Capital Controls and Income Inequality

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ABSTRACT. We examine the distributional implications of capital account policy in a small open economy model with heterogeneous agents and financial frictions. Households save through deposits in both domestic and foreign banks. Entrepreneurs finance investment with borrowed funds from domestic banks and foreign investors. Domestic banks engage in costly intermediation of deposits from households and loans to entrepreneurs. Government capital account policy consists of taxes on outflows and inflows. Given policy, a temporary decline in the world interest rate leads to a surge in inflows, benefiting entrepreneurs and hurting households. Raising inflow taxes or reducing outflow taxes mitigate this redistribution. However, in the long run liberalization of either inflows or outflows reduces inequality. The model’s short-run implications are supported by empirical evidence. Based on instrumental variable estimation with a panel of emerging market economies, we demonstrate that increases in private capital inflows raise income inequality, while increases in outflows reduce it. These effects are significant and robust to a wide variety of empirical specifications.
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)].

Capital flows may also have implications for the distribution of income. During the surge period, the benefits are likely to disproportionately fall on agents who are more adept at capitalizing on these inflows, exacerbating the skewness of the distribution of income. For example, Furceri and Loungani (2018) find that episodes of capital account liberalization are associated with increased inequality as measured by Gini coefficients. Furceri et al. (2019) examine cross-country industry-level data and obtain similar results. Moreover, when inflow reversals inevitably do occur, their burdens are likely to fall disproportionately on the poor [e.g. de Haan and Sturm (2016)].

Policymakers have gradually recognized the potential adverse effects of excessive capital flows on financial stability and income distributions for EMEs. For example, while the IMF has traditionally advocated the benefits of liberalizing EME capital accounts, 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).

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.\(^1\) 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.

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

\(^1\)Furceri et al. (2019) find that countries with less developed financial systems experience larger increases in income inequality following capital account liberalization.
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 to finance investment spending. 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 borrow from banks to finance spending, whereas households do not have access to the capital accumulation technology and they save in risk-free bank deposits. Thus, changes in capital flows impact on income distributions through changes in capital returns. We use our model to study the implications of changes in capital account policies and external shocks to capital flows on 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.

Our analytical solution to the steady-state equilibrium shows that a permanent reduction in either capital inflow taxes or outflow taxes can raise the household’s share of income and thus reduce income inequality. Reducing outflow taxes directly raises the deposit interest rate facing the household and therefore increases household income. The financial intermediary passes 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, domestic loan-to-output ratio declines, reducing the credit spread. Thus, the lending rate rises by less than the deposit rate. In the steady state, the rate of return on 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, reflecting 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 return on capital equals the domestic lending interest rate. 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 policies. Reducing the inflow taxes 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 short run, a temporary decline in the foreign interest rate leads to a surge in capital inflows to the small open economy. These capital inflows reduce the financing costs for investment, boosting the value of capital (Tobin’s q) and the entrepreneur’s income. Given capital account policies, the shock to the foreign interest rate also reduces the domestic deposit rate, depressing the household’s income. As a result, capital inflows skew the domestic income distribution in favor of the entrepreneur and raise the share of the entrepreneur’s income during the transition periods. Policy responses, such as transitory tightening of capital inflow controls or relaxation of outflow controls can partly stabilize the changes in capital flows, and thereby mitigate the increases in income inequality.

We solve for optimal capital account policies for a planner with a range of Pareto weights over the two types of agents’ welfare. We find that, in response to a transitory decline in the foreign interest rate, a planner who assigns a larger weight on household welfare chooses to raise inflow taxes or reduce outflow taxes more aggressively. In contrast, in the long run, a planners who favors households more would choose larger reductions in taxes on both inflows and outflows.

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—induced by global interest rate shocks 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 the interactions between changes in the two-year U.S. Treasury yields and 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. We also include country fixed effects as an additional instrumental variable, with the implicit assumption that fixed country characteristics affect annual changes in income distribution only through their impacts on capital flows.

Our instrumental-variable regressions indicate a significant impact of short-run changes in private capital flows on income inequality. Under our baseline specification, a one standard deviation annual increase in private inflows is associated on average with a 20 basis point increase in a country’s Gini coefficient in that year, while
a one standard deviation increase in private outflows is associated with a 23 basis point decrease in the Gini. These numbers are statistically significant and economically plausible. These results are robust to a wide variety of empirical specifications, measurements, and data samples.

II. Related literature

Our paper contributes to the literature on 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 (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. Temporary capital account restrictions can help stabilize large fluctuations in capital inflows (Ostry et al., 2010). 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).

Our work is closely related to a few theoretical analyses of capital account liberalization. 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 entreprises (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

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2However, evidence that capital controls themselves inhibit growth is limited (e.g. Jeanne (2013)).
3However, by limiting the pressure for capital inflows, capital account restrictions can themselves ease the need for undertaking such costly sterilization activity [e.g. Liu and Spiegel (2015)].
4See Erten et al. (2019) for a recent survey of the theoretical and empirical literature on capital controls.
loan rates faced by private firms. Capital account liberalization leads to a trade-off between production allocative efficiency stemming from reallocations between the two sectors and intertemporal allocative efficiency stemming from the households’ consumption-savings decisions. Unlike these studies, our focus here is on the impact of capital account liberalization on income distribution.

Distributional issues are also 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.\(^5\) 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 and the skewness of income distribution is increased. In contrast, our analysis considers the implications of liberalization of gross capital flows (inflows vs. outflows), which can have quite different implications for income distributions. As a consequence, we demonstrate that distinct inflow and outflow policies can be important for achieving desired distributional outcomes. Moreover, our dynamic specification illustrates the disparities in the implications of temporary and permanent changes in capital control policy.

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. The main difference between households and entrepreneurs is that entrepreneurs externally finance and accumulate capital; while households do not have capital investment technology and invest in risk free bank deposits and foreign assets.

Entrepreneurs and households both live for two periods—young and old. The household works, consumes, and saves for retirement when young and consumes the accumulated savings when old. The entrepreneur works, consumes, accumulates capital and borrows when young, and consumes using returns from holding capital minus his debt obligations when old. Both entrepreneurs and households transfer an exogenous

\(^5\)They obtain similar results for easing in quantitative restrictions on the share of bank financing from foreign investors, which are exogenous in their model.
fraction of their wealth to the next generation when they are old. The young entrepreneur finances the acquisition of capital through his labor income, borrowing, and his transfers from the old generation.

Banks operate in a perfectly competitive market, taking as given market interest rates on deposits and lending. The presence of financial intermediation costs facing banks gives rise to a credit spread, driving a wedge between the deposit and lending interest rates. Under its capital control policy regime, the government imposes taxes on both capital inflows and outflows.

III.1. The households. In each period, the economy has a continuum of identical households with measure $\theta$. A representative household born in period $t$ has the utility function

$$\max E \left\{ \ln(C^y_{ht}) + \beta \ln(C^o_{h,t+1}) \right\},$$

where $C^y_{ht}$ denotes consumption of the household when young, $C^o_{h,t+1}$ denotes consumption of the household when old.

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

$$C^y_{ht} + D_t + B^d_{ft} = w_t H_{ht} + \Gamma_{ht},$$

and

$$C^o_{h,t+1} = R_tD_t + (1 - \tau_d)R^*B^d_{ft} + T_{h,t+1} - \Gamma_{h,t+1}.$$  

When young, the household consumes $C^y_{ht}$ and saves in domestic bank deposits $D_t$ and foreign deposits $B^d_{ft}$. Each young household supplies $H_{ht}$ hours to firms at the competitive wage rate $w_t$. The young household also receives bequest income $\Gamma_{ht}$ from the previous old generation.

When old, the household consumes its asset holdings, which consist of interest earnings on domestic bank deposits $R_tD_t$ and after-tax earnings on foreign deposits $(1 - \tau_d)R^*B_{ft}$. Here, the term $R_t$ denotes the risk-free deposit rate, $R^*$ denotes the world interest rate, and $\tau_d$ denotes a tax on earnings from foreign assets (i.e., a tax on capital outflows). In addition, the old household also receives $T_{ht}$, the sum of dividend income from domestic banks and lump-sum transfers from the government. The old household leaves a bequest $\Gamma_{h,t+1}$ to the then-young generation. For simplicity, we

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6 This assumption is made to facilitate our numerical solutions, and drives none of our results.
assume that the bequest is a constant fraction $\Gamma$ of the old individual’s wealth, and it is given by
\[ \Gamma_{h,t+1} = \Gamma \left\{ R_t D_t + (1 - \tau_d)R_t^* B_{ft}^d + T_{h,t+1} \right\}. \] (4)

The household’s optimizing decisions are summarized by the following equations:
\[ \Lambda_{y_{ht}} = \frac{1}{C_{y_{ht}}}, \] (5)
\[ \Lambda_{o_{ht}} = \frac{1}{C_{o_{ht}}}, \] (6)
\[ 1 = \mathbb{E}_t \beta R_t \frac{\Lambda_{o_{h,t+1}}}{\Lambda_{y_{ht}}}, \] (7)
\[ 1 = \mathbb{E}_t \beta (1 - \tau_d)R_t^* \frac{\Lambda_{o_{h,t+1}}}{\Lambda_{o_{ht}}}, \] (8)

where $\Lambda_{y_{ht}}$ and $\Lambda_{o_{ht}}$ denotes the Lagrangian multiplier for the budget constraints (2)-(3).

