources $\Xi\left(\frac{B_t}{Y_t}\right)Y_t$ (in units of final output). And these resources must be produced and consumed in the period in which the loans are originated. The function $\Xi\left(\frac{B_t}{Y_t}\right)$ takes the form

$$\Xi\left(\frac{B_t}{Y_t}\right) = \xi\left(\frac{B_t}{Y_t}\right)^\eta, \quad (16)$$

where the elasticity parameter $\eta > 1$, such that the intermediation cost function $\Xi(\cdot)$ is strictly increasing and strictly convex. The convexity of $\Xi(\cdot)$ reflects diseconomies in intermediation and enforcement of loan contracts.

Taking the interest rates and aggregate output as given, banks choose deposits D_t and loans B_t to maximize profits

$$\Pi_t^b \equiv D_t - B_t - \Xi\left(\frac{B_t}{Y_t}\right)Y_t, \quad (17)$$

subject to the flow-of-funds constraint

$$R_{lt}B_t = R_tD_t. \quad (18)$$

At the end of the period, the bank distributes all excess funds received from depositors that are not lent out or used to pay the resource costs of loan origination to its shareholders (i.e., the households) in the form of dividend payments.

The first order condition for optimal credit supply is given by

$$R_{lt} = R_t \left[1 + \Xi'\left(\frac{B_t}{Y_t}\right) \right]. \quad (19)$$

Financial intermediation costs drive a wedge between the loan rate and the deposit rate, with the wedge (or credit spread) given by the term $\Xi'\left(\frac{B_t}{Y_t}\right)$. The convexity of the $\Xi(\cdot)$ function implies that credit spread increases with the loan-to-output ratio $\frac{B_t}{Y_t}$.

⁴For simplicity, we follow Krusell et al. (2000) and abstract from the general equilibrium effect from endogenous skill accumulation. See He and Liu (2008) for a general equilibrium model with capital-skill complementarity and endogenous skill accumulation decisions.

III.5. Foreign investors. Foreign investors lend to domestic entrepreneurs at the market loan rate R_{lt} , subject to a capital inflow tax of τ_l .⁵ The after-tax return for foreign investors is thus $(1 - \tau_l)R_{lt}$. Their effective funding cost is $\frac{R_t^*}{z_{lt}}$, where $z_{lt} > 0$ denotes an exogenous shock, which we interpret as a capital inflow shock. Foreign investors also requires a risk premium on their loans extended to domestic firms.

No arbitrage implies that

$$(1 - \tau_l)R_{lt} = \frac{R_t^*}{z_{lt}} \Phi \left(\frac{B_{ft}^l}{Y_t} \right). \quad (20)$$

where B_{ft}^l denotes the amount of foreign investment and $\Phi \left(\frac{B_{ft}^l}{Y_t} \right)$ denotes the risk premium, which depends on the amount of external debt relative to aggregate output.

We assume that the risk premium function is given by

$$\Phi \left(\frac{B_{ft}^l}{Y_t} \right) = \exp \left[\Phi_b \left(\frac{B_{ft}^l}{Y_t} - \kappa_f \right) \right], \quad (21)$$

where $\kappa_f \geq 0$ denotes the steady-state ratio of external debt to aggregate output and the parameter $\Phi_b > 0$ measures the sensitivity of the risk premium to changes in external debts.

The dependence of the risk premium on the relative size of external debts implies an externality, as individual firms take interest rates (inclusive of the risk premium) as given. The presence of the risk premium, along with capital inflow taxes, drives a wedge between domestic loan interest rate and the foreign investors' effective funding costs.⁶

III.6. Market clearing and equilibrium. An equilibrium consists of sequences of allocations $\{C_t^y, C_t^o, I_t, K_t, Y_t, H_{ht}, H_{et}, B_t, B_{ft}^l, NX_t\}$ and prices $\{w_t, R_t, q_t^k, R_{lt}\}$ that solve the optimizing problems for the workers, the entrepreneurs, and the banks. In equilibrium, final goods market clearing implies that the trade surplus (i.e., net exports) is given by

$$NX_t = Y_t - C_{ht}^y - C_{ht}^o - C_{et}^y - C_{et}^o - I_t - \frac{\Omega_k}{2} \left(\frac{I_t}{K_t^o} - \frac{\bar{I}}{\bar{K}^o} \right)^2 K_t^o - \Xi \left(\frac{B_t}{Y_t} \right) Y_t. \quad (22)$$

The loan market clearing condition is given by

$$B_t + B_{ft}^l = B_{et}. \quad (23)$$

⁵As the domestic deposit interest rate lies below the market loan rate (see Eq. (19)), foreign investors have no incentive to deposit funds in domestic banks.

Since labor supplies are inelasticity, labor market clearing implies that

$$H_{ht} = \theta, \quad H_{et} = 1 - \theta. \quad (24)$$

In each period, the government collects capital control taxes and transfers these taxes to the household and the entrepreneur. Meanwhile, banks distribute their profits to the household and the entrepreneur as their shareholders. Both the capital flow taxes and the bank's profit are distributed to the household and the entrepreneur as a lump sum, with the transfer amount proportional to the population share of each type of agents.

$$T_{ht} = \theta(\tau_d z_{d,t-1} R_{t-1}^* B_{f,t-1}^d + \tau_l R_{l,t-1} B_{f,t-1}^l + \Pi_t^b). \quad (25)$$

$$T_{et} = (1 - \theta)(\tau_d z_{d,t-1} R_{t-1}^* B_{f,t-1}^d + \tau_l R_{l,t-1} B_{f,t-1}^l + \Pi_t^b). \quad (26)$$

Summing up all sectors' budget constraints, we obtain the balance of payments condition

$$NX_t + (z_{d,t-1} R_{t-1}^* - 1) B_{f,t-1}^d - (R_{l,t-1} - 1) B_{f,t-1}^l = (B_{ft}^d - B_{ft}^l) - (B_{f,t-1}^d - B_{f,t-1}^l). \quad (27)$$

Real GDP equals final output net of the costs of financial intermediation and investment adjustments. The national income account identity holds such that

$$GDP_t = C_{ht}^y + C_{ht}^o + C_{et}^y + C_{et}^o + I_t + NX_t. \quad (28)$$

III.7. Income inequality and planner objective. The household's capital income includes interest earnings from domestic deposits and foreign asset holdings. It is given by

$$W_{ht}^c = (R_{t-1} - 1) D_{t-1} + [(1 - \tau_d) z_{d,t-1} R_{t-1}^* - 1] B_{f,t-1}^d. \quad (29)$$

The entrepreneur's capital income consists of returns on capital net of interest payments on debt and expenditures on investment. It is given by

$$\begin{aligned} W_{et}^c = & [q_t^k (1 - \delta) + r_t^k] (K_{t-1}^o + I_{t-1}) - (R_{l,t-1} - 1) B_{e,t-1} \\ & - \left[q_{t-1}^k K_{t-1}^o + I_{t-1} + \frac{\Omega_k}{2} \left(\frac{I_{t-1}}{K_{t-1}^o} - \frac{\bar{I}}{\bar{K}^o} \right)^2 K_{t-1}^o \right]. \end{aligned} \quad (30)$$

The labor incomes for the household and the entrepreneur are given by

$$W_{ht}^l = w_{ht} H_{ht} = \theta w_{ht}, \quad W_{et}^l = w_{et} H_{et} = (1 - \theta) w_{et}, \quad (31)$$

where we have used the assumption that labor supplies are inelastic and that the population sizes of the households and the entrepreneurs are θ and $1 - \theta$, respectively.

The planner's objective is a weighted average of the welfare of the two types of agents and it is given by

$$U_t = \omega(\ln C_{ht}^y + \ln C_{ht}^o) + (1 - \omega)(\ln C_{et}^y + \ln C_{et}^o) + E_t \beta U_{t+1}. \quad (32)$$

where ω denotes the Pareto weight on the household's welfare.

III.8. Capital flow shocks. There are three types of exogenous shocks in the model. The first type of the shock, z_{dt} , reflects exogenous shifts in the spread between the pre-tax return on foreign deposits and the world risk-free interest rate. Such shocks capture, for examples, exogenous movements in real exchange rates or changes in foreign monetary policy. The shock directly affects the returns on foreign deposits (i.e, capital outflows). In particular, an increase in z_{dt} boosts the returns on foreign assets and increases capital outflows. Thus, we interpret the shock z_{dt} as a capital outflow shock.

The second type of the shock, z_{lt} , reflects exogenous shifts in the spread between the foreign investors' funding costs from the world risk-free interest rate. Such shocks capture, for example, changes in foreign financial conditions that affect the costs of international financial intermediation. The shock directly impact on the funding costs for foreign investors and therefore affecting their investment decisions (i.e., capital inflows). In particular, an increase in z_{lt} reduces the effective funding costs for foreign investors and increases capital inflows. Thus, we interpret the shock z_{lt} as a capital inflow shock.

The third type of the shock, R_t^* , captures exogenous shifts in the world risk-free interest rates. These shifts affect the return on foreign assets and the cost of foreign debt at the same time. In particular, a fall in the world risk-free interest rate R_t^* leads to an increase in capital inflows by lowering the cost of foreign debt and, simultaneously, a decrease in capital outflows by lowering the return on foreign assets. Therefore, we interpret the movements in R_t^* as exogenous shocks to net capital flows, as opposed to the former two types of shocks, which are shocks to gross capital flows.

IV. CALIBRATION

A period in our overlapping generations model corresponds to 10 years. We set the subjective discount factor to $\beta = 0.665$, which implies an annualized discount factor of 0.96. We set $\delta = 0.651$, implying an annual depreciation rate of 10%. We set the capital adjustment cost parameter to $\Omega_k = 5$, which lies in the range of empirical estimates in the literature. We set the foreign interest rate to $R^* = 1.480$, implying

an annualized interest rate of 4%. The steady state values of the two capital flow shocks are normalized to unity ($z_d = 1$, $z_l = 1$). We calibrate the bequest parameter to $\Gamma = 0.39$, implying a steady-state domestic credit to output ratio of $\frac{B}{Y} = 0.1$, in line with the average credit-to-output ratio in emerging market economies.⁷ We set $\theta = 2/3$ such that the population share of the entrepreneur is $1 - \theta = 1/3$, consistent with the average share of self employment in EMEs including Brazil, Mexico, and Malaysia.

For the parameters in the production function, we capture the capital-skill complementarity by setting the elasticity of substitution between capital and unskilled labor to $\sigma = 1.67$ and the elasticity of substitution between capital and skilled labor to $\rho = 0.67$ based on the estimates of Krusell et al. (2000).

Our calibrated capital share parameter $\alpha_k = 0.62$ implies a labor income share of 0.53, which lies within the range of the global labor income share estimated by Karabarbounis and Neiman (2014)⁸. Our calibrated unskilled labor share parameter $\alpha_u = 0.17$ implies a skill premium (i.e. the ratio of skilled to unskilled wages $\frac{w_e}{w_n}$) of 2, consistent with the estimates by Cruz et al. (2018) for emerging economies.

We set the sensitivity parameter Φ_b in the risk premium function of external debt to 3, which is consistent with the estimates obtained by Bellas et al. (2010) using data on sovereign bond spreads and external debt-to-output ratios in emerging market economies. We set the steady-state foreign debt-to-output ratio $\kappa_f = 0.04$, following the 2002 “sustainability framework” of the IMF, which notes that 40% is the suggested ratio of external debt to annual output that should not be breached on a long-term basis.⁹

Following Cúrdia and Woodford (2016), we set $\xi = 0.50$, implying a steady-state credit spread of 2 percentage points per annum. We set $\eta = 1.6$ such that a 1%

⁷The domestic credit-to-output ratio varies widely across EMEs. For example, the World Bank data show that the private domestic bank credit as a share of GDP per annum ranges from 20% in Mexico to 60% in Brazil, and to over 120% in Malaysia and Vietnam.

⁸Karabarbounis and Neiman (2014) estimate that the labor income share in the corporate sector and the overall labor income share (defined as the share of employment compensation in GDP) have both declined in most countries since the early 1980s. In particular, the overall labor income share has declined from about 57 percent in the early 1980s to about 53 percent in 2012.

⁹International Monetary Fund, 2002, “Assessing Sustainability,” SM/02/06.

increase in the volume of domestic bank credit increases the credit spread by 0.01% per annum.¹⁰

In our baseline model, we set the Pareto weight in the planner's objective function to $\omega = 0.5$, implying equal weights on the utilities of the households and the entrepreneurs. As a baseline, we set the capital control taxes $\tau_d = 6.53\%$ and $\tau_l = 8.13\%$, implying $\frac{B^d}{Y} = 0.07$ and $\frac{B^l}{Y} = 0.05$ in the steady state. These two steady state values are consistent with average ratio of foreign assets to aggregate output and the average ratio of external debt to aggregate output in emerging market economies.

The calibrated value of the parameters are summarized in Table 1.

