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No Pain, No Gain. Multinational Banks in the Business Cycle*

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Abstract

We study the role of multinational banks in the propagation of business cycles in host countries. In our economy, multinational banks can transfer liquidity across borders through internal capital markets. However, their scarce knowledge of local firms' collateral hinders their allocation of liquidity to firms. We find that, through the interaction between the "liquidity origination" advantage and the "liquidity allocation" disadvantage, multinational banks can act as a stabilizer in the immediate aftermath of domestic liquidity shocks but be a drag on the subsequent recovery. Structural and cyclical policies can ameliorate the trade-off induced by the presence of multinational banks.

Keywords: Multinational Banks; Macroeconomic Stability; Business Cycle
JEL Codes: E44

1 Introduction

Banking is increasingly a global activity. In recent decades, multinational banks have expanded their presence in both advanced and emerging countries. As documented by BIS (2008), the international claims of BIS reporting banks rose from $6 trillion in 1990 to $37 trillion in 2007, over 70% of world GDP. In Central and Eastern Europe and in Latin America, large European and U.S. banks have broadened their networks of subsidiaries and branches. And the expansion of multinational banks is expected to accelerate in transition countries, such as China and Russia (BIS, 2016).

While the growing importance of multinational banks is well documented, we still have limited understanding of how global banking can influence the macroeconomic stability of host countries facing an inflow of foreign banks. This poses challenges to policy makers. In

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the 1990s, several countries liberalized foreign bank entry into their credit systems (Clarke et al., 2003). However, more recently, in the aftermath of the Great Financial Crisis, concerns have been mounting about the risks of instability associated with the expansion of global banks (Goulding and Nolle, 2012).

Fundamental questions arise from these observations: do multinational banks help insulate host countries from negative shocks or do they instead exacerbate their effects, amplifying business cycle fluctuations? Under what conditions, and following which shocks, can multinational banks better enhance the macroeconomic stability of host countries? The goal of this paper is to help address these questions building on two key findings of the empirical banking literature. On the one hand, multinational banks have been found to outpace local banks in mobilizing liquidity in a timely manner, helping overcome liquidity shortages in host economies. This advantage stems from their ability to tap internal capital markets and transfer liquidity across borders, raising resources without the need to resort to costly local deposits (Cetorelli and Goldberg, 2012b). We will label this the "liquidity origination advantage" of multinational banks. On the other hand, several empirical banking studies document that multinational banks can experience disadvantages in allocating their liquidity to firms in host countries due to their more limited experience and inside information about local borrowers (Giannetti and Ongena, 2012; Mian, 2006). This is due do their disadvantage vis-à-vis local banks at monitoring and gathering information about assets and activities of local businesses, especially small and medium-sized informationally opaque firms or firms with limited international engagement (e.g., in real estate or in other non-tradable sectors). We will label this the "liquidity allocation disadvantage" of multinational banks.[1]

We embed these two features of multinational banks in an otherwise standard two-country DSGE model where banks provide financing to firms. We then ask our model: how do these features determine multinational banks' (de)stabilizing role in host countries? And how do structural and cyclical policies shape this role?

Our economy consists of two countries, the host (domestic) country and the foreign country. There are two types of banks: local banks that operate within the country border, and multinational banks, with parent offices in the foreign country and affiliates in the host country. In each country, firms can borrow from local banks or from multinational ones. When borrowing, firms face collateral constraints. Building on the above findings of the empirical banking literature, we characterize multinational banks with two features: i) they have internal capital markets which allow them to make transfers, subject to costs, as well as (partly) consolidated balance sheets between parents and affiliates; and ii) they are less efficient at managing and liquidating local entrepreneurs' collateral assets.