The intertemporal Euler equations (7) and (8) imply the no-arbitrage condition
\[ R_t = (1 - \tau_d)R_t^*. \] (9)

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

III.2. The entrepreneurs. There is a continuum of entrepreneurs with measure $1 - \theta$. The representative entrepreneur born in period $t$ has the utility function
\[ \max \mathbb{E} \left\{ \ln(C_{y_{et}}) + \beta \ln(C_{o_{e,t+1}}) \right\}, \] (10)

where $C_{y_{et}}$ and $C_{o_{e,t+1}}$ denote the entrepreneur’s consumption when young and old, respectively.

The entrepreneur chooses consumption, external borrowings $B_{et}$, and investment $I_t$ to maximize the utility function (10) subject to the budget constraints
\[ C_{y_{et}} + q_t^k K_t^o + I_t + \frac{\Omega_k}{2} \left( \frac{I_t}{K_t^o} - \bar{I}_t \right)^2 K_t^o = w_t H_{et} + B_{et} + \Gamma_{et}, \] (11)
\[ C_{o_{e,t+1}} = \left[ q_{t+1}^k (1 - \delta) + r_{t+1}^k \right] (K_t^o + I_t) - R_{tt} B_{et} + T_{e,t+1} - \Gamma_{e,t+1}. \] (12)

where $H_{et}$ denotes the young entrepreneur’s inelastic labor supply.

When young, the entrepreneur consumes $C_{y_{et}}$, 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 finances
these spending by wage income $w_tH_{et}$, external debt $B_{et}$ at the loan interest rate $R_{lt}$, and bequest income $\Gamma_{et}$ from the previous old generation.

When old, the entrepreneur receives the returns from holding the capital, 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 $T_{e,t+1}$, which includes lump-sum transfers from the government and dividends distributed from the bank. The old entrepreneur use these income to purchase consumption goods $C_{o,e,t+1}$, repays the outstanding debts $R_{lt}B_{et}$, and leaves bequests $\Gamma_{e,t+1}$ to the then-young generation. The bequest is a constant fraction of the old entrepreneur’s accumulated wealth and is given by

$$\Gamma_{e,t+1} = \Gamma \left\{ [q_{t+1}^k(1 - \delta) + r_{t+1}^k] (K_{t}^o + I_t) - R_{lt}B_{et} + T_{e,t+1} \right\}. \quad (13)$$

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

$$\Lambda_{y_{et}} = \frac{1}{C_{y_{et}}}, \quad (14)$$

$$\Lambda_{o_{et}} = \frac{1}{C_{o_{et}}}, \quad (15)$$

$$1 = E_{t+1}^\beta R_{lt} \frac{\Lambda_{o_{et+1}}}{\Lambda_{y_{et}}}, \quad (16)$$

$$q_t^k + \frac{\Omega_k}{2} \left( \frac{I_t}{K_t^o} - \bar{I} \right)^2 - \Omega_k \left( \frac{I_t}{K_t^o} - \bar{I} \right) \frac{I_t}{K_t^o} = E_{t+1}^\beta \frac{\Lambda_{o_{et+1}}}{\Lambda_{y_{et}}} \left[ q_{t+1}^k(1 - \delta) + r_{t+1}^k \right], \quad (17)$$

$$1 + \Omega_k \left( \frac{I_t}{K_t^o} - \bar{I} \right)^2 = E_{t+1}^\beta \frac{\Lambda_{o_{et+1}}}{\Lambda_{y_{et}}} \left[ q_{t+1}^k(1 - \delta) + r_{t+1}^k \right], \quad (18)$$

where $\Lambda_{y_{et}}$ and $\Lambda_{o_{et}}$ denote the Lagrangian multipliers for the budget constraints (11)-(12).

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

$$K_t = K_t^o + I_t, \quad (19)$$

and

$$K_t^o = (1 - \delta)K_{t-1}. \quad (20)$$

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

$$K_t = (1 - \delta)K_{t-1} + I_t. \quad (21)$$
III.3. Firms. In each period, perfectly competitive firms with measure one produce a homogeneous good $Y_t$ using capital input $K_{t-1}$ and labor inputs $H_{ht}$ from the households and $H_{et}$ from the entrepreneurs, with the production function

$$Y_t = A(K_{t-1})^{1-\alpha}(H_{ht} + H_{et})^\alpha,$$

where $A$ denotes the total factor productivity, and the parameter $\alpha \in (0, 1)$ is the labor input elasticity in the production function.

The representative firm’s cost-minimizing decisions imply the conditional factor demand functions

$$w_t(H_{ht} + H_{et}) = \alpha Y_t$$

and

$$r_k^k K_{t-1} = (1 - \alpha)Y_t.$$

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:

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

where $\eta > 1$. Strict convexity of $\Xi(\cdot)$ indicates increasing costs due to a capacity constraint, e.g. the scarcity of available managerial time.

The bank collects deposits $D_t$ in the largest quantity that can be repaid from the proceeds of its loans, which means that the bank faces the constraint:

$$R_{lt} B_t = R_t D_t.$$

Any excess funds received from depositors that are not lent out or used to pay the resource costs of loan origination are distributed to the bank’s shareholders. Real distributions in period $t$ equal

$$\Pi^b_t = D_t - B_t - \Xi \left( \frac{B_t}{Y_t} \right) Y_t$$

(27)
The bank takes aggregate output $Y_t$ as given and chooses the loan amount $B_t$ and the deposit amount $D_t$ to maximize its profits $\Pi_t$ in Equation (27), subject to the constraint (26).

The first order condition for optimal credit supply is given by,

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

where the credit spread between loan rate and deposit rate is endogenously determined by the bank loan to output radio $\frac{B_t}{Y_t}$.

III.5. **Foreign investors.** Foreign investors lend to domestic entrepreneurs at the market loan rate $R_{lt}$. Foreign investors face an investment income tax $\tau_l$, with the after-tax returns $(1 - \tau_l)R_{lt}$. External debt also requires a risk premium. Under these assumptions, no arbitrage implies that

$$(1 - \tau_l)R_{lt} = R_t^* \Phi \left( \frac{B_{lt}^l}{Y_t} \right),$$

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

$$\Phi \left( \frac{B_{lt}^l}{Y_t} \right) = \exp \left[ \Phi_b \left( \frac{B_{lt}^l}{Y_t} - \kappa_f \right) \right].$$

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

III.6. **Market clearing and equilibrium.** An equilibrium consists of sequences of allocations $\{C_{ty}, C_{to}, I_t, K_t, Y_t, H_t, B_t, B_{lt}^l, NX_t\}$ and prices $\{w_t, R_t, q_k^t, R_{lt}\}$ that solve the optimizing problems for the workers, the entrepreneurs, and the banks. In the equilibrium, final goods market clearing implies that the trade surplus is given by

$$NX_t = Y_t - C_{ht}^y - C_{ht}^o - C_{et}^y - C_{et}^o - I_t - \frac{\Omega_k}{2} \left( \frac{I_t}{K_t^o} - \frac{\bar{I}}{\bar{K}^o} \right)^2 K_t^o - \Xi \left( \frac{B_t}{Y_t} \right) Y_t.$$
The loan market clearing condition is given by

$$B_t + B_{f,t}^d = B_{et}.$$  \hfill (32)

The labor market clearing condition is given by

$$H_{ht} + H_{et} = 1. \hfill (33)$$

The aggregate production function is then given by

$$Y_t = AK^{1-\alpha}_t. \hfill (34)$$

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.

$$T_{ht} = \theta(\tau_d R_{t-1}^* B_{f,t-1}^d + \tau_l R_{t,t-1} B_{f,t-1}^l + \Pi_t^b). \hfill (35)$$

$$T_{et} = (1 - \theta)(\tau_d R_{t-1}^* B_{f,t-1}^d + \tau_l R_{t,t-1} B_{f,t-1}^l + \Pi_t^b). \hfill (36)$$

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

$$NX_t + (R_{t-1}^* - 1)B_{f,t-1}^d - R_{t-1}^* \Phi \left( \frac{B_{f,t-1}^l}{Y_{t-1}} \right) - 1 B_{f,t-1}^l = (B_{f,t}^d - B_{f,t}^l) - (B_{f,t-1}^d - B_{f,t-1}^l). \hfill (37)$$

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

$$GDP_t = C^y_{ht} + C^o_{ht} + C^y_{et} + C^o_{et} + I_t + NX_t. \hfill (38)$$

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

$$W^c_{ht} = (R_{t-1} - 1)D_{t-1} + [(1 - \tau_d)R_{t-1}^* - 1]B_{f,t-1}^d. \hfill (39)$$
The entrepreneur’s capital income consists of returns on capital net of interest payments on debt and expenditures on investment. It is given by

$$W_{et}^c = \left[ q_t^k (1 - \delta) + r_t^k \right] (K_{t-1}^o + I_{t-1}) - (R_{t,t-1} - 1)B_{et,t-1}$$

$$- \left[ q_{t-1}^k K_{t-1}^o + I_{t-1} + \frac{\Omega_k}{2} \left( \frac{I_{t-1}}{K_{t-1}^o} - \bar{I}_{t-1} \right)^2 K_{t-1}^o \right].$$

(40)

The representative household and the representative entrepreneur also receive labor income when they are young. These are given by

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

(41)

where we have used the assumption that labor supplies are inelastic and that the population sizes of the households and the entrepreneurs are $\theta$ 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

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

(42)

where $\omega$ denotes the Pareto weight on the household’s welfare.

IV. Analytical steady-state results

This section provides some analytical characterizations of the steady-state implications of capital controls for income distributions between the two types of agents. We focus on the interior equilibrium with positive gross capital flows (both inflows and outflows).\textsuperscript{8} To keep the analytics tractable, we focus on a special case no bequests ($\Gamma = 0$) or lump-sum transfers ($T_{ht} = T_{et} = 0$).\textsuperscript{9}

IV.1. 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. (9) solves for the domestic deposit rate:

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

(43)

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

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\textsuperscript{8}Detailed analytical derivations of the steady-state equilibrium are shown in the Appendix.