TABLE 1. Calibration

Parameter	Description	Value
β	Household discount rate	0.665
δ	Capital depreciation rate	0.651
Ω_k	Scale of capital adjustment cost	5
r^*	Foreign interest rate	1.480
z_d	Steady-state value of foreign outflow shock	1
z_l	Steady-state value of foreign inflow shock	1
Γ	Bequest ratio	0.39
θ	Household labor income share	0.67
α_k	Capital share	0.62
α_u	Unskilled labor share	0.17
σ	Elasticity of substitution between capital and unskilled labor	1.67
ρ	Elasticity of substitution between capital and skilled labor	0.67
Φ_b	Elasticity of risk premium on external debt	3
κ_f	Steady-state ratio of external debt to output	0.04
ξ	Scale of intermediation cost	0.50
η	Elasticity of intermediation cost	1.6
ω	Pareto weight on household welfare	0.5
τ_d	Tax rate on foreign asset	6.53%
τ_l	Tax rate on foreign debt	8.13%

¹⁰This implies that $\frac{d \ln(R_l/R)}{d \ln(B)} = 0.01 \times 10 = 0.1$ in our decadal model, where $\frac{d \ln(R_l/R)}{d \ln(B)} = \frac{\xi \eta (\eta - 1) B^{\eta - 1}}{1 + \xi \eta B^{\eta - 1}} = \frac{(\eta - 1)(R_l/R - 1)}{R_l/R}$ can be derived using Eq. (19). This credit spread elasticity is obtained by regressing the annual growth in spread between bank prime loan rate and 1 year Treasury bills rate on the annual growth in commercial and industrial loans using U.S. quarterly data from 2001 to 2018.

V. CAPITAL FLOW SHOCKS AND TRANSITION DYNAMICS

We solve the perfect-foresight model based on the calibrated parameters. We use the model to study the transition dynamics following transitory shocks to capital flows.

V.0.1. *Responses to a capital inflow shocks.* We first consider a transitory positive shock to capital inflows, which follows the process

$$\begin{cases} z_{lt} = 1, & \text{if } t = 0, \\ z_{lt} = 1.01, & \text{if } t = 1, \\ z_{lt} = 1, & \text{if } t \geq 2. \end{cases} \quad (33)$$

Figure 1 displays the impulse responses to a 1% positive capital inflow shock that lasts for one period. With more capital inflows, the entrepreneurs rely less on domestic bank loans. The decrease in domestic loan demand reduces the credit spread and thus the lending rate. The reduced domestic lending rate stimulates capital investment and aggregate output. It also raises the relative price of capital, increasing the entrepreneurs' capital income. However, the inflow shock does not affect the domestic deposit rate, because the deposit rate is pinned down by the foreign interest rate and the outflow shock. Thus, the inflow shock does not affect the households' capital income. The rise in the entrepreneurs' capital income therefore reduces the households' share of capital income, as shown in the figure. Under capital-skill complementarity, the increase in the capital stock raises the skill wage premium. Thus, the household's share in labor income also declines.

Overall, the positive capital inflow shock boosts domestic production and investment, while reducing the share of household income and increasing income inequality.

V.0.2. *Responses to temporary capital outflow shocks.* We next consider a transitory positive shock to capital outflows, which follows the process

$$\begin{cases} z_{dt} = 1, & \text{if } t = 0, \\ z_{dt} = 1.01, & \text{if } t = 1, \\ z_{dt} = 1, & \text{if } t \geq 2. \end{cases} \quad (34)$$

Figure 2 displays the impulse responses to a 1% positive capital outflow shock that lasts for one period. The shock induces capital outflows, reducing the funds available for domestic bank lending. The shock also leads to an increase in the return on

foreign deposits, raising the domestic deposit rate under the no arbitrage condition and increasing the households' capital income.

Facing higher funding costs, banks increase the lending rate, depressing entrepreneurs' investment and aggregate output. The increase in the domestic lending rate also induces capital inflows, partly alleviating the contraction in production and investment. The shock leads to a fall in the relative price of capital, reducing the entrepreneur's capital income. Thus, the household share of capital income rises.

Under capital-skill complementarity, the decline in capital stocks reduces the skill wage premium. Despite the contraction in aggregate output that reduces the labor income for all workers, the decline in wage premium leads to an increase in the household share of labor income.

Overall, the positive capital outflow shock leads to a contraction in aggregate output and investment, but an increase in the share of household income, reducing income inequality.

V.0.3. *Responses to temporary foreign interest rate shocks.* We now consider a transitory shock to the foreign interest rate, which acts as a net capital flow shock. In particular, we assume that the foreign interest rate R^* falls from $R_0^* = 1.04^{10}$ in period zero (the initial steady-state value) to $R_1^* = 1.03^{10}$ in period $t = 1$ and returns to the initial level thereafter. In particular, the foreign interest rate follows the process

$$\begin{cases} R_0^* = 1.04^{10}, & \text{if } t = 0, \\ R_1^* = 1.03^{10}, & \text{if } t = 1, \\ R_t^* = 1.04^{10}, & \text{if } t \geq 2. \end{cases} \quad (35)$$

Figure 3 displays the impulse responses to a transitory decline in the foreign interest rate. The decline in the households' return on foreign deposits discourages capital outflows and pushes down the domestic deposit rate, reducing the households' capital income. The shock also induces foreign capital inflows, pushing down the domestic lending interest rate. The fall in the domestic lending rate stimulates investment and production and boosts the relative price of capital, raising the entrepreneurs' capital income. Thus, the share of households' capital income falls.

The increase in capital investment raises the skill wage premium under capital-skill complementarity. While the expansion in aggregate output raises the labor income for both types of agents, the households' share of labor income falls because they supply unskilled labor.

Overall, an exogenous decline in the foreign interest rate skews the income distributions in favor of the entrepreneurs at the expense of the households, raising income inequality.

VI. EMPIRICAL EVIDENCE

Our model predicts that (i) a shock that increases gross capital inflows should raise the income share of the entrepreneurs and thereby increase income inequality; (ii) a shock that increases gross capital outflows should reduce inequality; and (iii) a shock that increases *net* capital inflows should also increase income inequality. In this section, we demonstrate that each of these model predictions is consistent with empirical evidence.

VI.1. Methodology and Data. We examine the impact of changes in capital flows on income distributions using a panel of 87 emerging market economies, with annual data from 2002 to 2018.¹¹ We estimate our baseline regression model using an unbalanced panel with 968 country-year observations.¹²

We measure gross private capital inflows by changes in national liabilities, obtained from Lane and Milesi-Ferretti (2017), net of government borrowing, obtained from the World Debt Tables. Gross private capital outflows are measured by changes in national assets, also obtained from Lane and Milesi-Ferretti (2017), net of changes in total official reserves minus gold, obtained from the IMF *International Financial Statistics*.¹³ We measure income inequality using the Gini coefficient provided by the Standardized World Income Inequality Database. We exclude the offshore financial centers (OFC) from our sample based on the definition by Rose and Spiegel (2007).¹⁴

Since capital flows are potentially endogenous to domestic economic conditions, we use instrumental-variables (IV) estimation to isolate exogenous movements in capital flows and their implications for income inequality. Our model suggests that changes

¹¹With our baseline conditioning variables included, the number of countries in our sample falls to 77. However, we demonstrate below that our results are robust to dropping these conditioning variables and examining the full 87 country sample.

¹²Our baseline model includes GDP and population series as conditioning variables. These series are obtained from the Penn-World Tables 9.1, which imposes constraints on our sample size. Without the conditioning variables, our sample expands to 87 countries with 1,165 observations (after dropping missing observations).

¹³Updated data through 2018 was obtained from Gian Maria Milesi-Ferretti and Nan Li.

¹⁴Examples of offshore financial centers include Cayman Island, Cyprus, Monaco, Hong Kong, and Panama. See Rose and Spiegel (2007) for a complete list.

in the world interest rates can work through capital flows to drive changes in income distributions in a small open economy. We consider the countries in our sample to be relatively small, and thus changes in the world interest rates represent exogenous shocks. We measure the world interest rate by movements in the two-year U.S. Treasury yields, obtained from FRED of the Federal Reserve Bank of St. Louis.

To distinguish the impact of movements in two-year U.S. Treasury yields across countries, we interact the interest rate movements with a measure of financial remoteness, and use this interaction variable as an instrument for capital flows, termed *INTREMOTE*. We follow Rose and Spiegel (2009) and measure financial remoteness by the logarithm of the great-circle distance of a country from New York City, the financial center of the United States.¹⁵ A large literature documents that costs of financial intermediation increase with geographic distance, with the distance impacting both investment returns and lending behaviors. Indeed, Portes and Rey (2005) demonstrate that physical distance is a superior predictor of patterns in financial flows than in trade flows associated with the well-known “gravity model.” As a result, some studies have found that financial remoteness is associated with enhanced business cycle volatility [e.g., Rose and Spiegel (2009)] and reduced global monetary policy “discipline” [e.g., Spiegel (2009)].

Since our baseline regression includes both inflows and outflows as independent variables, it requires more than one instrument. We therefore expand the set of IV variables by including regional dummies identifying EMEs from Asia (*ASIA*), Africa (*AFRICA*), or the Western Hemisphere (*WESTHEM*). By including these regional dummies as instruments, we implicitly assume that the regional location of a country affects annual changes in its income distribution only through its impact on capital flows. Because we have more than one endogenous regressor, we report the CLR statistics for weak-instrument robust tests.¹⁶

Our use of regional fixed effects as instruments precludes the use of country fixed effects in the second stage, so we also introduce a battery of conditioning variables to

¹⁵Rose and Spiegel (2009) identify remoteness as the minimum distance of a country to either New York, London, or Tokyo. However, since our interacted variable is the two-year US treasury rate, remoteness from the United States seems more appropriate for our purposes.

¹⁶See Pflueger and Wang (2015) for discussions of weak instrument tests in linear IV regressions and Finlay et al. (2014) for Stata implementations of weak-instrument robust tests. We have also calculated robust F statistics for the first-stage weak instrument test. Although such F statistics may have questionable accuracy in regressions with more than one endogenous regressor, they reject the null of weak instruments in our first-stage regressions (detailed results are available upon request).

control for other characteristics that may influence changes in income distribution over the course of our sample in our base specification. The set of conditioning variables includes the Chinn and Ito (2008) measure of capital account openness (*CAOPEN*), the trade openness (*TRDOPEN*) measured by the share of exports plus imports in GDP, the World Bank governance indicator for “control of corruption” (*LOWCORR*), and the production-based GDP per capita (*GDPPCAP*) and population size (*POP*) from the Penn World Tables 9.1. Since the two-year Treasury yields are likely to influence global conditions, we also control for time fixed effects in our specifications.

We consider two alternative empirical specifications to study the relation between changes in income inequality and private capital flows, one for gross flows and the other for net flows. Our baseline second-stage specification for gross private flows satisfies

$$GGINI_{i,t} = c + \beta_1 PINFLOWS_{i,t} + \beta_2 POUTFLOWS_{i,t} + \beta X_{i,t} + \theta_t + \epsilon_{i,t} \quad (36)$$

where $GGINI_{i,t}$ denotes the change in country i 's Gini coefficient from year $t - 1$ to year t , $PINFLOWS_{i,t}$ denotes private capital inflows into country i in year t as a share of GDP, $POUTFLOWS_{i,t}$ denotes private capital outflows from country i in year t as a share of GDP, $X_{i,t}$ denotes the set of conditioning variable discussed above, θ_t represents time fixed effects, and $\epsilon_{i,t}$ represents the regression residual, with standard errors clustered by year.

Similarly, our baseline second-stage specification for *net* private inflows satisfies

$$GGINI_{i,t} = c + \beta_1 NPINFLOWS_{i,t} + \beta X_{i,t} + \theta_t + \epsilon_{i,t} \quad (37)$$

where $NPINFLOWS_{i,t}$ represents net private inflows into country i in year t as a share of GDP, calculated as the difference between $PINFLOWS_{i,t}$ and $POUTFLOWS_{i,t}$, and other regressors are the same as the previous specification.

Table 2 displays the summary statistics for the sample used in our baseline regressions. The data show a lot of variability, with outliers in both changes in the GINI coefficient and capital flows. We therefore consider the robustness of our results to winsorizing the data in our robustness checks, discussed below.

Overall, changes in the GINI coefficient in our sample on average are modest. Average net inflows in our sample of emerging market countries are positive, and around 5 percent of GDP per year. However, there are clearly large surges in both capital inflows and outflows in our data, with inflows in some years in our sample exceeding

TABLE 2. Summary Statistics

	(1)	(2)	(3)	(4)	(5)
Variables	N	Mean	Std. Dev.	Min	Max
<i>GGINI</i>	968	-0.002	0.006	-0.030	0.027
<i>PINFLOWS</i>	968	0.07	0.13	-0.92	1.13
<i>POUTFLOWS</i>	968	0.02	0.06	-0.89	0.31
<i>NPINFLOWS</i>	968	0.05	0.13	-1.04	1.04

Note: Summary statistics of the data sample for the baseline regressions. *GGINI* denotes the change in the GINI coefficient, *PINFLOWS* denotes the private capital inflows, *POUTFLOWS* denotes the private capital outflows, and *NPINFLOWS* denotes the net private capital inflows. See the text for detailed descriptions of these variables.

Source: IMF International Financial Statistics and the Standardized World Income Inequality Database.

the value of a country's GDP.¹⁷ Such large surges in capital flows can be particularly true for "risk off" episodes in our sample, including the global financial crisis. We therefore consider the implications of omitting the crisis years from our sample in one of our robustness exercises below.

VI.2. Baseline results. Table 3 shows the regression results under our baseline empirical specifications. Consistent with the theory's predictions, the regression results indicate that an increase in gross capital inflows is associated with an increase in income inequality, while an increase in gross outflows is associated with a decrease in income inequality [see Column (1)]. Both estimated coefficients are statistically significant at the 1% confidence level.

¹⁷Note that while our measures of private gross inflows and outflows are positive on average, we also observe large negative movements in these flows. Essentially, our convention takes changes in private asset holdings as outflows, and changes in private liability holdings as inflows. As such, for example, a large principal payment on private debt issuance would be considered a negative movement in private inflows, and could result in a negative value for overall annual private inflows. As these transactions are often lumpy, it is not surprising that the absolute values of negative values for private inflows can exceed GDP for some observations.

TABLE 3. Baseline regression results

Dependent variable:	(1)	(2)	(3)	(4)	(5)	(6)
<i>GINI</i>						
<i>PINFLOWS</i>	0.107*** (0.042)		0.083*** (0.028)		0.116*** (0.026)	
<i>POUTFLOWS</i>	-0.263*** (0.100)		-0.315*** (0.056)		-0.338*** (0.109)	
<i>NPINFLOWS</i>		0.141*** (0.031)		0.086*** (0.024)		0.112*** (0.023)
<i>CAOPEN</i>	-0.003* (0.002)	-0.003** (0.002)				
<i>TRDOPEN</i>	-0.004 (0.000)	-0.010*** (0.003)				
<i>LOWCORR</i>	-0.000 (0.006)	-0.001 (0.001)				
<i>GDPPCAP</i>	-0.004 (0.001)	-0.010 (0.007)				
<i>POP</i>	0.007 (0.005)	0.010** (0.005)				
<i>Constant</i>	0.001 (0.002)	-0.002 (0.001)	0.006*** (0.002)	-0.001*** (0.000)	-0.003 (0.004)	-0.009*** (0.002)
Observations	968	968	1,165	1,165	968	968
CLR	12.76	12.12	14.00	13.60	13.07	12.37
P-value	0.01	0.01	0.01	0.01	0.01	0.01

Note: Two-stage least squares estimation with *INTREMOTE* and regional dummies as instruments for *PINFLOWS*, *POUTFLOWS*, *NPINFLOWS*. Year fixed effects are included in all specifications. See the text for the variable definitions. For models (1), (2), we use the base sample with the conditioning variables. For models (3), and (4), we drop the conditioning variables, and thus expanding the sample size. For models (5) and (6), we use the base sample but drop the conditioning variables. Robust standard errors are shown in parentheses. P-values are for the CLR test of weak instruments. Statistical significance levels are indicated by the asterisks: *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.10$.

Based on the summary statistics in Table 2, the point estimates in Column (1) of Table 3 indicate that a one standard deviation annual increase in private inflows is associated on average with a 1.35 percentage point increase in the growth of a country's Gini coefficient in that year, while a one standard deviation increase in private outflows is associated with a 1.56 percentage point decrease.¹⁸ These numbers are not just statistically significant, but also economically important. The CLR statistic strongly rejects the null of weak instruments, with a p-value of less than 1%.

Column (2) in Table 3 reports the regression results in the specification for net private inflows. The estimation results show that an increase in net private inflows is associated with increased income inequality, again with statistical significance at a 1% confidence level. Our point estimate indicates that a one standard deviation increase in net private inflows is associated with a 1.80 percentage point increase in the growth of country's Gini coefficient in that year. As in the case for the gross flow regression in Column (1), the CLR statistic here rejects the null of weak instruments.

Our baseline estimation results are not driven by the second-stage conditioning variables. Dropping the conditioning variables from our second-stage regressions and running our full 87 country sample yields similar results to the baseline specification. These results are reported in Columns (3) and (4) in Table 3. Increases in gross (or net) private capital inflows continue to raise inequality, while increases in gross outflows continue to reduce it. These effects are statistically significant at the 1% level, and the magnitudes are comparable to those in the baseline specifications. Moreover, running the regression using the baseline sample (with 77 countries) but without the conditioning variables yields similar results as the baseline estimation [see columns (5) and (6) of the table].

VI.3. Splitting the sample by saving rates or labor income shares. Our model also implies that the sensitivity of income distribution to capital flows may depend on the saving rate and the labor income share.

Since households are savers in our model, one may interpret an economy with a high saving rate as one with a large share of households. Our model suggests that, in such an economy, income inequality would be more sensitive to gross capital outflows than to gross (or net) inflows. With a high domestic saving rate, entrepreneurs can

¹⁸To get these numbers, we multiply the standard deviation of the private capital inflows (0.1267) or outflows (0.0591) by the point estimates of the coefficient on these two variables in the baseline regression (0.1068 and -0.2633, respectively), and scale the results by 100 to obtain the percentage point changes in the growth rate of the Gini coefficient.

TABLE 4. Samples split by savings rates and labor shares

VARIABLES	High Savings		Low Savings		High Labor Share		Low Labor Share	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<i>PINFLOWS</i>	0.048*** (0.018)		0.115* (0.070)		0.063 (0.076)		0.095** (0.044)	
<i>POUTFLOWS</i>	-0.173** (0.068)		-0.134** (0.061)		-0.126 (0.100)		-0.295*** (0.089)	
<i>NPINFLOWS</i>		0.070*** (0.013)		0.121** (0.058)		0.081 (0.054)		0.123** (0.052)
<i>CAOPEN</i>	-0.003 (0.003)	-0.002 (0.001)	-0.005*** (0.002)	-0.005** (0.000)	-0.003 (0.003)	-0.003 (0.002)	-0.002 (0.002)	-0.002 (0.002)
<i>TRDOPEN</i>	0.000 (0.000)	-0.000*** (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)
<i>LOWCORR</i>	0.001 (0.001)	0.001** (0.001)	-0.002 (0.003)	-0.003 (0.002)	-0.000 (0.002)	-0.001 (0.001)	-0.001 (0.002)	-0.000 (0.002)
<i>GDPPCAP</i>	0.000 (0.000)	-0.000** (0.000)	0.000 (0.000)	0.000 (0.000)	-0.000 (0.000)	-0.000** (0.000)	0.000 (0.000)	-0.000 (0.000)
<i>POP</i>	0.001* (0.000)	-0.000*** (0.000)	0.000 (0.000)	-0.000 (0.000)	0.000** (0.000)	0.000** (0.000)	0.000 (0.000)	0.000 (0.000)
<i>Constant</i>	0.001 (0.001)	-0.001 (0.001)	-0.000 (0.004)	-0.001 (0.003)	-0.002 (0.003)	-0.003 (0.002)	0.000 (0.002)	-0.002 (0.003)
Observations	437	437	437	437	479	479	489	489
CLR	12.02	11.10	14.53	14.24	12.81	11.89	13.69	13.39
PVAL	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01

Note: Two-stage least squares estimation with INTREMOTE and country fixed effects as instruments for *PINFLOWS*; *POUTFLOWS*; *NPINFLOWS*. Year fixed effects in all specifications, suppressed here for space considerations. See text for variable definitions. Robust standard errors are shown in parentheses. Statistical significance levels are indicated by the asterisks: *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.10$.

rely more on domestic bank credits for financing investment and production, such that capital inflows would have a smaller impact on income distribution. However, income distribution remains sensitive to changes in capital outflows because outflows raise earnings on foreign asset holdings by households.

In an economy with a higher labor share, the income distribution would depend more on labor income and less on capital income. In our model, changes in capital

inflows or outflows alter the labor income distribution indirectly through capital accumulation and capital-skill complementarity. Therefore, in an economy with a higher labor share, changes in capital inflows or outflows would have a smaller impact on income inequality.

To examine whether these predictions are supported by the data, we split our baseline sample in half based on average saving rates and labor shares over our sample periods. We obtain the data on saving rates and labor shares from the Penn World Tables 9.1. We then re-estimate the baseline specifications in Equations (36) and (37) to examine the impact of capital flows on income distribution. An economy is included in the “high savings” subsample if its average saving rate (averaged across time) exceeds the median. For those economies with average saving rates below the median, we group them in the “low savings” sub-sample. Similarly, if an economy has a labor income share above (below) the median, then it is included in the sub-sample of “high (low) labor share.”

We report the estimation results in Table 4. Columns (1)-(4) show that income inequality in a high-savings economy is less sensitive to gross (or net) capital inflows, but more sensitive to capital outflows, than in a low-savings economy. This is consistent with our theory, although the differences of the point estimates across high vs. low savings economies are statistically insignificant.

Columns (5)-(8) show the estimation results for the subsamples with high vs. low labor income shares. Income inequality in a high labor share economy is not sensitive to capital flows [Columns (5)-(6)], reflecting that income inequality is primarily driven by labor income, not by capital income. In contrast, income inequality in an economy with a low labor share is sensitive to both capital inflows and outflows [Columns (7)-(8)]. These results are consistent with our model’s predictions.

VI.4. Robustness. We have conducted a battery of further robustness checks. To conserve space, we present those results in the Appendix A.1.

Table A.1 shows the estimation results for a variety of perturbations to the empirical specifications and control variables. These include using different measures of capital account restrictions constructed by Fernández et al. (2016) (FKRSU) in place of the Chinn-Ito index (Models 1 and 2), including years of schooling as an additional control variable (Model 3), including additional controls (one at a time) the World Governance Indicators (WGI) for voice and accountability, political stability, government effectiveness, regulatory quality, or rule of law (Models 4-8), adding the

log distance from New York City as a remoteness variable on its own (Model 9), and using country fixed effects instead of regional dummies as instruments (Model 10).

In all cases, the estimated coefficients on the variables of interest continue to enter with the predicted signs and similar levels of statistical significance. An exception is the case for capital outflows in the model with the education variable added. Even in that case, the outflow variable continues to enter negatively with a similar point estimate, although the standard error is relatively large.¹⁹

Table A.2 examines the robustness of our results to a variety of changes in sample. We drop the extreme observations with very large or very small private inflows and outflows one at a time, with the outliers defined as the observations more than three standard deviations from the sample mean. We also drop the observations with exceptionally unequal or exceptionally equal income distributions, and those with exceptionally remote or proximate countries, again one at a time with the outliers defined as the realizations more than three standard deviations from the sample mean. We also drop the observations coinciding with the 2008 and 2009 global financial crisis. For all of these perturbations, we re-estimate our base specification and cluster the standard errors by year. Our estimation results are robust to all of these perturbations. The estimated coefficients on the variables of interest all enter with the predicted signs and with strong statistical significance.

Finally, Table A.3 examines the robustness of our results to changes in estimation methods. First, to demonstrate that our baseline estimation results are not driven by outliers in the data, we winsorize the sample at the 1% level. Next, we re-estimate our baseline specification with White's heteroskedasticity-robust standard errors, and then with regular standard errors. Finally, instead of clustering by year, we cluster by region and then by country. All of the specifications continue to enter with statistical significance and with point estimates similar to what we obtain under the base specification.

Overall then, consistent with our theory, the empirical results provide robust evidence that private capital inflows, both gross and net, are associated with short-run increases in income inequality, while private capital outflows are associated with short-run declines in inequality.

¹⁹The issue here appears to be about the sample, rather than the inclusion of the education variable: the sample is reduced to 776 observations when we include the education variable. To confirm this conjecture, we estimate our baseline specification without the education variable, but with this smaller sample. We find that the statistical significance of the estimated coefficient on private capital outflows marginally misses the 10% confidence level.

VII. IMPLICATIONS FOR CAPITAL CONTROL POLICIES

Our theoretical model predicts that transitory surges in capital inflows (outflows) increase (decrease) income inequality. These model predictions are supported by empirical evidence. In our model, capital flows are driven not just by exogenous shocks, but also by capital account policies. We now examine the model's implications of capital account policies for income distributions.

VII.1. Steady-state implications of capital controls. We begin with examining the steady-state implications of capital account policies for income inequality, focusing on capital income. To obtain analytical characterizations of the steady-state equilibrium, we focus on the special case with a Cobb-Douglas production function, and thus abstracting from capital-skill complementarity. We then use the calibrated baseline model (with capital-skill complementarity) to study the quantitative steady-state effects of capital account policies on income distributions.

VII.1.1. Analytical solution. To keep the analytics tractable, we focus on the special case with positive gross capital flows (both inflows and outflows), no bequests ($\Gamma = 0$), no lump-sum transfers ($T_{ht} = T_{et} = 0$), and a Cobb-Douglas production function ($\rho = \sigma = 1$).²⁰

Domestic interest rates and output. We first examine how changes in capital controls affect domestic interest rates and output. In the interior equilibrium, the no-arbitrage condition Eq. (5) pins down the domestic deposit rate

$$R = (1 - \tau_d)R^*. \quad (38)$$

This relation implies that liberalizing capital outflow controls (decreasing τ_d) raises the domestic deposit rate.

The optimal credit supply condition Eq. (19) implies that the domestic lending rate depends on the deposit rate and the credit spread

$$R_l = R \left[1 + \xi \eta \left(\frac{B}{Y} \right)^{\eta-1} \right] \quad (39)$$

²⁰With no lump-sum transfers, we are implicitly assuming that the government collects income taxes on capital flows and bank profits to finance some exogenous government spending that does not affect the private agents' welfare. Under our calibration, the amount of such spending is small, accounting for less than 2% of aggregate output in the steady state. We provide detailed derivations of the analytical steady-state equilibrium in the Appendix.

Under the assumption that $\eta > 1$, the credit spread increases with the loan-to-output ratio $\frac{B}{Y}$.

Reducing capital inflow taxes τ_l encourages foreign lending to domestic firms, crowding out domestic lending. Thus, the domestic loan-to-output ratio $\frac{B}{Y}$ falls, as does the credit spread. This in turn lowers the domestic lending interest rate, as we formally show in Proposition VII.1 below.