\textsuperscript{9}This simplification assumes that the income taxes on capital flows and the bank’s profit, which are trivial (around 2% of output) under our calibration, are not distributed to the household and the entrepreneur but are discarded.
The optimal credit supply condition Eq. (28) implies that the domestic lending rate depends on the deposit rate and the credit spread

\[ R_l = R \left[ 1 + \xi \eta \left( \frac{B}{Y} \right)^{\eta - 1} \right] \tag{44} \]

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

Reducing inflow taxes induces more foreign lending to domestic firms, crowding out domestic lending and thus reducing the loan-to-output ratio. This in turn reduces the domestic lending interest rate faced by the entrepreneurs, as we formally establish in Proposition IV.1 below.

Reducing outflow taxes 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 the reduction in the credit spread. Of course, the loan-to-output ratio is also endogenous to changes in the lending rate. Despite these two opposing effects, Proposition IV.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 IV.1.** Denote by \( R(\tau_d, \tau_l) \) the equilibrium lending interest rate as a function of the policy parameters \( \tau_d \) and \( \tau_l \). In the steady-state equilibrium, the lending rate \( R(\tau_d, \tau_l) \) decreases with \( \tau_d \) \( (\frac{\partial R}{\partial \tau_d} < 0) \) and increases with \( \tau_l \) \( (\frac{\partial R}{\partial \tau_l} > 0) \).

*Proof.* We provide a proof in the Appendix. \( \square \)

Changes in the domestic lending rate drive changes in capital returns, which in turn determine the equilibrium levels of capital stock and output. In the Appendix, we show that aggregate output decreases with domestic lending rate and is given by

\[ Y = \left( \frac{1 - \alpha}{R_l - 1 + \delta} \right)^{\frac{1 - \alpha}{\alpha}} . \tag{45} \]

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

**Proposition IV.2.** Denote by \( Y(\tau_d, \tau_l) \) the aggregate output as a function of the policy parameters \( \tau_d \) and \( \tau_l \). In the steady state equilibrium, aggregate output \( Y(\tau_d, \tau_l) \) increases with \( \tau_d \) \( (\frac{\partial Y}{\partial \tau_d} > 0) \) and decreases with \( \tau_l \) \( (\frac{\partial Y}{\partial \tau_l} < 0) \).
Proof. This result follows immediately from Proposition IV.1 and the negative relation between \( Y \) and \( R_t \) shown in Eq. (45).

IV.2. Household income. We now examine the steady-state implications of capital account policies for the representative household’s labor income and capital income. The optimal cost-minimizing solution (23) implies that the household’s labor income is a constant fraction of output, which is given by

\[
W_h^l = \alpha \theta Y(\tau_d, \tau_l).
\]

(46)

Thus, from Proposition IV.2, the household’s labor income increases with \( \tau_d \) and decreases with \( \tau_l \).

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

\[
D + B_d^f = \frac{\beta \alpha \theta}{1+\beta} Y(\tau_d, \tau_l).
\]

(47)

The household’s capital income is then given by,

\[
W_h^c = [(1-\tau_d)R^* - 1](D + B_d^f) = [(1-\tau_d)R^* - 1]\frac{\beta \alpha \theta}{1+\beta} Y(\tau_d, \tau_l).
\]

(48)

This relation implies that liberalizing capital outflow controls (decreasing \( \tau_d \)) increases the household’s capital income by raising their return to savings. However, the consequent increase in domestic interest rates depresses output (see Proposition IV.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 \((1-\alpha)\). As implied by Eq. (45), 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.\(^{10}\)

By comparison, liberalizing capital inflow controls (decreasing \( \tau_l \)) has a positive effect on the household’s labor income, without affecting the returns on household

\(^{10}\)In the appendix, we prove that the household’s capital income decreases with the capital outflow tax under the condition that \( (\frac{\alpha}{1-\alpha} > \frac{R-1}{R} ) \), where \( R \) is the steady-state domestic deposit rate. In EMEs with the labor share \( \alpha \) no less than 50%, this condition is always satisfied.
savings. Consequently, reducing inflow taxes unambiguously raises household capital income.

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

**Proposition IV.3.** Denote by $W_h(\tau_d, \tau_l)$ the household’s capital income as a function of the policy parameters $\tau_d$ and $\tau_l$. In the steady-state equilibrium, the household’s capital income $W_h(\tau_d, \tau_l)$ decreases with $\tau_d$ (i.e., $\frac{\partial W_h}{\partial \tau_d} < 0$). Furthermore, if the labor share $\alpha$ in production is sufficiently large (in particular, if $\frac{\alpha}{1-\alpha} > \frac{(1-\tau_d)R^*-1}{(1-\tau_d)R^*}$), then $W_h(\tau_d, \tau_l)$ also decreases with $\tau_l$ (i.e., $\frac{\partial W_h}{\partial \tau_l} < 0$).

**Proof.** We provide a proof in the Appendix.

### IV.3. Entrepreneur income.

We next examine the steady-state implications of capital account policies for the representative entrepreneur’s income. The optimal cost-minimizing solution (23) implies that the entrepreneur’s labor income is a constant fraction of output given by

$$W_e^l = \alpha(1 - \theta)Y(\tau_d, \tau_l). \tag{49}$$

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.

Under the optimal borrowing decision, the entrepreneurs consume a fraction $\frac{\beta}{1+\beta}$ of their labor income in bank deposits and keep the rest as their net worth for capital investment. The entrepreneur finances capital spending by both the internal funds (savings) and external debt, with the net worth given by

$$K - B_e = \frac{\beta \alpha(1 - \theta)}{1 + \beta}Y(\tau_d, \tau_l). \tag{50}$$

The entrepreneur’s capital income is then given by

$$W_e^c = (R_l - 1)(K - B_e) \equiv [R(\tau_d, \tau_l) - 1] \frac{\beta \alpha(1 - \theta)}{1 + \beta}Y(\tau_d, \tau_l). \tag{51}$$

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 \((1 - \alpha)\). As implied by Eq.\((45)\), the smaller the production share of capital, the less sensitive the output responds 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.\(^{11}\)

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

Proposition IV.4. Denote by \(W_e(\tau_d, \tau_l)\) the entrepreneur’s capital income as a function of the policy parameters \(\tau_d\) and \(\tau_l\). If the labor share \(\alpha\) is sufficiently large (in particular, if \(\frac{\alpha}{1 - \alpha} > \frac{R(\tau_d, \tau_l) - 1}{R(\tau_d, \tau_l)}\)), then the entrepreneur’s capital income \(W_e(\tau_d, \tau_l)\) decreases with \(\tau_d\) (i.e., \(\frac{\partial W_e}{\partial \tau_d} < 0\)) and increases with \(\tau_l\) (i.e., \(\frac{\partial W_e}{\partial \tau_l} > 0\)).

Proof. We provide a proof in the Appendix. □

IV.4. Income distribution. Last, we 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. \((41)\)), the relative labor income of household is also constant and invariant to capital account policy:

\[
\frac{W_l}{W_e} = \frac{\theta}{1 - \theta}. \quad (52)
\]

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 \((48)\) and \((51)\), the capital income ratio is given by,

\[
\frac{W_e}{W_l} = \left[\frac{1}{\mathcal{R}(\tau_d, \tau_l) - 1}\right]^{\frac{\beta(1 - \theta)}{1 + \beta}} \mathcal{Y}(\tau_d, \tau_l) = \frac{\theta}{1 - \theta} \frac{(1 - \tau_d)R^* - 1}{\mathcal{R}(\tau_d, \tau_l) - 1}. \quad (53)
\]

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 \(\tau_l\)) 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.

\(^{11}\)In the appendix, we prove that the entrepreneurs’ capital income increases with the domestic lending rate under the condition that \(\frac{\alpha}{1 - \alpha} > \frac{R_l - 1}{R_l}\), where \(R_l\) is the steady-state domestic lending rate. In EMEs with the labor share \(\alpha\) no less than 50%, this condition is always satisfied.
Lowering capital outflow taxes (i.e., decreasing $\tau_d$) raises the household’s return to saving and the entrepreneur’s return to capital at the same time, but with different magnitudes. In particular, liberalizing capital outflows directly raises the domestic deposit rate through the no-arbitrage condition (Eq. (43)). 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 IV.5.** Denote by $W_c(\tau_d, \tau_l)$ the household-to-entrepreneur capital income ratio as a function of the policy parameters $\tau_d$ and $\tau_l$. The household’s relative capital income $W_c(\tau_d, \tau_l)$ decreases with both $\tau_d$ and $\tau_l$ (i.e., $\frac{\partial W_c}{\partial \tau_d} < 0$ and $\frac{\partial W_c}{\partial \tau_l} < 0$).

*Proof.* We provide a proof in the Appendix. \hfill \Box

**V. Quantitative results**

Our analytical results show the steady-state relations between capital account policies and income distribution in the special case without bequests and government transfers. We now examine the equilibrium in our more general model setup and study the model’s transition dynamics following a foreign interest rate shock. For this purpose, we solve the model numerically based on calibrated parameters.

**V.1. Calibration.** We assume that 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 range of the empirical estimates in the literature. We set the foreign interest rate to $R^* = 1.480$, implying an annualized interest rate of 4%. We calibrate the bequest ratio to $\Gamma = 0.53$ such that the steady-state domestic credit to output ratio $(\frac{B}{Y})$ equals 0.08, which is consistent with the data of emerging market economies.\footnote{The domestic credit to output ratio varies a lot among EMEs. Based on data from the World Bank, the ratio of domestic bank credit to private sectors as a fraction of output per annum ranges from 20% in Mexico to 60% in Brazil to over 120% in Malaysia and Vietnam.}
We calibrate the labor income share to $\alpha = 0.5$, in line with the estimates by Brandt et al. (2008) for China and slightly lower but close to the range of global labor income share estimated by Karabarbounis and Neiman (2014). We set $\theta = 2/3$ such that the population share of the entrepreneur is $1 - \theta = 1/3$, consistent with the employment share of the self-employed in EMEs such as Brazil, Mexico, and Malaysia.

For the parameters related to external debt, we set the risk premium parameter on foreign debt to $\Phi_b = 3$, which is consistent with the estimate for the elasticity of emerging market sovereign bond spread to external debt-to-output ratio estimated by Bellas et al. (2010). We set the desirable foreign debt-to-output ratio $\kappa_f = 0.04$, following the 2002 “sustainability framework” of the IMF, which notes that 40% is the suggested external debt-to-output ratio that should not be breached on a long-term basis.\(^{13}\)

For the parameters related to the intermediation technology $\Xi(B)$, we set $\xi = 0.57$ such that the steady-state credit spread equals 2.0 percentage points per annum, following Cúrdia and Woodford (2016).\(^{14}\) We set $\eta = 1.6$ such that a 1% increase in the volume of domestic bank credit increases the credit spread by 0.01% per annum.\(^{15}\)

For the policy parameters, we set the weight of the household in the planner’s objective function $\omega = 0.5$ (equally weighting the utilities of the households and entrepreneurs) as the baseline case. We choose the capital control policy parameters $\tau_d$ and $\tau_l$ as the optimal values that maximize the planner’s objective function (42) in the steady state. Under our calibration, $\tau_d = 1.64\%$ and $\tau_l = 10.17\%$.\(^{16}\)

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

\(^{13}\)International Monetary Fund, 2002, “Assessing Sustainability,” SM/02/06.

\(^{14}\)This calibration means $R_l/R = 1 + 0.02 \times 10$ in our decadal model.

\(^{15}\)This implies that $d\ln(R_l/R)/d\ln(B) = 0.01 \times 10 = 0.1$ in our decadal model, where $d\ln(R_l/R)/d\ln(B) = 0.01 = \frac{\xi \eta (\eta - 1) B^{\eta - 1}}{1 + \xi \eta B^{\eta - 1}} = \frac{\eta - 1}{R_l/R}$ can be derived using (28). 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.

\(^{16}\)The high capital inflow tax is driven by the planner’s desire to correct the over-borrowing externality arising from the risk premium on external debt.
### Table 1. Calibration

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\beta$</td>
<td>Household discount rate</td>
<td>0.665</td>
</tr>
<tr>
<td>$\delta$</td>
<td>Capital depreciation rate</td>
<td>0.651</td>
</tr>
<tr>
<td>$\Omega_k$</td>
<td>Capital adjustment cost</td>
<td>5</td>
</tr>
<tr>
<td>$r^*$</td>
<td>Foreign interest rate</td>
<td>1.480</td>
</tr>
<tr>
<td>$\Gamma$</td>
<td>Transfer from old to young</td>
<td>0.53</td>
</tr>
<tr>
<td>$\alpha$</td>
<td>Labor income share</td>
<td>0.5</td>
</tr>
<tr>
<td>$\theta$</td>
<td>Household labor income share</td>
<td>0.67</td>
</tr>
<tr>
<td>$\Phi_b$</td>
<td>Elasticity of risk premium to external debt-to-GDP ratio</td>
<td>3</td>
</tr>
<tr>
<td>$\kappa_f$</td>
<td>Desirable foreign debt-to-output ratio</td>
<td>0.04</td>
</tr>
<tr>
<td>$\xi$</td>
<td>Scale parameter in intermediation technolog</td>
<td>0.57</td>
</tr>
<tr>
<td>$\eta$</td>
<td>Elasticity parameter in intermediation technolog</td>
<td>1.6</td>
</tr>
<tr>
<td>$\omega$</td>
<td>Weight of the household in the planner’s objective function</td>
<td>0.5</td>
</tr>
<tr>
<td>$\tau_d$</td>
<td>Tax rate on foreign asset</td>
<td>1.64%</td>
</tr>
<tr>
<td>$\tau_l$</td>
<td>Tax rate on foreign debt</td>
<td>10.17%</td>
</tr>
</tbody>
</table>
V.2. Changes in capital account policies and transition dynamics. We solve the model based on the calibrated parameters. We use the model to study the transition dynamics following transitory changes in capital account policies.

V.2.1. Temporary changes in capital inflow taxes. We consider a temporary increase in the capital inflow tax under the assumption that the capital inflow tax follows:

$$\tau_{lt} = \rho \tau_{l,t-1} + (1 - \rho) \bar{\tau}_l + \epsilon_{lt}. \quad (54)$$

where $\bar{\tau}_l$ denotes the capital inflow tax in the steady state. $\epsilon_{lt}$ denotes the unexpected change in the capital inflow tax. The persistence parameter $\rho$ is set to 0.9, implying an annualized autocorrelation ratio of 0.9 in the capital inflow tax.

Figure 1 and Figure 2 display the impulse responses to a 5% temporary increase in the capital inflow tax ($\epsilon_{l1} = 5\%$). The increase in capital inflow taxes crowds out capital inflows and, therefore, the entrepreneurs have to rely more on domestic bank loans. The increase in domestic bank loans leads to an increase in the credit spread and a rise in the lending rate. The higher domestic lending rate reduces capital investment as well as the price of capital, which reduces entrepreneur capital income. Meanwhile, the household capital income barely responds to the shock as the domestic deposit rate remains constant.

V.2.2. Temporary changes in capital outflow taxes. Now, consider a temporary increase in the capital outflow tax under the assumption that the capital outflow tax follows:

$$\tau_{dt} = \rho \tau_{d,t-1} + (1 - \rho) \bar{\tau}_d + \epsilon_{dt}. \quad (55)$$

where $\bar{\tau}_d$ denotes the capital outflow tax in the steady state. $\epsilon_{dt}$ denotes the unexpected change in the capital outflow tax. The persistence parameter $\rho$ is set to 0.9, implying an annualized autocorrelation ratio of 0.9 in the capital outflow tax.

Figure 3 and Figure 4 display the impulse responses to a 5% temporary increase in the capital outflow tax ($\epsilon_{d1} = 5\%$). The increase in capital outflow taxes reduces the after-tax return on foreign assets and leads to a decrease in domestic deposit rate under the no arbitrage condition. The decreased asset returns have a negative effect on household capital income.

Banks responds to the decline in the deposit interest rate by lowering the market lending rate. The decreased lending rate encourages entrepreneur investment and therefore raises the capital stock. As a result, the price of capital rises, raising the entrepreneur’s capital income.
V.3. **Foreign interest rate shocks and transition dynamics.** Following the onset of the 2008-09 global financial crisis, monetary policy easing in advanced economies have led to surges in capital inflows to emerging market economies (EMEs). We now examine the implications of capital flows induced by a reduction in the foreign interest rate for the macro economy and income distribution. We also study optimal responses of capital account policies following the foreign interest rate shock.

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 gradually returns to the initial level thereafter. In particular, the foreign interest rate follows the process

\[
R^*_t = \begin{cases} 
R^*_0 = 1.04^{10}, & \text{if } t = 0, \\
R^*_1 = 1.03^{10}, & \text{if } t = 1, \\
R^*_{t-1} \rho (t-1) R^*_0 \rho t - 1, & \text{if } t \geq 2.
\end{cases}
\]

(56)

where we set the persistence parameter \( \rho \) to 0.9, implying an annualized autocorrelation of 0.9.

V.3.1. **Baseline capital account policies.** We first examine the baseline case with capital account policies held constant. Figure 5 and Figure 6 display the impulse responses to a temporary decline in the foreign interest rate. The shock reduces the household’s return on foreign deposits, discouraging capital outflows and pushing down domestic deposit rate. Meanwhile, the lower foreign interest rate induces more foreign capital inflows, pushing down the domestic lending interest rate. The fall in the domestic lending rate stimulates investment and production.

The expansion in domestic production raises the labor income for both types of agents. However, the capital incomes of the household and the entrepreneur capital income move in opposite directions. Household capital income falls, since the deposit rate declines. The entrepreneur capital income increases in the short run since the decline in the lending interest rate stimulates investment and raises the price of capital. Over time, as the capital stock gradually rises, the return on capital gradually declines, reducing the entrepreneur’s capital income in the long run. In the baseline case, the fall in the foreign interest rate reduces the household welfare, but improves the entrepreneur’s welfare.

Stimulated by the reduction in the domestic lending rate, bank loans increase, widening the credit spread. The increase in the credit spread partially offsets the
decline in the domestic lending rate, mitigating the distributional effect of the changes in capital flows stemming from the foreign interest rate shock.