Reducing capital outflow taxes τ_d has two opposing effects on the domestic lending rate. First, it raises the deposit rate R , and thus raises the lending rate R_l . Second, it induces more capital outflows and thus reduces domestic bank deposits, leading to a decline in the loan-to-output ratio $\frac{B}{Y}$ and a reduction in the credit spread and the domestic lending rate. Despite these two opposing effects, Proposition VII.1 shows that reducing capital outflow taxes raises the domestic lending rate in equilibrium, suggesting that the first effect (through raising domestic deposit rate) dominates.

Proposition VII.1. *Denote by $\mathcal{R}(\tau_d, \tau_l)$ the equilibrium lending interest rate as a function of the policy parameters τ_d and τ_l . In the steady-state equilibrium, the lending rate $\mathcal{R}(\tau_d, \tau_l)$ decreases with τ_d ($\frac{\partial \mathcal{R}}{\partial \tau_d} < 0$) and increases with τ_l ($\frac{\partial \mathcal{R}}{\partial \tau_l} > 0$).*

Proof. We provide a proof in the Appendix. □

Changes in the domestic lending rate drive changes in capital returns, which in turn determine the equilibrium levels of capital stock and output. With diminishing marginal product of capital, an increase in the lending rate implies a decline in capital stock and therefore in aggregate output. In particular, as we show in the Appendix, aggregate output is related to the domestic lending rate by

$$Y = \left[\frac{(1 - \alpha_u)\alpha_k}{R_l - 1 + \delta} \right]^{\frac{(1 - \alpha_u)\alpha_k}{1 - (1 - \alpha_u)\alpha_k}} [\theta^{\alpha_u}(1 - \theta)^{(1 - \alpha_u)(1 - \alpha_k)}]^{\frac{1}{1 - (1 - \alpha_u)\alpha_k}}. \quad (40)$$

The following proposition summarizes the relation between capital account policies and aggregate output, which works through the domestic lending rate.

Proposition VII.2. *Denote by $\mathcal{Y}(\tau_d, \tau_l)$ the aggregate output as a function of the policy parameters τ_d and τ_l . In the steady state equilibrium, aggregate output $\mathcal{Y}(\tau_d, \tau_l)$ increases with τ_d ($\frac{\partial \mathcal{Y}}{\partial \tau_d} > 0$) and decreases with τ_l ($\frac{\partial \mathcal{Y}}{\partial \tau_l} < 0$).*

Proof. This result follows immediately from Proposition VII.1 and the negative relation between Y and R_l shown in Eq. (40). □

Household income. We now examine the steady-state implications of capital account policies for the representative household's labor income and capital income.

Eq. (13) implies that the household's labor income is a constant fraction of output given by

$$W_h^l = \alpha_u \mathcal{Y}(\tau_d, \tau_l). \quad (41)$$

Thus, from Proposition VII.2, the household's labor income increases with τ_d and decreases with τ_l .

Under the optimal intertemporal decisions, the household saves a constant fraction $\frac{\beta}{1+\beta}$ of their labor income in bank deposits and foreign assets, and consumes the rest. In particular, total savings are given by

$$D + B_f^d = \frac{\beta \alpha_u}{1 + \beta} \mathcal{Y}(\tau_d, \tau_l). \quad (42)$$

The household's capital income is then given by,

$$W_h^c = [(1 - \tau_d)R^* - 1](D + B_f^d) = [(1 - \tau_d)R^* - 1] \frac{\beta \alpha_u}{1 + \beta} \mathcal{Y}(\tau_d, \tau_l). \quad (43)$$

This relation implies that liberalizing capital outflow controls (decreasing τ_d) increases the household's capital income by raising their return to savings. However, the consequent increase in domestic interest rates depresses output (see Proposition VII.2). Depressed output leads to a fall in the household's labor income and decreases the funds available for saving, which partially offsets the positive effect on the household's capital income through returns to savings. Note that this offsetting effect is stronger the greater is the share of capital in production $[\alpha_k(1 - \alpha_u)]$. As implied by Eq. (40), the larger the production share of capital, the more sensitive is the output response to the domestic lending rate, and therefore the larger the decline in the household's labor income and their funds available for saving. However, the positive return-to-savings effect always dominates the negative total-savings effect unless the production share of capital is extremely large.²¹

By comparison, liberalizing capital inflow controls (decreasing τ_l) raises aggregate output (Prop VII.2), without affecting the returns on household savings. It follows from Equations (41) and (43) that reducing inflow taxes unambiguously raises both the labor income and capital income for the households.

The following proposition summarizes the relation between capital account policies and the household capital income.

²¹In the appendix, we prove that the household's capital income decreases with the capital outflow tax under the condition that $\frac{\alpha_k(1-\alpha_u)}{1-\alpha_k(1-\alpha_u)} < \frac{R}{R-1} \frac{R_l-1+\delta}{R_l}$, where R is the steady-state domestic deposit rate, R_l is the steady-state market lending rate. In the presence of credit spreads, $R_l > R > 1$, which implies that $\frac{R}{R-1} \frac{R_l-1+\delta}{R_l} > \frac{R}{R-1} \frac{R_l-1}{R_l} > 1$. Therefore, in EMEs with the capital share $\alpha_k(1 - \alpha_u)$ less than 50%, this condition is always satisfied.

Proposition VII.3. *Denote by $\mathcal{W}_h(\tau_d, \tau_l)$ the household's capital income as a function of the policy parameters τ_d and τ_l . In the steady-state equilibrium, the household's capital income $\mathcal{W}_h(\tau_d, \tau_l)$ decreases with τ_l (i.e., $\frac{\partial \mathcal{W}_h}{\partial \tau_l} < 0$). Furthermore, if the capital share $\alpha_k(1 - \alpha_u)$ in production is sufficiently small (in particular, if $\frac{\alpha_k(1 - \alpha_u)}{1 - \alpha_k(1 - \alpha_u)} < \frac{(1 - \tau_d)R^*}{(1 - \tau_d)R^* - 1} \frac{\mathcal{R}(\tau_d, \tau_l) - 1 + \delta}{\mathcal{R}(\tau_d, \tau_l)}$), then $\mathcal{W}_h(\tau_d, \tau_l)$ also decreases with τ_d (i.e., $\frac{\partial \mathcal{W}_h}{\partial \tau_d} < 0$).*

Proof. We provide a proof in the Appendix. □

Entrepreneur income. We next examine the steady-state implications of capital account policies for the representative entrepreneur's income. The optimal cost-minimizing decision (14) implies that the entrepreneur's labor income is a constant fraction of output given by

$$W_e^l = (1 - \alpha_u)(1 - \alpha_k)\mathcal{Y}(\tau_d, \tau_l). \quad (44)$$

Therefore, in the steady state, the entrepreneur's labor income increases with the outflow tax and decreases with the inflow tax, as does the household labor income.

The optimizing intertemporal decisions imply that the entrepreneur has the steady-state net worth

$$K - B_e = \frac{\beta(1 - \alpha_u)(1 - \alpha_k)}{1 + \beta}\mathcal{Y}(\tau_d, \tau_l). \quad (45)$$

The entrepreneur's capital income is then given by

$$\begin{aligned} W_e^c &= (R_l - 1)(K - B_e) \\ &\equiv [\mathcal{R}(\tau_d, \tau_l) - 1] \frac{\beta(1 - \alpha_u)(1 - \alpha_k)}{1 + \beta}\mathcal{Y}(\tau_d, \tau_l). \end{aligned} \quad (46)$$

Changes in the domestic lending rate affect the entrepreneur's capital income through two channels. First, an increase in domestic lending rate raises the entrepreneur's capital returns and therefore increases the entrepreneurs' capital income. Second, an increase in the lending rate depresses investment and output, reducing the entrepreneur's labor income and net worth. The reduction in net worth partially offsets the positive effect of increased capital returns. The negative net-worth effect becomes weaker the smaller the production share of capital $[\alpha_k(1 - \alpha_u)]$. As implied by Eq.(40), the smaller the production share of capital, the smaller the aggregate output responses to the domestic lending rate, and therefore the smaller the decline

in the entrepreneur's labor income and the funds available for investment. The positive capital-return effect always dominates unless the production share of capital is extremely large.²²

The following proposition summarizes the relation between capital account policies and the entrepreneur's capital income.

Proposition VII.4. *Denote by $\mathcal{W}_e(\tau_d, \tau_l)$ the entrepreneur's capital income as a function of the policy parameters τ_d and τ_l . If the capital share $\alpha_k(1 - \alpha_u)$ is sufficiently small (in particular, if $\frac{\alpha_k(1-\alpha_u)}{1-\alpha_k(1-\alpha_u)} < \frac{\mathcal{R}(\tau_d, \tau_l)-1+\delta}{\mathcal{R}(\tau_d, \tau_l)-1}$), then the entrepreneur's capital income $\mathcal{W}_e(\tau_d, \tau_l)$ decreases with τ_d (i.e., $\frac{\partial \mathcal{W}_e}{\partial \tau_d} < 0$) and increases with τ_l (i.e., $\frac{\partial \mathcal{W}_e}{\partial \tau_l} > 0$).*

Proof. We provide a proof in the Appendix. \square

Income distribution. We now examine how capital account policies affect the income distribution between the household and the entrepreneur. Since the labor income of each type of agents is a constant fraction of aggregate output (see Eq. (13) and Eq. (14)), the relative labor income of household is also constant and invariant to capital account policy:

$$\frac{W_h^l}{W_e^l} = \frac{\alpha_u}{(1 - \alpha_u)(1 - \alpha_k)}. \quad (47)$$

Therefore, the capital control policies affect the income distribution between the household and the entrepreneur through their effects on the capital income distribution. From Equations (43) and (46), the capital income ratio is given by,

$$\frac{W_h^c}{W_e^c} = \frac{[(1 - \tau_d)R^* - 1] \frac{\beta \alpha_u}{1+\beta} \mathcal{Y}(\tau_d, \tau_l)}{[\mathcal{R}(\tau_d, \tau_l) - 1] \frac{\beta(1-\alpha_u)(1-\alpha_k)}{1+\beta} \mathcal{Y}(\tau_d, \tau_l)} = \frac{\alpha_u}{(1 - \alpha_u)(1 - \alpha_k)} \frac{(1 - \tau_d)R^* - 1}{\mathcal{R}(\tau_d, \tau_l) - 1}. \quad (48)$$

Thus, the household-to-entrepreneur capital income ratio depends on the ratio between the household's return to saving, which equals the net deposit rate $(1 - \tau_d)R^* - 1$, and the entrepreneur's return to capital, which equals the net lending rate $\mathcal{R}(\tau_d, \tau_l) - 1$.

Lowering capital inflow taxes (i.e., decreasing τ_l) reduces the domestic lending rate and thus the entrepreneur's returns on capital, but it has no impact on the domestic deposit rate and thus does not affect the household's return on savings. As a result, liberalizing capital inflows increases the household's share in capital income.

Lowering capital outflow taxes (i.e., decreasing τ_d) raises the household's return on savings and the entrepreneur's return on capital at the same time, but with different

²²In the appendix, we prove that the entrepreneurs' capital income increases with the domestic lending rate under the condition that $\frac{\alpha_k(1-\alpha_u)}{1-\alpha_k(1-\alpha_u)} < \frac{R_l-1+\delta}{R_l-1}$, where R_l is the steady-state domestic lending rate. In EMEs with the labor share α no less than 50%, this condition is always satisfied.

magnitudes. In particular, liberalizing capital outflows directly raises the domestic deposit rate through the no-arbitrage condition (Eq. (38)). The bank does not fully pass through the increases in the deposit rate to the lending rate, because the household shifts a fraction of their deposits abroad (i.e., capital outflows increase), resulting in a decline in the loan-to-output ratio and reducing the credit spread. Since the magnitude of the increases in the entrepreneur’s return on capital (which equals the lending rate) is smaller than that in the increases in the household’s return to savings, liberalizing capital outflows raises the household’s share in capital income.

The following proposition summarizes the relation between capital account policies and the capital income distribution between the household and the entrepreneur.

Proposition VII.5. *Denote by $\mathcal{W}_c(\tau_d, \tau_l)$ the household-to-entrepreneur capital income ratio as a function of the policy parameters τ_d and τ_l . The household’s relative capital income $\mathcal{W}_c(\tau_d, \tau_l)$ decreases with both τ_d and τ_l (i.e., $\frac{\partial \mathcal{W}_c}{\partial \tau_d} < 0$ and $\frac{\partial \mathcal{W}_c}{\partial \tau_l} < 0$).*

Proof. We provide a proof in the Appendix. □

Our analytical results here show that, in the special case without capital-skill complementarity, a permanent reduction in capital inflow taxes reduces entrepreneurs’ return on investment, raising the share of capital income of households and thus alleviating income inequality. A permanent reduction in capital outflow taxes raises the returns on household savings, also reducing income inequality.

VII.2. Quantitative implications. We now use the calibrated baseline model (that incorporates capital-skill complementarity) to examine the steady state implications of capital account policies for income distributions.

VII.2.1. Capital inflow tax. We first consider the steady-state implication of varying the capital inflow tax rate τ_l , while holding the outflow tax rate τ_d constant.

Figure 4 displays the relationship between the steady-state capital inflow tax (τ_l) and several macroeconomic variables. Liberalizing inflow controls sufficiently raises foreign investors’ after-tax returns and induces foreign inflows. Competition from foreign investors crowd out domestic bank loans. The fall in domestic bank loans reduces the credit spreads as the marginal resource costs of lending declines. The subsequent decline in market lending rate encourages capital investment and stimulates production, raising the labor income for both types of agents. With the capital-skill complementarity, the entrepreneurs experience a larger increase in the wage rate than the households, leading to a rise in the entrepreneurs’ share in labor income.