V.3.2. Optimal capital account policies. We now examine the transition dynamics under optimal capital account policy following the foreign interest rate shock. 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 taxes constant at the calibrated value. Let \( \tau_{d0}, \tau_{d1} \) and \( \tau_{d2} \) represent the tax rate 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

\[
\tau_{dt} = \begin{cases} 
\tau_{d0}, & \text{if } t = 0, \\
\tau_{d1}, & \text{if } t = 1, \\
\rho \tau_{d,t-1} + (1 - \rho) \tau_{d2}, & \text{if } t \geq 2.
\end{cases}
\] (57)

Similarly, in the case with optimal inflow taxes, we hold outflow taxes constant at the calibrated value. Denote by \( \tau_{l0}, \tau_{l1} \) and \( \tau_{l2} \) 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

\[
\tau_{lt} = \begin{cases} 
\tau_{l0}, & \text{if } t = 0, \\
\tau_{l1}, & \text{if } t = 1, \\
\rho \tau_{l,t-1} + (1 - \rho) \tau_{l2}, & \text{if } t \geq 2.
\end{cases}
\] (58)

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

\[
V(\tau_{d1}, \tau_{d2}, \tau_{l1}, \tau_{l2}, \omega) = \omega V_h(\tau_{d1}, \tau_{d2}, \tau_{l1}, \tau_{l2}) + (1 - \omega) V_e(\tau_{d1}, \tau_{d2}, \tau_{l1}, \tau_{l2}),
\] (59)

where \( \omega \) denotes the Pareto weight on the household welfare \( V_h(\cdot) \) along the transition path, and \( V_e(\cdot) \) denotes the transition welfare of the entrepreneur. \( V_h(\cdot) \) and \( V_e(\cdot) \) are given by

\[
V_h(\tau_{d1}, \tau_{d2}, \tau_{l1}, \tau_{l2}) = \sum_{t=1}^{\infty} \beta^t \left( \ln(C_{ht}^{y}) + \ln(C_{ht}^{o}) \right),
\] (60)

and

\[
V_e(\tau_{d1}, \tau_{d2}, \tau_{l1}, \tau_{l2}) = \sum_{t=1}^{\infty} \beta^t \left( \ln(C_{et}^{y}) + \ln(C_{et}^{o}) \right),
\] (61)

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 $\tau_{d1}$, $\tau_{d2}$, $\tau_{l1}$ and $\tau_{l2}$ to maximize the planner’s objective function $V(\tau_{d1}, \tau_{d2}, \tau_{l1}, \tau_{l2}, \omega)$ under a range of values of $\omega$. Table 2 shows the optimal policy parameters. For comparison, the table also shows the benchmark policy parameters (in Column (1)).

| Table 2. Optimal capital account policies following a temporary fall in foreign interest rate |
|---------------------------------|---------------------------------|---------------------------------|
| Benchmark policy | Optimal inflow tax | Optimal outflow tax |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| $\omega$ | 0.5 | 0.3 | 0.5 | 0.7 | 0.3 | 0.5 | 0.7 |

Consider first the optimal capital inflow tax policy in response to the decline in the foreign interest rate, holding the outflow tax rate constant (Columns (2)-(4)). In the case where the planner assigns equal weights to the household and the entrepreneur (i.e., $\omega = 0.5$), as in our benchmark case, the optimal response to the interest rate shock calls for a tightening of inflow controls both in the short run and the long run, as shown in the Table 2 (Column (3)).

In the short run, an increase in capital inflow taxes ($\tau_{l1}$) curbs capital inflows induced by the foreign interest rate shock. Entrepreneurs rely more on domestic bank loans to finance investment and production. The increased demand for bank loans 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 $\omega$), the higher the optimal capital inflow tax rate in the short run (i.e., the value of $\tau_{l1}$ declines as $\omega$ rises), consistent with our analytical steady-state results in Section IV.

In the long run, raising the capital inflow tax rate ($\tau_{l2}$) leads to an increase in the domestic lending rate and in the entrepreneur’s capital returns. But the increased lending rate depresses production and reduces labor income, hurting the household. The more the planner favors the household, the lower the long-run capital inflow tax rate (i.e., the value of $\tau_{l2}$ declines as $\omega$ rises), consistent with our analytical steady-state results in Section IV.

Next, consider the optimal capital outflow tax policy in response to the foreign interest rate shock, holding the inflow tax rate constant (Columns (5)-(7) in Table 2).
In the short run, the planner chooses to increase capital outflow taxes ($\tau_{d1}$ increases relative to the benchmark policy), resulting in a decline in the domestic deposit rate. In response, banks reduce the lending rate and increase the amount of loans. This leads to a boom in investment and production, raising the labor income for both the household and the entrepreneur. The entrepreneur’s capital income rises relative to the household’s, because the investment boom raises the capital price while the increase in the outflow tax rate depresses the household’s return from 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, 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 capital outflow taxes raises the capital income of both agents, with the household benefits more than the entrepreneur. The more the planner favors the household, the lower the long-run capital outflow tax rate, which is also consistent with our steady state analysis.

Overall, we find that shocks to foreign interest rates, working through its impact on capital flows, can potentially drive changes in welfare and income distribution in the small open economy. This finding holds true for both the baseline and the optimal capital account policies.

VI. Empirical Evidence

Our model predicts that a shock that increases capital inflows should raise the income share of the entrepreneurs and thereby increase income inequality, whereas a shock that increases capital outflows should reduce inequality. In this section, we demonstrate that these model predictions are supported by empirical evidence.

VI.1. Methodology and Data. We examine the impact of changes in capital flows on income distribution using a panel of 87 emerging market economies, with annual data from 2001 to 2018. We measure income inequality by the Gini coefficient. Our panel is unbalanced, since our sample has a large number of missing observations for the Gini coefficient. Overall, we have 1,165 country-year observations in our baseline regression sample.

Private gross capital inflows are calculated as changes in national liabilities, obtained from Lane and Milesi-Ferretti (2017), net of government borrowing, obtained from the World Debt Tables. Private gross capital outflows are calculated as 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.*\(^{17}\) Income inequality measures are based on the World Bank’s estimates of the Gini coefficient. We eliminate offshore financial centers from our sample, whose capital flows are likely to be unrepresentative, using the base designation of offshore centers in Rose and Spiegel (2007).\(^{18}\)

Since capital flows are potentially endogenous to domestic economic conditions, we use instrumental variables estimation to isolate exogenous movements in capital flows and their panel implications. In particular, we consider the countries in our sample to be relatively small, and thus changes in the world interest rates are treated as relatively exogenous. 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. Since the two-year Treasury yields are likely to influence global conditions, we also control for time fixed effects in all specifications.

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. 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.\(^{19}\) A large literature documents that costs of financial intermediation increase with geographic distance, with physical distance impacting both returns and lending behavior. 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)].

To capture the impact of a change in global financial conditions weighted by a country’s geographical distance from the United States, we use the interactive term (denoted by \(\text{INTREMOTE}\)) as a first-stage instrument for private capital flows. We

\(^{17}\)We thank Gian Maria Milesi-Ferretti and Nan Li for sharing the national assets and liabilities data, updated through 2018.

\(^{18}\)Examples of offshore financial centers include Cayman Island, Cyprus, Monaco, Hong Kong, and Panama. See Rose and Spiegel (2007) for a complete list.

\(^{19}\)Rose 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.
also instrument with country fixed effects, which implies that fixed country characteristics affect annual changes in income distribution only through their impacts on capital flows.

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. We estimate two-stage least squares using panel data, with robust standard errors. Our baseline second-stage specification for gross private flows satisfies

\[
GGINI_{i,t} = c + \beta_1 PINFLOWS_{i,t} + \beta_2 POUTFLOWS_{i,t} + \theta_t + \epsilon_{i,t}
\]

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, \(\theta_t\) represents time fixed effects, and \(\epsilon_{i,t}\) represents the regression residual, with standard errors clustered by year in our base specification.

In the first-stage specification, we regress each measure of capital flows on the interaction between changes in two-year U.S. Treasury yields from year \(t - 1\) to \(t\) and the country’s financial remoteness measured by the log distance between country \(i\) and New York City (the interaction term is denoted by \(INTREMOTE_{i,t}\)), the country fixed effect (denoted by \(\gamma_i\)), and year fixed effect \(\theta_t\). \(^{20}\)

Similarly, our baseline specification for the second stage regression for net private inflows satisfies

\[
GGINI_{i,t} = c + \beta_1 NPINFLOWS_{i,t} + \theta_t + \epsilon_{i,t}
\]

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 \(POUTFLOWS_{i,t}\), \(\theta_t\) represents time fixed effects, and \(\epsilon_{i,t}\) represents the residual, again with standard errors clustered by year in our base specification. We also instrument \(NPINFLOWS_{i,t}\) using the interaction term \(INTREMOTE_{i,t}\), the country fixed effect \(\gamma_i\), and the year fixed effect \(\theta_t\).

Table 3 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

\(^{20}\)Our baseline specification with both gross inflows and outflows requires additional instrumental variables beyond the \(INTREMOTE_{i,t}\) measure. We include country fixed effects to serve this purpose. Since the independent variable in our baseline specification is year-over-year changes in the Gini coefficients, using the country fixed effects as an instrumental variable for capital flows should be relatively innocuous for the exclusion restrictions.
Table 3. Summary Statistics

<table>
<thead>
<tr>
<th>Variables</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
</tr>
</thead>
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<tr>
<td>GGINI</td>
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<td>-0.002</td>
<td>0.005</td>
<td>-0.030</td>
<td>0.027</td>
</tr>
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<td>PINFLOWS</td>
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<td>-1.14</td>
<td>1.13</td>
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<td>POUTFLOWS</td>
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<td>0.49</td>
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<tr>
<td>NPINFLOWS</td>
<td>1,165</td>
<td>0.05</td>
<td>0.13</td>
<td>-1.16</td>
<td>1.04</td>
</tr>
</tbody>
</table>

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.


coefficient and capital flows. We therefore consider the robustness of our results to winsorizing the data 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 the value of a country’s GDP.