We now turn to capital incomes. Lowering capital inflow taxes (i.e., decreasing τ_l) reduces the domestic lending rate and thus the entrepreneur's returns on capital, but it has no impact on the domestic deposit rate and thus does not affect the household's return on savings. As a result, liberalizing capital inflows increases the households' share in capital income.

Overall, reducing the capital inflow tax raises the households' share in capital income but reduces the households' share in labor income. Under our calibration, the labor-income effect dominates the capital-income effect and thus liberalizing inflow controls reduces the households' share in total income and worsens the income equality.

VII.2.2. *Capital outflow tax.* We next examine the steady-state implications of varying the capital outflow tax rate τ_d , while holding the inflow tax rate τ_l constant.

Figure 5 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). If τ_d is sufficiently high, households will not invest abroad. When τ_d declines sufficiently, however, the households begin to invest a fraction of their savings abroad, raising foreign asset holdings while reducing domestic bank deposits. No arbitrage implies that the domestic deposit interest rate rises to the level of the after-tax returns on foreign assets. The increased asset returns have a positive effect on household capital income.

Meanwhile, banks must respond to the increase in the deposit interest rate by also raising the market lending interest rate in order to remain solvent. In the steady state equilibrium, this increase in the market lending rate implies an increase in the entrepreneurs' capital return. However, because the bank does not fully pass through the increases in the deposit rate to the lending rate in the presence of costly financial intermediation, the increase in the entrepreneurs' capital return is smaller than the increase in the households' capital return, leading to a fall in the entrepreneurs' share in capital income.

We now turn to labor incomes. The increase in the lending rate depresses investment and output, reducing labor income for both types of agents. However, under capital-skill complementarity, the entrepreneurs experience a larger decline in wages than households, leading to a fall in the entrepreneurs' share in labor income as well.

Overall, liberalizing capital outflows improves income equality by raising the household share in both capital income and labor income, as shown in Figure 5.

VII.3. Optimal capital control policies. Finally, we examine optimal responses of capital account policies following a reduction in the foreign interest rate, similar to that observed during the 2008-09 global financial crisis and again, in the more recent Covid-19 pandemic. In particular, we consider a counterfactual experiment in which the foreign interest rate R^* falls from $R_0^* = 1.04^{10}$ in period zero (the initial steady-state value) to $R_1^* = 1.03^{10}$ in period $t = 1$ and returns to the initial level thereafter. This foreign interest rate shock is the same one described by (35) and skews the income distributions in favor of the entrepreneurs at the expense of the households.

To keep our analysis tractable, we consider optimal policy for inflow taxes and outflow taxes separately.

In the case with optimal capital outflow taxes, we hold the inflow tax rate constant at the calibrated value. Let τ_{d0} , τ_{d1} and τ_{d2} represent the tax rates on capital outflows in the initial steady state, the first period during transition, and the final steady state, respectively. The transition path of the capital outflow tax rate is then given by

$$\tau_{dt} = \begin{cases} \tau_{d0}, & \text{if } t = 0, \\ \tau_{d1}, & \text{if } t = 1, \\ \tau_{d2}, & \text{if } t \geq 2. \end{cases} \quad (49)$$

Similarly, in the case with optimal inflow taxes, we hold the outflow tax rate constant at the calibrated value. Denote by τ_{l0} , τ_{l1} and τ_{l2} the tax rate on capital inflows in the initial steady state, in the first period during the transition, and in the final steady state respectively. The outflow tax rate follows the path

$$\tau_{lt} = \begin{cases} \tau_{l0}, & \text{if } t = 0, \\ \tau_{l1}, & \text{if } t = 1, \\ \tau_{l2}, & \text{if } t \geq 2. \end{cases} \quad (50)$$

The planner's welfare objective is a weighted average of the household welfare and the entrepreneur welfare, and is given by

$$V(\tau_{d1}, \tau_{d2}, \tau_{l1}, \tau_{l2}, \omega) = \omega V_h(\tau_{d1}, \tau_{d2}, \tau_{l1}, \tau_{l2}) + (1 - \omega) V_e(\tau_{d1}, \tau_{d2}, \tau_{l1}, \tau_{l2}), \quad (51)$$

where $V_h(\cdot)$ and $V_e(\cdot)$ denote the transition welfare of the households and of the entrepreneurs, respectively, and ω is the Pareto weight that the planner assigns on

the households' welfare. The welfare of the two types of agents are given by

$$V_h(\tau_{d1}, \tau_{d2}, \tau_{l1}, \tau_{l2}) = \sum_{t=1}^{\infty} \beta^t (\ln(C_{ht}^y) + \ln(C_{ht}^o)), \quad (52)$$

and

$$V_e(\tau_{d1}, \tau_{d2}, \tau_{l1}, \tau_{l2}) = \sum_{t=1}^{\infty} \beta^t (\ln(C_{et}^y) + \ln(C_{et}^o)), \quad (53)$$

where C_{ht}^y and C_{ht}^o denote young and old household consumption, and C_{et}^y and C_{et}^o denote young and old entrepreneur consumption along the transition path.

We solve for the capital account policy parameters $\{\tau_{d1}, \tau_{d2}, \tau_{l1}, \tau_{l2}\}$ that maximize the planner's objective function $V(\tau_{d1}, \tau_{d2}, \tau_{l1}, \tau_{l2}, \omega)$ under a given value of $\omega \in (0, 1)$. Table 5 shows the optimal policy parameters. For comparison, the table also shows the benchmark policy parameters [see Column (1)].

TABLE 5. Optimal capital account policies following transitory declines in the foreign interest rate

	Benchmark policy	Optimal inflow tax			Optimal outflow tax		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
ω	—	0.3	0.5	0.7	0.3	0.5	0.7
τ_{l1}	8.13%	8.12%	10.86%	12.68%	—	—	—
τ_{l2}	8.13%	10.77%	11.29%	11.65%	—	—	—
τ_{d1}	6.53%	—	—	—	12.35%	-0.57%	-15.26%
τ_{d2}	6.53%	—	—	—	3.58%	-4.79%	-20.09%

Consider first the optimal response of capital inflow tax policy to the decline in the foreign interest rate, holding the outflow tax rate constant [Columns (2)-(4)]. In the case with equal weights on the welfare of households and entrepreneurs (i.e., $\omega = 0.5$), as in the benchmark model, the planner chooses to tighten inflow controls by raising the inflow tax rate, both in the short run and in the long run [see Column (3) in Table 5].

In the short run, an increase in capital inflow taxes (τ_{l1}) curbs capital inflows induced by the foreign interest rate shock and shifts entrepreneurs' demand for loans toward domestic banks. Thus, the policy raises the domestic lending rate, stabilizing the investment and output booms driven by the surge in capital inflows. The more the planner favors the household (i.e., the larger the value of ω), the higher the optimal capital inflow tax rate in the short run (i.e., the higher the value of τ_{l1}).

In the long run, the entrepreneurs' capital returns converge to the lending interest rate (as Tobin's q converges to the steady-state level of one). Thus, a higher capital

inflow tax rate (τ_{l2}) leads to a higher domestic lending rate, raising the entrepreneurs' capital income. However, the higher lending rate also depresses domestic production and investment, reducing the labor income for both types of agents and hurting the entrepreneurs more than the households. Under our calibration, the labor-income effect dominates the capital-income effect. Therefore, the more the planner favors the household, the higher the long-run capital inflow tax rate (i.e., the value of τ_{l2} rises as ω rises), consistent with our steady-state quantitative results.

Next, consider the optimal response of the capital outflow tax policy to the foreign interest rate shock, holding the inflow tax rate constant [Columns (5)-(7) in Table 5]. In the short run, the planner chooses to reduce the capital outflow tax rate (τ_{d1}) relative to the benchmark level, raising the domestic deposit rate. In response, banks raise the lending rate and decrease lending. This depresses investment and production, reducing the labor income for both the households and the entrepreneurs, with a larger decline for the latter. The entrepreneurs' capital income also falls relative to that of the households, because the investment contraction reduces the capital price while the cut in the outflow tax rate raises the household's returns on savings. The more the planner favors the household, the lower the short-run outflow tax rate. For a sufficiently large Pareto weight assigned to the household's welfare (e.g., $\omega = 0.7$), the planner chooses to subsidize capital outflows (i.e., $\tau_{d1} < 0$).

With the benchmark Pareto weight ($\omega = 0.5$), the long-run capital outflow tax rate is much lower than that in the short run [i.e., $\tau_{d2} < \tau_{d1}$, see Column (6) of the table]. The decline in the outflow tax rate raises the capital income of both agents in the long run, with the households benefiting more than the entrepreneurs. It also depresses production and reduces the labor income of both agents in the long run, with the entrepreneurs suffering more than the households. The more the planner favors the households, the lower the long-run capital outflow tax rate, which is also consistent with our steady state analysis.

VIII. CONCLUSION

We build a small open economy model with heterogeneous agents and financial frictions to illustrate the channels through which capital flows can impact on income inequality. Our model implies that a shock that leads to a short-run surge in capital inflows boosts domestic production and investment, increasing entrepreneur capital income. Through capital-skill complementarity, the inflow surge also increase the entrepreneurs' share of labor income. Overall, an increase in capital inflows skews the

income distribution in favor of the entrepreneurs and against the households, raising income inequality. Through a similar channel, the model also predicts that a shock that leads to an short-run increase in capital outflows would reduce income inequality. We present empirical evidence that supports these model predictions. In particular, our instrumental-variable estimation using a panel of emerging market economies shows robust evidence that income inequality (measured by the Gini coefficient) rises with private capital inflows and falls with outflows, in line with the model predictions.

We also analyze the role of capital account policies in driving capital flows and income distributions. We show that, in the long-run, a permanent reduction in the outflow tax would increase the share of capital income as well as labor income held by households and unambiguously reduce income inequality. A permanent reduction in the capital inflow tax would increase the households' share of capital income but reduce the households' share of labor income through capital-skill complementarity. Under our calibration, the labor-income effect dominates the capital-income effect so that capital inflow liberalization worsens income inequality in the long run. We find that, in response to a decline in the foreign interest rate that induces capital inflows and discourages outflows, a social planner who assigns a larger Pareto weight on the household welfare would tighten inflow controls or relax outflow controls more aggressively.

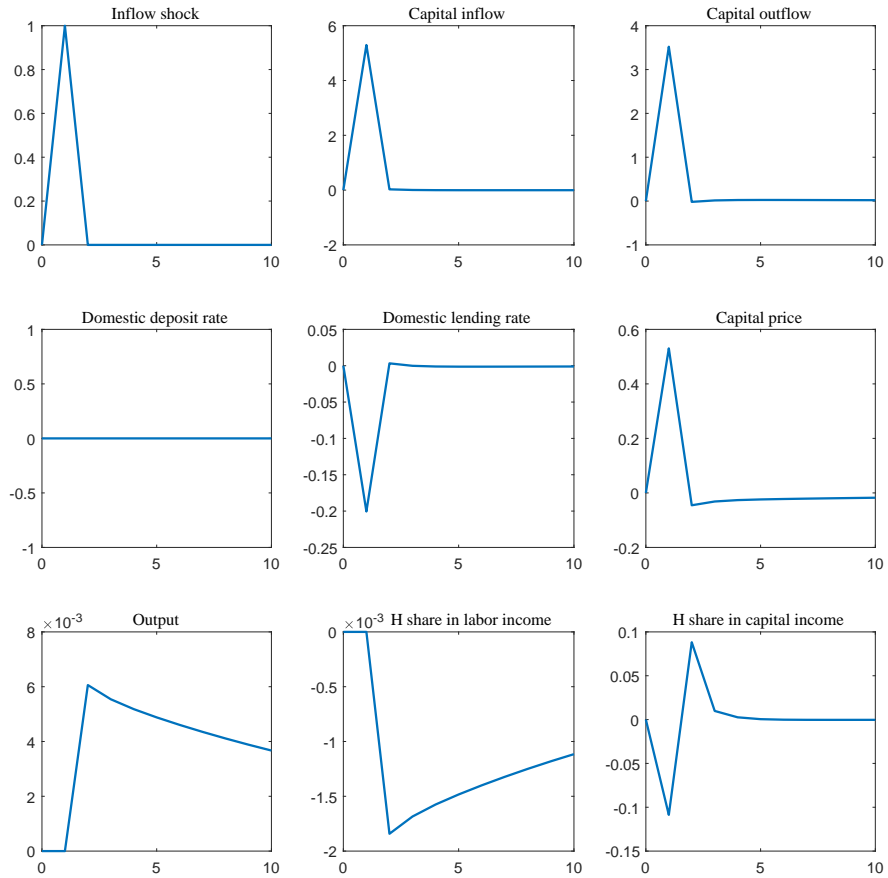


FIGURE 1. Transition dynamics following a temporary positive shock to capital inflows (z_l). The units of the vertical axes are deviations from the steady state levels for all variables, except that the units for the household (H) share of labor income and capital income are percentage-point deviations from the steady state level.