Note 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. This could 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. **Empirical results.** Table 4 shows the regression results under our baseline empirical specifications. Consistent with our theory’s predictions, the regression results in Column (1) indicate that an increase in gross inflows is associated with an increase in income inequality, while an increase in gross outflows is associated with a decrease in income inequality. Both estimated coefficients are statistically significant at the 1% confidence level.

<table>
<thead>
<tr>
<th>Dependent variable:</th>
<th>(1)</th>
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<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>GGINI</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>\textit{PINFLOWS}</td>
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<td>0.014***</td>
<td>0.015***</td>
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<td>(0.003)</td>
<td>(0.003)</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>\textit{POUTFLOWS}</td>
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<td>-0.027***</td>
<td>-0.038***</td>
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</tr>
<tr>
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<td>(0.008)</td>
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<td></td>
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</tr>
<tr>
<td>\textit{NPINFLOWS}</td>
<td>0.014***</td>
<td>0.014***</td>
<td>0.014***</td>
<td></td>
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<td>0.000***</td>
<td>-0.000**</td>
<td>0.001</td>
<td>-0.000</td>
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<tr>
<td></td>
<td>(0.000)</td>
<td>(0.000)</td>
<td>(0.000)</td>
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</tr>
<tr>
<td>Observations</td>
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<td>1,165</td>
<td>1,165</td>
<td>1,165</td>
<td>1,165</td>
</tr>
</tbody>
</table>

*Note:* Two-stage least squares estimation with \textit{INTREMOT}E and country fixed effects as instruments for \textit{PINFLOWS}, \textit{POUTFLOWS}, \textit{NPINFLOWS}. Year fixed effects in all specifications, suppressed here for space considerations. See text for variable definitions. For models (1), (2), (3), and (4), standard errors are clustered by years. For models (5) and (6), robust standard errors are shown in parentheses. Variables used in models (3) and (4) are winsorized at the 1% level. Statistical significance levels are indicated by the asterisks: *** $p<0.01$, ** $p<0.05$, and * $p<0.10$.

Based on our summary statistics, the point estimates in Column (1) of Table 4 indicate that a one standard deviation annual increase in private inflows is associated on average with a 20 basis point increase in a country’s Gini coefficient in that year, while a one standard deviation increase in private outflows is associated with a 23 basis point decrease. These numbers are not just statistically significant, but also economically plausible.
Column (2) in Table 4 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 an 18 basis point increase in the Gini coefficient in that year.

Our baseline estimation results are not driven by outliers in the data. Columns (3) and (4) show the regression estimates when we winsorize the data at the 1% level to trim the outliers in our sample. After winsorizing, the minimum values of gross private inflows and outflows (as shares of GDP) are raised to -0.26 and -0.23 respectively (from -1.14 and -0.89, respectively), while the maximum values are reduced to 0.44 and 0.45 respectively (from 1.13 and 0.49, respectively). After winsorizing, the coefficient estimates remain statistically significant at the 1% confidence level. They are also similar in magnitude to those in our full sample reported in Column (1) and (2).

Columns (5) and (6) in Table 4 show the baseline regression estimates with robust standard errors (instead of clustering the standard errors by year). The estimation results are also very similar to the baseline estimated reported in Columns (1) and (2).

We have conducted further robustness checks. To conserve space, we present those results in Tables A1 and A2 in the Appendix (Section C). Table A1 repeats our base specifications with conditioning for a variety of capital account policies. These include the indicators of capital account openness constructed by Chinn and Ito (2006), and indicators of capital account restrictions constructed by Klein et al. (2016) (FKRSU). The FKRSU measures are particularly useful for our purposes, since they allow us to distinguish between controls on inflows and outflows, although their data are only available through 2016. We also include the overall indicator of capital account restrictions in FKRSU. It is not clear how capital controls should influence income distributions after one has already conditioned for capital flows. However, it is possible that capital account restrictions affect the characteristics of inward and outward flows, and thereby change the relationship between capital flows and inequality. For that reason, we include both the Chinn-Ito and FKRSU indicators as additional controls in our robustness checks.

We find that our results for the implications of capital flows for income distribution are robust to the inclusion of any of these indicators of the severity of capital account distortions. Including these indicators of capital account policies reduces the sample
size significantly due to missing data. It is therefore difficult to compare the point estimates with those in our baseline estimation. However, the estimated coefficients on the variables of interest continue to have the correct signs and remain both statistically and economically significant.

We subject our empirical specification to a battery of additional robustness checks and report the results in Table A2 in the Appendix. We drop observations with very large or very small private inflows and outflows one at a time, with outliers defined as observations more than three standard deviations from the sample mean. We also drop observations with exceptionally unequal and exceptionally equal income distributions, and those with exceptionally remote and proximate countries, again one at a time with outliers defined as realizations more than three standard deviations from the sample mean. We also drop observations coinciding with the 2008 and 2009 global financial crisis. We re-estimate our base specification using both clustering by country fixed effects and conventional standard errors. Finally, we re-estimate our base specification under ordinary least squares.

Our instrumented results are robust to all of these perturbations, and usually, but not always, at the 1% confidence level. The primary exception is when we cluster by country fixed effects, where coefficient estimates on gross private capital outflows falls to the 10% significance level, although the coefficients on both gross and net private flows remain significant at the 5% level.

Our ordinary least squares (OLS) results are weaker, with gross private inflows now insignificant, and net inflows entering marginally significant at the 10% confidence level, although private outflows do enter at the 1% confidence level. Even in this case, all of the variables enter with the correct signs and with similar orders of magnitude as in our baseline regressions. We interpret our OLS results as illustrating the importance of instrumenting for capital inflows and outflows in our analysis.

Overall, our 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. This empirical evidence lends support to our theory.

VII. Conclusion

We have studied the implications of capital account policies for income inequality in a small open economy model with heterogeneous agents and financial frictions. Our results highlight the disparities in the impact of liberalization of capital outflows and
inflows, as well as over different horizons. In the steady state, both outflow liberalization and inflow liberalization raises the household share of income. In the short run, changes in capital inflows and outflows have opposite impacts on income inequality: increasing outflows raises the income share of households, whereas increasing inflows raises the income share of entrepreneurs. We also examine a temporary negative shock to the foreign interest rate, which results in a surge in capital inflows and increases the skewness of the distribution of income in favor of the entrepreneurs. Elevating capital account restrictions mitigates this effect, with heterogeneous impacts on households and entrepreneurs.

We solve for optimal policies for the social planner with a range of Pareto weights over the welfare of the two types of agents. Our results suggest that a planner that favors the households responds to a temporary decline in the foreign interest rate by increasing controls on inflows and reducing controls on outflows. In contrast, in the steady state, the planner who favors the households would choose to reduce taxes on both inflows and outflows.

Our model’s predicted short-run implications of capital flows for income inequality are supported by the data. Using a panel of emerging market economies, and instrumenting for the potential endogeneity of capital flows, we demonstrate that private capital inflows are associated with transitory increases in income inequality while private capital outflows are associated with declines. These results are robust to a large variety of sensitivity analyses and provide empirical support to our model’s mechanism.
Figure 1. The transition path following a temporary rise in the inflow tax $\tau_l$. The vertical axis units of the inflow tax and the credit spread ($R_l/R - 1$) are the percentage-point deviations from the steady state level. The vertical axis units of all other variables are percent deviations from the steady state levels.
**Figure 2.** The transition path following a temporary rise in the inflow tax $\tau_l$. The vertical axis units of the household share in capital income, and the household share in total income are the percentage-point deviations from the steady state level. The vertical axis units of all other variables are percent deviations from the steady state levels.
Figure 3. The transition path following a temporary rise in the outflow tax $\tau_d$. The vertical axis units of the outflow tax and the credit spread ($R_l/R - 1$) are the percentage-point deviations from the steady state level. The vertical axis units of all other variables are percent deviations from the steady state levels.
Figure 4. The transition path following a temporary rise in the outflow tax \( \tau_l \). The vertical axis units of the household share in capital income, and the household share in total income are the percentage-point deviations from the steady state level. The vertical axis units of all other variables are percent deviations from the steady state levels.
Figure 5. The transition path following a temporary fall in foreign interest rate. The vertical axis unit of the credit spread ($R_t/R - 1$) is the percentage-point deviations from the steady state level. The vertical axis units of all other variables are percent deviations from the steady state levels.
Figure 6. The transition path following a temporary fall in foreign interest rate. The vertical axis units of the household share in capital income, and the household share in total income are the percentage-point deviations from the steady state level. The vertical axis units of all other variables are percent deviations from the steady state levels.
Appendix A. Steady state solution

In the interior equilibrium, the no-arbitrage condition Eq. (9) solves for the domestic deposit rate:

\[ R = (1 - \tau_d)R^*. \]  \hspace{1cm} (A1)

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 \( \tau_d \) and \( \tau_l \).