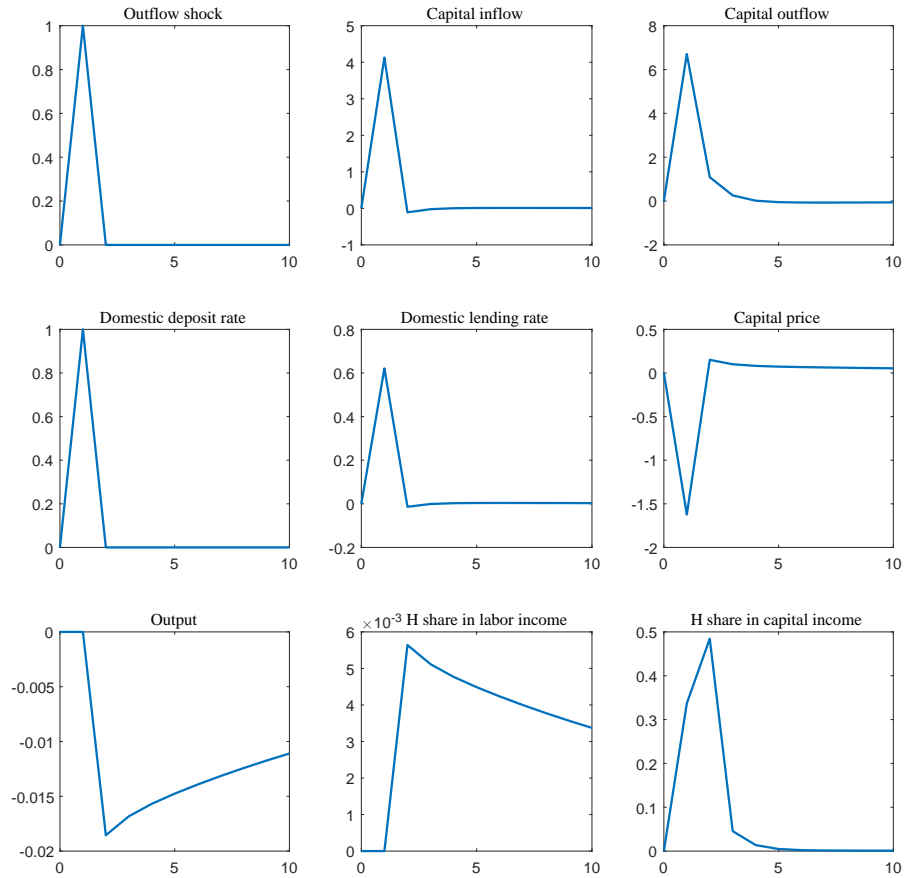


FIGURE 2. Transition dynamics following a temporary positive shock to capital outflows (z_d). The units of the vertical axes are deviations from the steady state levels for all variables, except that the units for the household (H) share of labor income and capital income are percentage-point deviations from the steady state level.

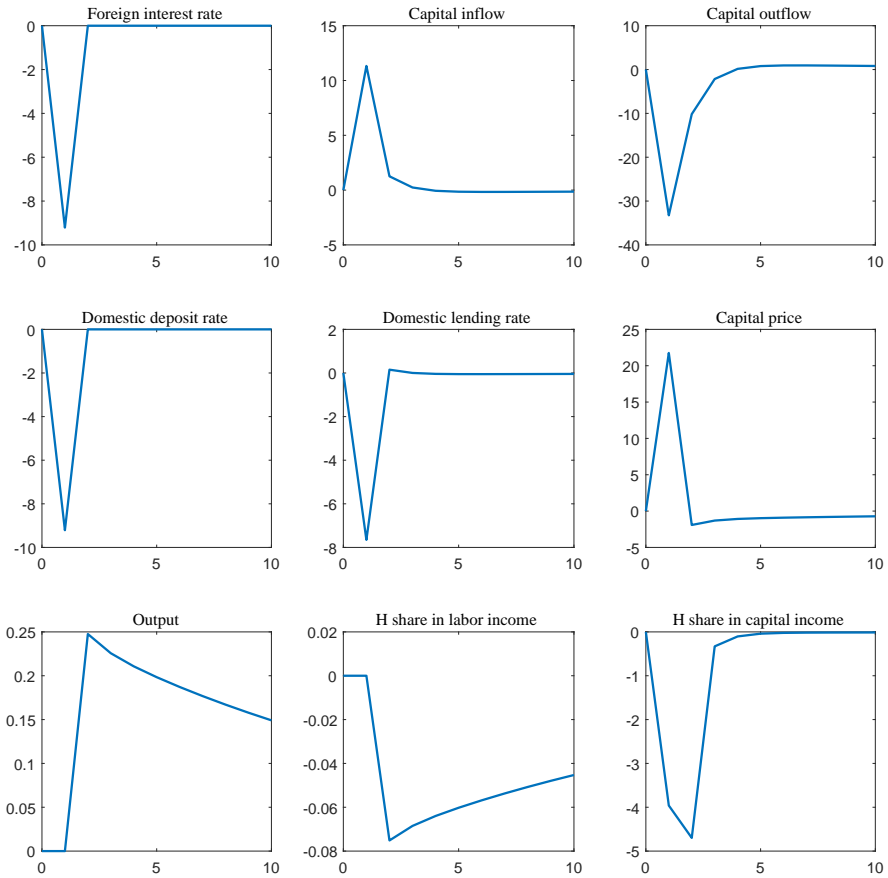


FIGURE 3. Transition dynamics following a temporary fall in the foreign interest rate. The units of the vertical axes are deviations from the steady state levels for all variables, except that the units for the household (H) share of labor income and capital income are percentage-point deviations from the steady state level.

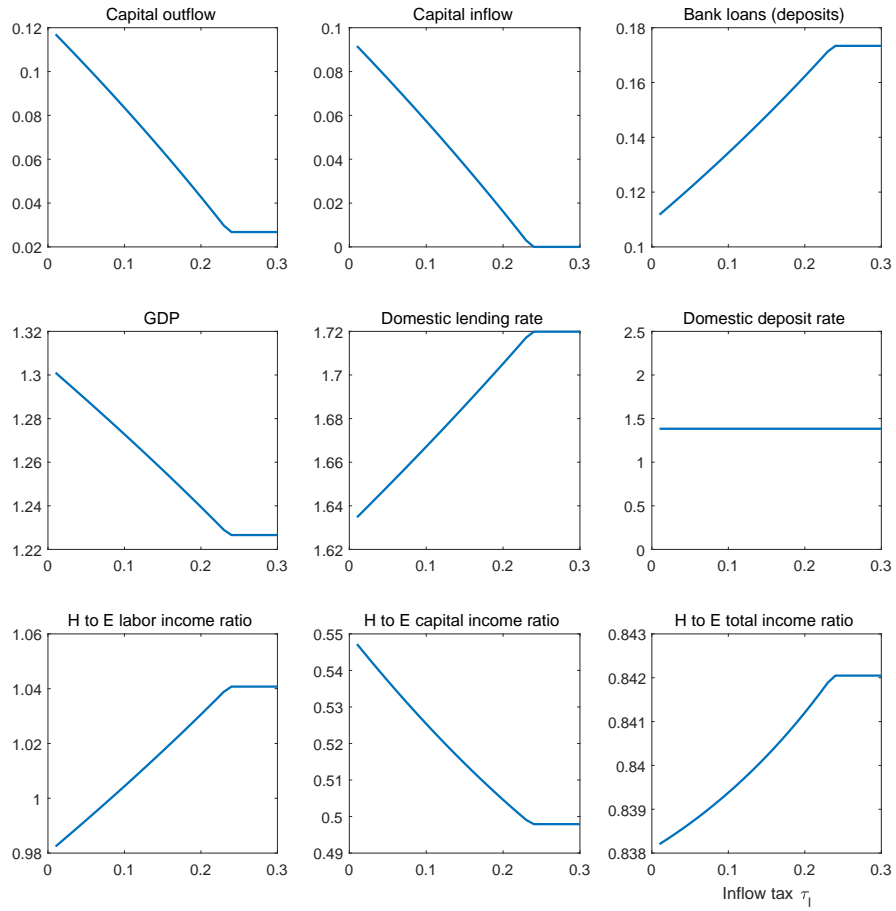


FIGURE 4. Steady-state implications of liberalizing capital inflow controls.

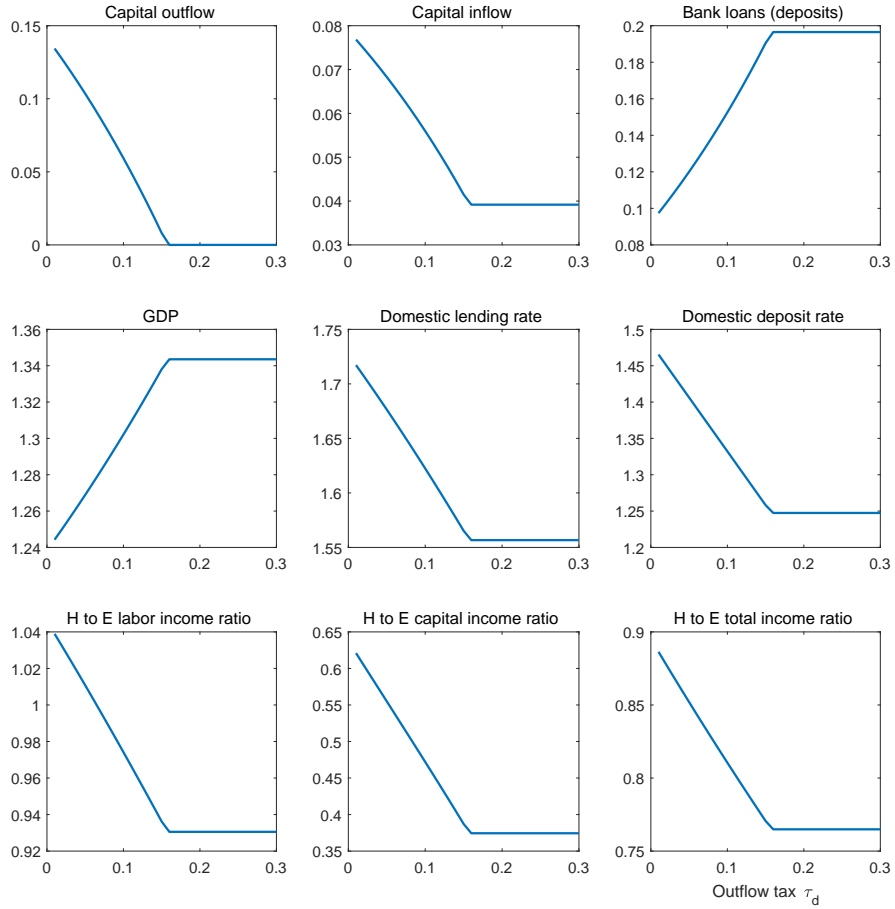


FIGURE 5. Steady-state implications of liberalizing capital outflow controls.

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APPENDIX A. ONLINE APPENDIX (NOT FOR PUBLICATION)

This online appendix presents some robustness checks on the baseline empirical results and provides detailed proofs to the propositions in the text.

A.1. Robustness checks for Empirics. Our baseline results are robust to a battery of alternative empirical specifications, samples, and estimation methods. Table A.1 summarizes the estimated coefficients on private capital inflows, outflows, and net inflows under 10 alternative specifications. Table A.2 summarizes the estimation results in a variety of subsamples. Table A.3 shows the results under alternative methods of estimation and standard error calculations.

TABLE A.1. Alternative specifications

Model	(1) PINFLOWS	(2) POUTFLOWS	(3) NPINFLOWS
(1) FKRSU Total	0.221** (0.088)	-0.310** (0.144)	0.234*** (0.082)
(2) FKRSU Inf. and Out.	0.205*** (0.078)	-0.316** (0.139)	0.218*** (0.076)
(3) Education	0.143** (0.056)	-0.261 (0.194)	0.159*** (0.048)
(4) Voice and Acct.	0.123** (0.048)	-0.299** (0.145)	0.141*** (0.041)
(5) Pol. Stab.	0.109*** (0.041)	-0.270** (0.105)	0.141*** (0.031)
(6) Govt. Eff.	0.105** (0.047)	-0.264*** (0.097)	0.148*** (0.031)
(7) Reg. Qual.	0.105** (0.047)	-0.254** (0.108)	0.149*** (0.029)
(8) Rule of Law	0.093** (0.045)	-0.248*** (0.093)	0.131*** (0.029)
(9) Remoteness	0.055** (0.025)	-0.162*** (0.047)	0.084*** (0.025)
(10) Country FEs	0.021*** (0.005)	-0.054*** (0.006)	0.021*** (0.004)

Note: Two-stage least squares estimation with *INTREMOTE* and regional fixed effects as instruments for *PINFLOWS*, *POUTFLOWS*, *NPINFLOWS* with standard errors clustered by year (except where indicated otherwise). Models (1) and (2) apply Fernández et al. (2016) (FKRSU) restrictions. Model (3) adds years of schooling. Model (4) adds the WGI voice and accountability variable. Model (5) adds the WGI political stability variable. Model (6) adds the WGI government effectiveness measure. Model (7) adds the WGI regulatory quality. Model (8) adds the WGI rule of law. Model (9) adds the log of distance from New York City. Model (10) uses country dummies instead of regions as instruments. Year fixed effects are included throughout. See text for variable definitions. Statistical significance levels indicated by asterisks: *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.10$.