We first derive the expressions for the household’s income as a fraction of output. The optimal cost-minimizing solution (23) implies that households’ labor income is a constant fraction of the output,

\[ \frac{W^l_h}{Y} = \alpha \theta. \]  \hspace{1cm} (A2)

With the household’s budget constraints, we have,

\[ \frac{C^y_h}{Y} = \alpha(1 - \theta) - \left( \frac{D}{Y} + \frac{B^d_f}{Y} \right), \]  \hspace{1cm} (A3)

\[ \frac{C^o_h}{Y} = \left( 1 - \tau_d \right) R^* \frac{B^d_f}{Y} = \left( 1 - \tau_d \right) R^* \left( \frac{D}{Y} + \frac{B^d_f}{Y} \right). \]  \hspace{1cm} (A4)

By substituting the above expressions into the household’s optimal saving condition (7), we can solve for the household’s total saving amount:

\[ \frac{D}{Y} + \frac{B^d_f}{Y} = \frac{\beta \alpha \theta}{1 + \beta}. \]  \hspace{1cm} (A5)

The household’s capital income is then given by,

\[ \frac{W^c_h}{Y} = \left[ (1 - \tau_d)R^* - 1 \right]\left( \frac{D}{Y} + \frac{B^d_f}{Y} \right) = \left[ (1 - \tau_d)R^* - 1 \right] \frac{\beta \alpha \theta}{1 + \beta}. \]  \hspace{1cm} (A6)

We now derive the expressions for the entrepreneur’s income as a fraction of output. The optimal cost-minimizing solution (23) implies that entrepreneurs’ labor income is a constant fraction of the output,

\[ \frac{W^l_e}{Y} = \alpha (1 - \theta). \]  \hspace{1cm} (A7)

The entrepreneur’s optimal conditions Eq. (16) - Eq. (18) implies that the entrepreneur’s return to capital equals the domestic lending rate:

\[ 1 - \delta + r^k = R_l. \]  \hspace{1cm} (A8)
With the entrepreneur’s budget constraints, we have,
\[ C^o_y = \alpha(1 - \theta) - \frac{N_e}{Y}, \]  
(A9)
\[ C^o_t = R_t \frac{N_e}{Y}. \]  
(A10)
where \( \frac{N_e}{Y} \) is the ratio of the entrepreneur’s net worth to total output:
\[ \frac{N_e}{Y} \equiv K - B - \frac{B_f}{Y}. \]  
(A11)

By substituting the above expressions into the entrepreneur’s optimal borrowing condition (16), we can solve for the entrepreneur’s net worth:
\[ \frac{N_e}{Y} = \frac{\beta \alpha \theta (1 - \theta)}{1 + \beta}. \]  
(A12)
The entrepreneur’s capital income is then given by,
\[ \frac{W^c_e}{Y} = (R_t - 1) \frac{N_e}{Y} = (R_t - 1) \frac{\beta \alpha (1 - \theta)}{1 + \beta}. \]  
(A13)

We now solve for the domestic lending rate \( R_t \). We first use (24),(28) and (29) to express \( K, B \) and \( B_f \) as a function of the lending interest rate \( R_t \),
\[ \frac{K}{Y} = \frac{1 - \alpha}{r^k} = \frac{1 - \alpha}{R_t - 1 + \delta}, \]  
(A14)
\[ \frac{B}{Y} = \left( \frac{R_t - 1}{\xi \eta} \right)^{\frac{1}{\eta - 1}} = \left( \frac{(1 - \tau_l)R_t - 1}{\xi \eta} \right)^{\frac{1}{\eta - 1}}, \]  
(A15)
\[ \frac{B_f}{Y} = \kappa_f + \frac{1}{\Phi_b} \ln \left( \frac{(1 - \tau_d)R_t}{R^*} \right). \]  
(A16)
By substituting the above expressions into (A11), we can express \( \frac{N_e}{Y} \) as a function of \( R_t, \tau_d \) and \( \tau_l \),
\[ \frac{N_e}{Y} \equiv f(R_t, \tau_d, \tau_l) = \frac{1 - \alpha}{R_t - 1 + \delta} - \left( \frac{R_t}{(1 - \tau_d)R^* - 1} \right)^{\frac{1}{\eta - 1}} - \kappa_f - \frac{1}{\Phi_b} \ln \left( \frac{(1 - \tau_l)R_t}{R^*} \right). \]  
(A17)
We can then solve for \( R_t \) as a function of \( \tau_d \) and \( \tau_l \) by combining (A17) with (50). In particular, define \( R_t \equiv \mathcal{R}(\tau_d, \tau_l) \). The function \( \mathcal{R}(\cdot, \cdot) \) is then given by,
\[ f(\mathcal{R}(\tau_d, \tau_l), \tau_d, \tau_l) = \frac{\beta \alpha \theta (1 - \theta)}{1 + \beta}. \]  
(A18)
Last, we solve for the output. Using the cost-minimizing solution (24), we obtain,
\[ \frac{K}{Y} = \frac{1 - \alpha}{r^k} \]  
(A19)
where the capital rent rate \( r^k \) is given by Eq.(A8).
With some algebra, we can solve for the output as a function of the domestic lending rate $R_l$,

$$Y = \left( \frac{K}{Y} \right)^{\frac{1}{1-\alpha}} = \left( \frac{1 - \alpha}{r^k} \right)^{\frac{1}{1-\alpha}} = \left( \frac{1 - \alpha}{R_l - 1 + \delta} \right)^{\frac{1}{1-\alpha}}. \quad (A20)$$

**Appendix B. Proofs of propositions**

**B.1. Proof for Proposition IV.1.**

**Proof.** For convenience of references, we rewrite Equation (A18), which solves for $R_l \equiv R(\tau_d, \tau_l)$ as a function of $\tau_d$ and $\tau_l$:

$$f(R_l, \tau_d, \tau_l) = \frac{\beta \alpha \theta (1 - \theta)}{1 + \beta}.$$

where the function $f(\cdot)$ is given by Equation (A17):

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

Given that the right hand side of Equation (A18) is a constant, we have,

$$\frac{\partial f}{\partial \tau_d} = f_1 \frac{\partial R}{\partial \tau_d} + f_2 = 0, \quad (A21)$$

$$\frac{\partial f}{\partial \tau_l} = f_1 \frac{\partial R}{\partial \tau_l} + f_3 = 0. \quad (A22)$$

where

$$f_1 = -\frac{1 - \alpha}{(R_l - 1 + \delta)^2} - \frac{1}{\eta - 1} \left( \frac{R_l}{(1 - \tau_d)R^*} - \frac{1}{\xi \eta} \right)^{\frac{1}{\eta-1}} - \frac{1}{\Phi_b R_l} - \frac{1}{\Phi_b R_l} < 0 \quad (A23)$$

$$f_2 = -\frac{1}{\eta - 1} \left( \frac{R_l}{(1 - \tau_d)R^*} - \frac{1}{\xi \eta} \right)^{\frac{1}{\eta-1}} - \frac{R_l}{R^* \xi \eta (1 - \tau_d)^2} < 0, \quad (A24)$$

$$f_3 = \frac{1}{\Phi_b (1 - \tau_l)} > 0. \quad (A25)$$

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

$$\frac{\partial \mathcal{R}}{\partial \tau_d} = -\frac{f_2}{f_1} < 0, \quad (A26)$$

$$\frac{\partial \mathcal{R}}{\partial \tau_l} = -\frac{f_3}{f_1} > 0. \quad (A27)$$

□
B.2. Proof for Proposition IV.3.

Proof. For convenience of references, we rewrite Equation (48), which expresses the household’s capital income as a function of \( \tau_d \) and \( \tau_l \):

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

Then, the first derivatives of the household’s capital income with respect to \( \tau_l \) is given by,

\[
\frac{\partial W_h}{\partial \tau_l} = [(1 - \tau_d)R^* - 1] \frac{\beta \alpha \theta}{1 + \beta} \frac{\partial \mathcal{Y}}{\partial \tau_l} < 0.
\]

The first derivatives of the household’s capital income with respect to \( \tau_d \) is given by,

\[
\frac{\partial W_h}{\partial \tau_d} = \frac{\beta \alpha \theta}{1 + \beta} \left\{ -R^* \mathcal{Y}(\tau_d, \tau_l) + [(1 - \tau_d)R^* - 1] \frac{\partial \mathcal{Y}}{\partial \tau_d} \right\},
\]

where

\[
\frac{\partial \mathcal{Y}}{\partial \tau_d} = y'(R_l) \frac{\partial R}{\partial \tau_d}
\]

\[
= \frac{1 - \alpha}{\alpha} \frac{Y}{R_l} - \frac{1}{\alpha R_l} \left( \frac{1}{\eta - 1} \left( \frac{R_l}{\eta \xi_d \tau_d} \right) - \frac{1}{\eta - 1} \left( \frac{R_l}{R^* \xi_d \tau_d} \right) \right) - \frac{1}{\alpha (R_l + \delta) \eta - 1} \frac{1}{R^* \xi_d (1 - \tau_d)} - \frac{1}{\alpha R_l \Phi_l R_l}
\]

\[
< \frac{1 - \alpha}{\alpha} \frac{Y}{(1 - \tau_d)}.
\]

Then, we have,

\[
\frac{\partial W_h}{\partial \tau_d} = \frac{\beta \alpha \theta}{1 + \beta} \left\{ -R^* \mathcal{Y}(\tau_d, \tau_l) + [(1 - \tau_d)R^* - 1] \frac{\partial \mathcal{Y}}{\partial \tau_d} \right\}
\]

\[
< \frac{\beta \alpha \theta}{1 + \beta} \left\{ -R^* \mathcal{Y}(\tau_d, \tau_l) + [(1 - \tau_d)R^* - 1] \frac{1 - \alpha}{\alpha} \mathcal{Y}(\tau_d, \tau_l) \right\}
\]

\[
= \frac{\beta \alpha \theta}{1 + \beta} \mathcal{Y}(\tau_d, \tau_l) \left\{ -1 + \tau_d + (1 - \tau_d)R^* - 1 \right\} \frac{1 - \alpha}{\alpha}
\]

If the labor share \( \alpha \) is large enough so that \( \frac{\alpha}{1 - \alpha} > \frac{(1 - \tau_d)R^*}{(1 - \tau_d)} \), then

\[
\frac{\partial W_h}{\partial \tau_d} < \frac{\beta \alpha \theta}{1 + \beta} \mathcal{Y}(\tau_d, \tau_l) \left\{ -(1 - \tau_d)R^* + [(1 - \tau_d)R^* - 1] \frac{1 - \alpha}{\alpha} \right\} < 0.
\]