TABLE A.2. Alternative samples

Model	(1) PINFLOWS	(2) POUTFLOWS	(3) NPINFLOWS
(1) Drop Large Inflows	0.141* (0.077)	-0.331** (0.140)	0.194*** (0.066)
(2) Drop Small Inflows	0.133** (0.056)	-0.204* (0.111)	0.156*** (0.029)
(3) Drop Large Outflows	0.104** (0.043)	-0.278*** (0.104)	0.139*** (0.031)
(4) Drop Small Outflows	0.118*** (0.036)	-0.305** (0.129)	0.139*** (0.035)
(5) Drop High GINI	0.109** (0.042)	-0.247*** (0.093)	0.143*** (0.030)
(6) Drop Low GINI	0.101** (0.041)	-0.279*** (0.104)	0.134*** (0.031)
(7) Drop Most Remote	0.107** (0.042)	-0.263*** (0.100)	0.141*** (0.031)
(8) Drop Least Remote	0.107** (0.042)	-0.263*** (0.100)	0.141*** (0.031)
(9) Drop Crisis Years	0.077** (0.034)	-0.297** (0.118)	0.110*** (0.023)

Note: Two-stage least squares estimation with *INTREMOTE* and country fixed effects as instruments for *PINFLOWS*, *POUTFLOWS*, *NPINFLOWS* with standard errors clustered by year (except where indicated otherwise). Year fixed effects included throughout. See text for variable definitions. Models (1) through (8) drop observations with variables more than three standard errors from sample means. Model (9) drops crisis years 2008 and 2009. Statistical significance levels indicated by asterisks: *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.10$.

TABLE A.3. Alternative estimation methods

Model	(1) PINFLOWS	(2) POUTFLOWS	(3) NPINFLOWS
(1) Winsorize 1%	0.132** (0.052)	-0.289** (0.119)	0.160*** (0.040)
(2) Robust SEs	0.107** (0.045)	-0.263*** (0.096)	0.141*** (0.038)
(3) Standard SEs	0.107** (0.052)	-0.263*** (0.090)	0.141*** (0.031)
(4) Cluster by Region	0.107*** (0.028)	-0.263*** (0.040)	0.141*** (0.034)
(5) Cluster by Country	0.107** (0.050)	-0.263*** (0.100)	0.141*** (0.051)

Note: Two-stage least squares estimation with *INTREMOTE* and country fixed effects as instruments for *PINFLOWS*, *POUTFLOWS*, *NPINFLOWS* with standard errors clustered by year (except where indicated otherwise). Year fixed effects included throughout. See text for variable definitions. Models (1) winsorizes at the 1% level. Model (2) estimated with robust standard errors. Model (3) estimated with conventional standard errors. Model (4) clusters by country FEs. Statistical significance levels indicated by asterisks: *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.10$.

A.2. Steady state solution. The household's intertemporal optimizing decisions are given by

$$1 = E_t \beta R_t \frac{\Lambda_{h,t+1}^o}{\Lambda_{ht}^y}, \quad (\text{A1})$$

$$1 = E_t \beta (1 - \tau_d) R_t^* \frac{\Lambda_{h,t+1}^o}{\Lambda_{ht}^y}, \quad (\text{A2})$$

where $\Lambda_{ht}^y = \frac{1}{C_{ht}^y}$ and $\Lambda_{ht}^o = \frac{1}{C_{ht}^o}$ denote the Lagrangian multipliers associated with the budget constraints for the young and the old households, respectively.

In the interior equilibrium, the no-arbitrage condition Eq. (5) solves for the domestic deposit rate:

$$R = (1 - \tau_d) R^*. \quad (\text{A3})$$

In what follows, we first take the lending rate R_l as given and solve for expressions of saving, debt, capital and income as a fraction of output. We then use these expressions to solve for the lending rate and the output as functions of τ_d and τ_l .

We first derive the expressions for the household's income as a fraction of output. The optimal cost-minimizing solution (13) implies that households' labor income is a constant fraction of the output,

$$\frac{W_h^l}{Y} = \alpha_u. \quad (\text{A4})$$

With the household's budget constraints, we have,

$$\frac{C_h^y}{Y} = \alpha_u - \left(\frac{D}{Y} + \frac{B_f^d}{Y} \right), \quad (\text{A5})$$

$$\frac{C_h^o}{Y} = R \frac{D}{Y} + (1 - \tau_d) R^* \frac{B_f^d}{Y} = (1 - \tau_d) R^* \left(\frac{D}{Y} + \frac{B_f^d}{Y} \right). \quad (\text{A6})$$

By substituting the above expressions into the household's optimal saving condition (A1), we can solve for the household's total saving amount:

$$\frac{D}{Y} + \frac{B_f^d}{Y} = \frac{\beta \alpha_u}{1 + \beta}. \quad (\text{A7})$$

The household's capital income is then given by,

$$\frac{W_h^c}{Y} = [(1 - \tau_d) R^* - 1] \left(\frac{D}{Y} + \frac{B_f^d}{Y} \right) = [(1 - \tau_d) R^* - 1] \frac{\beta \alpha_u}{1 + \beta}. \quad (\text{A8})$$

We now derive the expressions for the entrepreneur's income as a fraction of output.

The entrepreneur's intertemporal optimizing decisions are summarized by the following equations:

$$1 = E_t \beta R_{lt} \frac{\Lambda_{e,t+1}^o}{\Lambda_{et}^y}, \quad (\text{A9})$$

$$q_t^k + \frac{\Omega_k}{2} \left(\frac{I_t}{K_t^o} - \frac{\bar{I}}{\bar{K}^o} \right)^2 - \Omega_k \left(\frac{I_t}{K_t^o} - \frac{\bar{I}}{\bar{K}^o} \right) \frac{I_t}{K_t^o} = E_t \beta [q_{t+1}^k (1 - \delta) + r_{t+1}^k] \frac{\Lambda_{e,t+1}^o}{\Lambda_{et}^y} \quad (\text{A10})$$

$$1 + \Omega_k \left(\frac{I_t}{K_t^o} - \frac{\bar{I}}{\bar{K}^o} \right) = E_t \beta [q_{t+1}^k (1 - \delta) + r_{t+1}^k] \frac{\Lambda_{e,t+1}^o}{\Lambda_{et}^y} \quad (\text{A11})$$

where $\Lambda_{et}^y = \frac{1}{C_{et}^y}$ and $\Lambda_{et}^o = \frac{1}{C_{et}^o}$ denote the Lagrangian multipliers associated with the budget constraints for the young and the old entrepreneurs, respectively.

The optimal cost-minimizing solution (14) implies that entrepreneurs' labor income is a constant fraction of the output,

$$\frac{W_e^l}{Y} = (1 - \alpha_u)(1 - \alpha_k). \quad (\text{A12})$$

The entrepreneur's optimal conditions Eq. (A9) - Eq. (A11) implies that, in the steady state, the entrepreneur's return to capital equals the domestic lending rate:

$$1 - \delta + r^k = R_l. \quad (\text{A13})$$

With the entrepreneur's budget constraints, we have,

$$\frac{C_e^y}{Y} = (1 - \alpha_u)(1 - \alpha_k) - \frac{N_e}{Y}, \quad (\text{A14})$$

$$\frac{C_e^o}{Y} = R_l \frac{N_e}{Y}. \quad (\text{A15})$$

where $\frac{N_e}{Y}$ is the ratio of the entrepreneur's net worth to total output:

$$\frac{N_e}{Y} \equiv \frac{K}{Y} - \frac{B}{Y} - \frac{B_f^l}{Y}. \quad (\text{A16})$$

By substituting the above expressions into the entrepreneur's optimal borrowing condition (A9), we can solve for the entrepreneur's net worth:

$$\frac{N_e}{Y} = \frac{\beta(1 - \alpha_u)(1 - \alpha_k)}{1 + \beta}. \quad (\text{A17})$$

The entrepreneur's capital income is then given by,

$$\frac{W_e^c}{Y} = (R_l - 1) \frac{N_e}{Y} = (R_l - 1) \frac{\beta(1 - \alpha_u)(1 - \alpha_k)}{1 + \beta}. \quad (\text{A18})$$

We now solve for the domestic lending rate R_l . We first use (15),(19) and (20) to express $\frac{K}{Y}$, $\frac{B}{Y}$ and $\frac{B_f^l}{Y}$ as a function of the lending interest rate R_l ,

$$\frac{K}{Y} = \frac{(1 - \alpha_u)\alpha_k}{r^k} = \frac{(1 - \alpha_u)\alpha_k}{R_l - 1 + \delta}, \quad (\text{A19})$$

$$\frac{B}{Y} = \left(\frac{R_l - 1}{\xi\eta}\right)^{\frac{1}{\eta-1}} = \left(\frac{\frac{R_l}{(1-\tau_d)R^*} - 1}{\xi\eta}\right)^{\frac{1}{\eta-1}}, \quad (\text{A20})$$

$$\frac{B_f^l}{Y} = \kappa_f + \frac{1}{\Phi_b} \ln \left[\frac{(1 - \tau_l)R_l}{R^*} \right]. \quad (\text{A21})$$

By substituting the above expressions into (A16), we can express $\frac{N_e}{Y}$ as a function of R_l , τ_l and τ_d ,

$$\frac{N_e}{Y} \equiv f(R_l, \tau_d, \tau_l) = \frac{(1 - \alpha_u)\alpha_k}{R_l - 1 + \delta} - \left(\frac{\frac{R_l}{(1-\tau_d)R^*} - 1}{\xi\eta}\right)^{\frac{1}{\eta-1}} - \kappa_f - \frac{1}{\Phi_b} \ln \left[\frac{(1 - \tau_l)R_l}{R^*} \right]. \quad (\text{A22})$$

We can then solve for R_l as a function of τ_d and τ_l by combining (A22) with (A17). In particular, define $R_l \equiv \mathcal{R}(\tau_d, \tau_l)$. The function $\mathcal{R}(\cdot, \cdot)$ is then given by,

$$f(\mathcal{R}(\tau_d, \tau_l), \tau_d, \tau_l) = \frac{\beta(1 - \alpha_u)(1 - \alpha_k)}{1 + \beta}. \quad (\text{A23})$$

Last, we solve for the output. Using the cost-minimizing solution (15), we obtain,

$$\frac{K}{Y} = \frac{(1 - \alpha_u)\alpha_k}{r^k} \quad (\text{A24})$$

where the capital rent rate r^k is given by Eq.(A13).

With some algebra, we can solve for the output as a function of the domestic lending rate R_l ,

$$\begin{aligned} Y &= \left(\frac{K}{Y}\right)^{\frac{(1-\alpha_u)\alpha_k}{1-(1-\alpha_u)\alpha_k}} [\theta^{\alpha_u}(1-\theta)^{(1-\alpha_u)(1-\alpha_k)}]^{\frac{1}{1-(1-\alpha_u)\alpha_k}} \\ &= \left[\frac{(1-\alpha_u)\alpha_k}{R_l - 1 + \delta}\right]^{\frac{(1-\alpha_u)\alpha_k}{1-(1-\alpha_u)\alpha_k}} [\theta^{\alpha_u}(1-\theta)^{(1-\alpha_u)(1-\alpha_k)}]^{\frac{1}{1-(1-\alpha_u)\alpha_k}}. \end{aligned} \quad (\text{A25})$$

APPENDIX B. PROOFS OF PROPOSITIONS

B.1. Proof for Proposition VII.1.

Proof. For convenience of references, we rewrite Equation (A23), which solves for $R_l \equiv \mathcal{R}(\tau_d, \tau_l)$ as a function of τ_d and τ_l :

$$f(\mathcal{R}(\tau_d, \tau_l), \tau_d, \tau_l) = \frac{\beta(1 - \alpha_u)(1 - \alpha_k)}{1 + \beta}..$$

where the function $f(\cdot)$ is given by Equation (A22):

$$f(R_l, \tau_d, \tau_l) = \frac{(1 - \alpha_u)\alpha_k}{R_l - 1 + \delta} - \left(\frac{\frac{R_l}{(1-\tau_d)R^*} - 1}{\xi\eta}\right)^{\frac{1}{\eta-1}} - \kappa_f - \frac{1}{\Phi_b} \ln \left[\frac{(1 - \tau_l)R_l}{R^*} \right].$$

Given that the right hand side of Equation (A23) is a constant, we have,

$$\frac{\partial f}{\partial \tau_d} = f_1 \frac{\partial \mathcal{R}}{\partial \tau_d} + f_2 = 0, \quad (\text{A26})$$

$$\frac{\partial f}{\partial \tau_l} = f_1 \frac{\partial \mathcal{R}}{\partial \tau_l} + f_3 = 0. \quad (\text{A27})$$

where

$$f_1 = -\frac{(1 - \alpha_u)\alpha_k}{(R_l - 1 + \delta)^2} - \frac{1}{\eta - 1} \left(\frac{\frac{R_l}{(1 - \tau_d)R^*} - 1}{\xi\eta} \right)^{\frac{1}{\eta-1}-1} \frac{1}{(1 - \tau_d)R^*\xi\eta} - \frac{1}{\Phi_b R_l} < 0 \quad (\text{A28})$$

$$f_2 = -\frac{1}{\eta - 1} \left(\frac{\frac{R_l}{(1 - \tau_d)R^*} - 1}{\xi\eta} \right)^{\frac{1}{\eta-1}-1} \frac{R_l}{R^*\xi\eta} \frac{1}{(1 - \tau_d)^2} < 0, \quad (\text{A29})$$

$$f_3 = \frac{1}{\Phi_b(1 - \tau_l)} > 0. \quad (\text{A30})$$

Then, we solve for the first derivatives of $\mathcal{R}(\cdot, \cdot)$,

$$\frac{\partial \mathcal{R}}{\partial \tau_d} = -\frac{f_2}{f_1} < 0, \quad (\text{A31})$$

$$\frac{\partial \mathcal{R}}{\partial \tau_l} = -\frac{f_3}{f_1} > 0. \quad (\text{A32})$$

□

B.2. Proof for Proposition VII.3.

Proof. For convenience of references, we rewrite Equation (43), which expresses the household's capital income as a function of τ_d and τ_l :

$$W_h^c \equiv \mathcal{W}_h(\tau_d, \tau_l) = [(1 - \tau_d)R^* - 1] \frac{\beta\alpha_u}{1 + \beta} \mathcal{Y}(\tau_d, \tau_l).$$

Then, the first derivatives of the household's capital income with respect to τ_l is given by,

$$\frac{\partial \mathcal{W}_h}{\partial \tau_l} = [(1 - \tau_d)R^* - 1] \frac{\beta\alpha_u}{1 + \beta} \frac{\partial \mathcal{Y}}{\partial \tau_l} < 0.$$

The first derivatives of the household's capital income with respect to τ_d is given by,

$$\frac{\partial \mathcal{W}_h}{\partial \tau_d} = \frac{\beta\alpha_u}{1 + \beta} \left\{ -R^* \mathcal{Y}(\tau_d, \tau_l) + [(1 - \tau_d)R^* - 1] \frac{\partial \mathcal{Y}}{\partial \tau_d} \right\}.$$

where

$$\begin{aligned}
\frac{\partial \mathcal{Y}}{\partial \tau_d} &= y'(R_l) \frac{\partial \mathcal{R}}{\partial \tau_d} \\
&= \frac{(1 - \alpha_u) \alpha_k}{1 - (1 - \alpha_u) \alpha_k} \frac{Y}{R_l - 1 + \delta} \frac{-\frac{1}{\eta-1} \left(\frac{R_l}{(1-\tau_d)R^*} - 1 \right)^{\frac{1}{\eta-1}-1} \frac{R_l}{R^* \xi \eta} \frac{1}{(1-\tau_d)^2}}{-\frac{1-\alpha}{(R_l-1+\delta)^2} - \frac{1}{\eta-1} \left(\frac{R_l}{(1-\tau_d)R^*} - 1 \right)^{\frac{1}{\eta-1}-1} \frac{1}{(1-\tau_d)R^* \xi \eta} - \frac{1}{\Phi_b R_l}} \\
&= \frac{(1 - \alpha_u) \alpha_k}{1 - (1 - \alpha_u) \alpha_k} \frac{Y}{(1 - \tau_d)} \frac{R_l}{R_l - 1 + \delta} \frac{\frac{1}{\eta-1} \left(\frac{R_l}{(1-\tau_d)R^*} - 1 \right)^{\frac{1}{\eta-1}-1} \frac{1}{R^* \xi \eta} \frac{1}{(1-\tau_d)}}{\frac{1-\alpha}{(R_l-1+\delta)^2} + \frac{1}{\eta-1} \left(\frac{R_l}{(1-\tau_d)R^*} - 1 \right)^{\frac{1}{\eta-1}-1} \frac{1}{(1-\tau_d)R^* \xi \eta} + \frac{1}{\Phi_b R_l}} \\
&< \frac{(1 - \alpha_u) \alpha_k}{1 - (1 - \alpha_u) \alpha_k} \frac{Y}{(1 - \tau_d)} \frac{R_l}{R_l - 1 + \delta}.
\end{aligned}$$

Then, we have,

$$\begin{aligned}
\frac{\partial \mathcal{W}_h}{\partial \tau_d} &= \frac{\beta \alpha_u}{1 + \beta} \left\{ -R^* \mathcal{Y}(\tau_d, \tau_l) + [(1 - \tau_d)R^* - 1] \frac{\partial \mathcal{Y}}{\partial \tau_d} \right\} \\
&< \frac{\beta \alpha_u}{1 + \beta} \left\{ -R^* \mathcal{Y}(\tau_d, \tau_l) + [(1 - \tau_d)R^* - 1] \frac{(1 - \alpha_u) \alpha_k}{1 - (1 - \alpha_u) \alpha_k} \frac{\mathcal{Y}(\tau_d, \tau_l)}{(1 - \tau_d)} \frac{R_l}{R_l - 1 + \delta} \right\} \\
&= \frac{\beta \alpha_u}{1 + \beta} \frac{\mathcal{Y}(\tau_d, \tau_l)}{(1 - \tau_d)} \left\{ -(1 - \tau_d)R^* + [(1 - \tau_d)R^* - 1] \frac{(1 - \alpha_u) \alpha_k}{1 - (1 - \alpha_u) \alpha_k} \frac{R_l}{R_l - 1 + \delta} \right\}
\end{aligned}$$

If the capital share $(1 - \alpha_u) \alpha_k$ is small enough so that $\frac{(1 - \alpha_u) \alpha_k}{1 - (1 - \alpha_u) \alpha_k} < \frac{(1 - \tau_d)R^*}{(1 - \tau_d)R^* - 1} \frac{R_l - 1 + \delta}{R_l}$, then

$$\frac{\partial \mathcal{W}_h}{\partial \tau_d} < \frac{\beta \alpha_u}{1 + \beta} \frac{\mathcal{Y}(\tau_d, \tau_l)}{(1 - \tau_d)} \left\{ -(1 - \tau_d)R^* + [(1 - \tau_d)R^* - 1] \frac{(1 - \alpha_u) \alpha_k}{1 - (1 - \alpha_u) \alpha_k} \frac{R_l}{R_l - 1 + \delta} \right\} < 0.$$

□

B.3. Proof for Proposition VII.4.

Proof. For convenience of references, we rewrite Equation (46), which expresses the entrepreneur's capital income as a function of the lending interest rate R_l :

$$W_h^e \equiv w_e(R_l) = (R_l - 1) \frac{\beta(1 - \alpha_u)(1 - \alpha_k)}{1 + \beta} y(R_l).$$

where $y(R_l)$ expresses the output as a function of R_l ,

$$y(R_l) = \left[\frac{(1 - \alpha_u) \alpha_k}{R_l - 1 + \delta} \right]^{\frac{(1 - \alpha_u) \alpha_k}{1 - (1 - \alpha_u) \alpha_k}} [\theta^{\alpha_u} (1 - \theta)^{(1 - \alpha_u)(1 - \alpha_k)}]^{1 - \frac{1}{1 - (1 - \alpha_u) \alpha_k}}.$$

Then, the first derivatives of the entrepreneur's capital income with respect to R_l is given by,

$$\begin{aligned} w'_e(R_l) &= \frac{\beta(1-\alpha_u)(1-\alpha_k)}{1+\beta} [y(R_l) + (R_l-1)y'(R_l)] \\ &= \frac{\beta(1-\alpha_u)(1-\alpha_k)}{1+\beta} \left[y(R_l) - (R_l-1) \frac{(1-\alpha_u)\alpha_k}{1-(1-\alpha_u)\alpha_k} \frac{y(R_l)}{R_l-1+\delta} \right] \\ &= \frac{\beta(1-\alpha_u)(1-\alpha_k)}{1+\beta} \frac{y(R_l)}{R_l-1+\delta} \left[R_l-1+\delta - (R_l-1) \frac{(1-\alpha_u)\alpha_k}{1-(1-\alpha_u)\alpha_k} \right]. \end{aligned}$$

If the capital share $(1-\alpha_u)\alpha_k$ is small enough so that $\frac{(1-\alpha_u)\alpha_k}{1-(1-\alpha_u)\alpha_k} < \frac{R_l-1+\delta}{R_l-1}$, then the entrepreneur's capital income is an increasing function of the lending interest rate R_l

$$w'_e(R_l) = \frac{\beta(1-\alpha_u)(1-\alpha_k)}{1+\beta} \frac{y(R_l)}{R_l} \left[R_l-1+\delta - (R_l-1) \frac{(1-\alpha_u)\alpha_k}{1-(1-\alpha_u)\alpha_k} \right] > 0.$$

Denote $\mathcal{R}(\tau_d, \tau_l)$ as a function of the policy parameters τ_d and τ_l that solves for the steady-state domestic lending rate R_l for given values of τ_d and τ_l . Then, we can express the entrepreneur's capital income as a function of τ_d and τ_l :

$$W_h^e \equiv \mathcal{W}_e(\tau_d, \tau_l) = w_e(\mathcal{R}(\tau_d, \tau_l)).$$

Then, using Proposition VII.1, the first derivatives of the entrepreneur's capital income with respect to τ_d and τ_l are given by,

$$\begin{aligned} \frac{\partial \mathcal{W}_e}{\partial \tau_d} &= w'_e(R_l) \frac{\partial \mathcal{R}}{\partial \tau_d} < 0, \\ \frac{\partial \mathcal{W}_e}{\partial \tau_l} &= w'_e(R_l) \frac{\partial \mathcal{R}}{\partial \tau_l} > 0. \end{aligned}$$

□

B.4. Proof for Proposition VII.5.

Proof. For convenience of references, we rewrite Equation (48), which expresses the capital income ratio between the household and the entrepreneur as a function of τ_d and τ_l :

$$\frac{W_h^c}{W_e^c} \equiv \mathcal{W}_c(\tau_d, \tau_l) = \frac{\alpha_u}{(1-\alpha_u)(1-\alpha_k)} \frac{(1-\tau_d)R^* - 1}{\mathcal{R}(\tau_d, \tau_l) - 1}.$$

where $\mathcal{R}(\tau_d, \tau_l)$ solves for the steady-state domestic lending rate R_l as a function of τ_d and τ_l , given by Proposition VII.1.

Then, the first derivatives of the capital income ratio with respect to τ_l is given by,

$$\frac{\partial \mathcal{W}_c}{\partial \tau_l} = - \frac{\alpha_u}{(1-\alpha_u)(1-\alpha_k)} \frac{(1-\tau_d)R^* - 1}{[\mathcal{R}(\tau_d, \tau_l) - 1]^2} \frac{\partial \mathcal{R}}{\partial \tau_l} < 0.$$

The first derivatives of the capital income ratio with respect to τ_d is given by,

$$\frac{\partial \mathcal{W}_c}{\partial \tau_d} = \frac{\alpha_u}{(1 - \alpha_u)(1 - \alpha_k)} \frac{-R^*[\mathcal{R}(\tau_d, \tau_l) - 1] - [(1 - \tau_d)R^* - 1] \frac{\partial \mathcal{R}}{\partial \tau_d}}{[\mathcal{R}(\tau_d, \tau_l) - 1]^2}.$$

where $\frac{\partial \mathcal{R}}{\partial \tau_d}$ is given by,

$$\begin{aligned} \frac{\partial \mathcal{R}}{\partial \tau_d} &= - \frac{-\frac{1}{\eta-1} \left(\frac{R_l}{(1-\tau_d)R^*} \right)^{\frac{1}{\eta-1}-1} \frac{R_l}{R^* \xi \eta} \frac{1}{(1-\tau_d)^2}}{-\frac{(1-\alpha_u)\alpha_k}{(R_l-1+\delta)^2} - \frac{1}{\eta-1} \left(\frac{R_l}{(1-\tau_d)R^*} \right)^{\frac{1}{\eta-1}-1} \frac{1}{(1-\tau_d)R^* \xi \eta} - \frac{1}{\Phi_b R_l}} \\ &= - \frac{R_l}{(1-\tau_d)} \frac{\frac{1}{\eta-1} \left(\frac{R_l}{(1-\tau_d)R^*} \right)^{\frac{1}{\eta-1}-1} \frac{1}{R^* \xi \eta} \frac{1}{(1-\tau_d)}}{\frac{(1-\alpha_u)\alpha_k}{(R_l-1+\delta)^2} + \frac{1}{\eta-1} \left(\frac{R_l}{(1-\tau_d)R^*} \right)^{\frac{1}{\eta-1}-1} \frac{1}{(1-\tau_d)R^* \xi \eta} + \frac{1}{\Phi_b R_l}} \\ &> - \frac{R_l}{(1-\tau_d)} = - \frac{\mathcal{R}(\tau_d, \tau_l)}{(1-\tau_d)}. \end{aligned}$$

Then, we have,

$$\begin{aligned} \frac{\partial \mathcal{W}_c}{\partial \tau_d} &= \frac{\alpha_u}{(1 - \alpha_u)(1 - \alpha_k)} \frac{-R^*[\mathcal{R}(\tau_d, \tau_l) - 1] - [(1 - \tau_d)R^* - 1] \frac{\partial \mathcal{R}}{\partial \tau_d}}{[\mathcal{R}(\tau_d, \tau_l) - 1]^2} \\ &< \frac{\alpha_u}{(1 - \alpha_u)(1 - \alpha_k)} \frac{-R^*[\mathcal{R}(\tau_d, \tau_l) - 1] + [(1 - \tau_d)R^* - 1] \frac{\mathcal{R}(\tau_d, \tau_l)}{(1-\tau_d)}}{[\mathcal{R}(\tau_d, \tau_l) - 1]^2} \\ &= \frac{\alpha_u}{(1 - \alpha_u)(1 - \alpha_k)} \frac{R^* - \frac{\mathcal{R}(\tau_d, \tau_l)}{(1-\tau_d)}}{[\mathcal{R}(\tau_d, \tau_l) - 1]^2} \end{aligned}$$

Note that under financial frictions, the domestic lending rate is absolutely higher than the domestic deposit rate, which implies that,

$$\mathcal{R}(\tau_d, \tau_l) = R_l > R = R^*(1 - \tau_d).$$

Then

$$\frac{\partial \mathcal{W}_c}{\partial \tau_d} < \frac{\alpha_u}{(1 - \alpha_u)(1 - \alpha_k)} \frac{R^* - \frac{\mathcal{R}(\tau_d, \tau_l)}{(1-\tau_d)}}{[\mathcal{R}(\tau_d, \tau_l) - 1]^2} < 0.$$

□