\( \square \)

Proof. For convenience of references, we rewrite Equation (51), which expresses the entrepreneur’s capital income as a function of the lending interest rate $R_l$:

$$W^e_h \equiv w_e(R_l) = (R_l - 1) \frac{\beta \alpha (1 - \theta)}{1 + \beta} y(R_l).$$

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

$$y(R_l) = \left( \frac{1 - \alpha}{R_l - 1 + \delta} \right)^{1-\alpha}. $$

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

$$w_e'(R_l) = \frac{\beta \alpha (1 - \theta)}{1 + \beta} [y(R_l) + (R_l - 1) y'(R_l)]$$

$$w_e'(R_l) = \frac{\beta \alpha (1 - \theta)}{1 + \beta} [y(R_l) - (R_l - 1) \frac{1 - \alpha y(R_l)}{\alpha R_l}]$$

$$w_e'(R_l) = \frac{\beta \alpha (1 - \theta)}{1 + \beta} \frac{y(R_l)}{R_l} [R_l - (R_l - 1) \frac{1 - \alpha}{\alpha}].$$

If the labor share $\alpha$ is large enough so that $(\frac{\alpha}{1-\alpha} > \frac{R_l - 1}{R_l})$, then the entrepreneur’s capital income is an increasing function of the lending interest rate $R_l$

$$w_e'(R_l) = \frac{\beta \alpha (1 - \theta) y(R_l)}{1 + \beta} \frac{R_l}{R_l} [R_l - (R_l - 1) \frac{1 - \alpha}{\alpha}] > 0.$$ 

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

$$W^e_h \equiv W_e(\tau_d, \tau_l) = w_e(R(\tau_d, \tau_l)).$$

Then, using Proposition IV.1, the first derivatives of the entrepreneur’s capital income with respect to $\tau_d$ and $\tau_l$ are given by,

$$\frac{\partial W_e}{\partial \tau_d} = w_e'(R_l) \frac{\partial R}{\partial \tau_d} < 0,$$

$$\frac{\partial W_e}{\partial \tau_l} = w_e'(R_l) \frac{\partial R}{\partial \tau_l} > 0.$$ 

$\square$
B.4. Proof for Proposition IV.5.

Proof. For convenience of references, we rewrite Equation (53), which expresses the capital income ratio between the household and the entrepreneur as a function of \( \tau_d \) and \( \tau_l \):

\[
\frac{W^c_h}{W^c_e} \equiv W^c(\tau_d, \tau_l) = \frac{\theta (1-\tau_d)R^* - 1}{1 - \theta \mathcal{R}(\tau_d, \tau_l) - 1}.
\]

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

Then, the first derivatives of the capital income ratio with respect to \( \tau_l \) is given by,

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

The first derivatives of the capital income ratio with respect to \( \tau_d \) is given by,

\[
\frac{\partial W^c}{\partial \tau_d} = \frac{\theta - R^*[\mathcal{R}(\tau_d, \tau_l) - 1] - [(1-\tau_d)R^* - 1]\frac{\partial \mathcal{R}}{\partial \tau_d}}{[\mathcal{R}(\tau_d, \tau_l) - 1]^2}.
\]

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

\[
\frac{\partial \mathcal{R}}{\partial \tau_d} = \frac{1}{\eta - 1} \left( \frac{\frac{R_l}{(1-\tau_d)R^*} - 1}{\xi \eta} \right) \frac{1}{1-\eta} - \frac{1}{\eta - 1} \left( \frac{\frac{R_l}{(1-\tau_d)R^*} - 1}{\xi \eta} \right) \frac{1}{(1-\eta)R^* \xi \eta} - \frac{1}{\xi \eta} \Phi_b R_l
\]

Then, we have,

\[
\frac{\partial W^c}{\partial \tau_d} = \frac{\theta - R^*[\mathcal{R}(\tau_d, \tau_l) - 1] - [(1-\tau_d)R^* - 1]\frac{\partial \mathcal{R}}{\partial \tau_d}}{[\mathcal{R}(\tau_d, \tau_l) - 1]^2}
\]

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
\[
\frac{\partial W_c}{\partial \tau_d} < \theta \frac{R^* - \mathcal{R}(\tau_d, \tau_l)}{(1 - \tau_d)} < 0.
\]

Appendix C. Robustness checks for Empirics
### Table A.1. Results with capital controls added

<table>
<thead>
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<th>Dependent variable: Growth in GINI</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
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<td>0.041***</td>
<td>0.041***</td>
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</tr>
<tr>
<td>(0.003)</td>
<td>(0.005)</td>
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<td></td>
<td></td>
<td></td>
</tr>
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<td>POUTFLOWS</td>
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<td>-0.070***</td>
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</tr>
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<td>(0.010)</td>
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<td></td>
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</tr>
<tr>
<td>NPINFLOWS</td>
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<td>0.044***</td>
<td>0.044***</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>(0.003)</td>
<td>(0.005)</td>
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<td></td>
<td></td>
<td></td>
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</tr>
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<td>-0.001***</td>
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<td></td>
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</tr>
<tr>
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<td>(0.000)</td>
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<tr>
<td>CC</td>
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<td>0.004***</td>
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<td>0.005***</td>
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<td>(0.002)</td>
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<tr>
<td>CCO</td>
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<td>Constant</td>
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<td>-0.001**</td>
<td>-0.002***</td>
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<tr>
<td>(0.000)</td>
<td>(0.000)</td>
<td>(0.000)</td>
<td>(0.000)</td>
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Note: Two-stage least squares estimation with INTREMOTE and country fixed effects as instruments for PINFLOWS, POUTFLOWS, NPINFLOWS. Standard errors clustered by year. Year fixed effects in all specifications, suppressed here for space considerations. See text for variable definitions. Indicators of severity of capital account restrictions added. Models (1), (2), estimated with Chinn-Ito indicator of capital account openness (COPEN), (3) and (4) with FKRSU indicator of severity of overall restrictions (CC), and (5) and (6) estimated with FKRSU indicators of restrictions on inflows and outflows (CCI and CCO). Statistical significance levels are indicated by the asterisks: *** p<0.01, ** p<0.05, and * p<0.10.
### Table A.2. Robustness Checks

<table>
<thead>
<tr>
<th>Model</th>
<th>PINFLOWS</th>
<th>POUTFLOWS</th>
<th>NPINFLOWS</th>
</tr>
</thead>
<tbody>
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<td>(1) Drop Large Inflows</td>
<td>0.017***</td>
<td>-0.025***</td>
<td>0.019***</td>
</tr>
<tr>
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<td>(0.003)</td>
<td>(0.004)</td>
<td>(0.003)</td>
</tr>
<tr>
<td>(2) Drop Small Inflows</td>
<td>0.015***</td>
<td>-0.028***</td>
<td>0.014***</td>
</tr>
<tr>
<td></td>
<td>(0.003)</td>
<td>(0.004)</td>
<td>(0.003)</td>
</tr>
<tr>
<td>(3) Drop Large Outflows</td>
<td>0.015***</td>
<td>-0.028***</td>
<td>0.015***</td>
</tr>
<tr>
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<td>(0.003)</td>
<td>(0.004)</td>
<td>(0.003)</td>
</tr>
<tr>
<td>(4) Drop Small Outflows</td>
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<td>-0.023**</td>
<td>0.014***</td>
</tr>
<tr>
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<td>(0.003)</td>
<td>(0.003)</td>
</tr>
<tr>
<td>(5) Drop High GINI</td>
<td>0.016***</td>
<td>-0.033***</td>
<td>0.016***</td>
</tr>
<tr>
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<td>(0.003)</td>
<td>(0.005)</td>
<td>(0.003)</td>
</tr>
<tr>
<td>(6) Drop Low GINI</td>
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<td>-0.024***</td>
<td>0.014***</td>
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<tr>
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<td>(0.004)</td>
<td>(0.003)</td>
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<tr>
<td>(7) Drop Most Remote</td>
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<td>0.015***</td>
</tr>
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<td>(0.003)</td>
<td>(0.004)</td>
<td>(0.003)</td>
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<tr>
<td>(8) Drop Least Remote</td>
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<td>0.015***</td>
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<tr>
<td></td>
<td>(0.003)</td>
<td>(0.004)</td>
<td>(0.003)</td>
</tr>
<tr>
<td>(9) Drop Crisis Years</td>
<td>0.010***</td>
<td>-0.019**</td>
<td>0.010***</td>
</tr>
<tr>
<td></td>
<td>(0.003)</td>
<td>(0.004)</td>
<td>(0.003)</td>
</tr>
<tr>
<td>(10) Cluster by Country FE</td>
<td>0.015**</td>
<td>-0.038*</td>
<td>0.014**</td>
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<tr>
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<td>(0.007)</td>
<td>(0.020)</td>
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<tr>
<td>(11) Conventional SEs</td>
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<td>-0.028***</td>
<td>0.015***</td>
</tr>
<tr>
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<td>(0.004)</td>
<td>(0.008)</td>
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<tr>
<td>(12) OLS</td>
<td>0.011</td>
<td>-0.005***</td>
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</tr>
<tr>
<td></td>
<td>(0.001)</td>
<td>(0.002)</td>
<td>(0.001)</td>
</tr>
</tbody>
</table>

**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. Model (10) clusters by country FEs. Model (11) estimated with conventional standard errors. Model (12) presents OLS results for second stage of base specification. Statistical significance levels indicated by asterisks: *** p < 0.01, ** p < 0.05, and * p < 0.10.
References