We perturb the host economy with two types of shocks: a financial shock that origi-

[1]Foreign banks can suffer from limited knowledge of the local markets, assets, and legal procedures, especially when assets are inherently local and non-tradable, and when markets are informationally opaque, as it is the case in several emerging countries (Boot and Kanatas, 1995; Bulow and Rogoff, 1989; Diwan, 1990). Domestic banks may possess private information not available to multinational banks.

nates in the domestic banking sector and a productivity shock. The "liquidity origination advantage" and the "liquidity allocation disadvantage" of multinational banks give rise to a rich channel of propagation of the shocks. Consider the domestic financial shock. Multinational banks can supplant the liquidity shortage in the host country through cross-border transfers to their affiliates via internal capital markets. This is not feasible for local banks, which rely on domestic liquidity. Thus, on impact multinational banks play a stabilizing role, partly compensating for the drop in local banks' credit by swiftly transferring liquidity across borders. However, over the medium run, the reshuffling of local firms' borrowing to multinational banks is not without costs. The average pledgeability of collateral gets eroded by the switch from domestic to multinational banks both directly (multinational banks are less able to liquidate the collateral assets of local firms) and via general equilibrium effects (firms' demand for collateral assets is lower when borrowing from banks that are less knowledgeable about local collateral, and this depresses collateral asset values). The reduced collateral pledgeability, in turn, shrinks credit. These adverse effects persist into the medium run through the endogenous response of banks' net worth. Overall, a "no pain, no gain" message arises: following the shock, multinational banks act as a short-run buffer, but the reallocation they trigger in the credit market slows down the subsequent recovery.

Consider next a domestic TFP shock, which reduces firms' demand for credit and multinational banks' return from investing in the host economy. On impact multinational banks amplify the shock by repatriating liquidity to their parents in the foreign country. However, again, a trade-off emerges: in the medium run, the reallocation of borrowing in the credit market makes the economy recover more quickly. To summarize: depending on the nature of the shock, multinational banks can act as a stabilizer or an amplifier in the short run, but their presence is the source of a trade-off between the short-run response of the economy and its medium-run recovery.

We examine how structural and cyclical policies shape the trade-off induced by multinational banks following a domestic financial shock. We find that a higher degree of consolidation of multinational banks' balance sheets (due, e.g., to regulations that incentivize their entry through branches rather than subsidiaries) mitigates the negative effect of the shock in the short run without costs in the medium term. By contrast, higher costs of multinational banks' transfers (due, e.g., to regulations inhibiting internal capital markets) have a nuanced effect, eroding the stabilizing role of multinational banks in the short run but also mitigating their destabilizing impact in the medium run. And a similar nuanced conclusion applies to the nature of multinational banks' transfers, namely, whether the transfers take the form of loans from parents to affiliates or equity injections.

We also study the role of cyclical policies, focusing on credit market interventions that adjust the loan-to-value ratios required from firms in the loan market. This is the type of policies that have been implemented in various countries facing a large inflow of multinational banks (see, e.g., Bierut et al., 2015, for the case of Poland and other Eastern European countries). We find that a policy maker interested in ameliorating the trade-off

caused by multinational banks should enact countercyclical policies that target multinational banks. Instead, perhaps surprisingly, no benefit appears to arise from countercyclical LTV policies that target both local and multinational banks.

The remainder of the paper unfolds as follows. In the next section, we relate the analysis to prior literature. Section 3 lays out the model and solves for agents' decisions. Section 4 presents the calibration and the simulation results. In Section 5, we study structural and cyclical policies. Section 6 concludes. The online Appendix contains additional robustness analysis.

2 Prior Literature

2.1 Empirical motivation

This paper builds on the findings of a broad empirical literature on the lending and liquidity management of multinational banks. Studies that investigate the role of internal capital markets in transferring liquidity include De Haas and Van Lelyveld (2010) and Cetorelli and Goldberg (2012b). De Haas and Van Lelyveld (2010) document that in emerging Europe, during crises, lending by foreign banks has been more stable than lending by domestic banks. Cetorelli and Goldberg (2012b) show that following liquidity shocks multinational banks can be a stabilizing force because they withstand the shocks better than domestic banks by transferring liquidity across borders. However, multinational banks also exhibit less experience and inside information about domestic activities and assets (Detragiache et al., 2008). Several studies find that this can result into tighter financing constraints for small and medium-sized local enterprises as foreign banks may primarily serve big and transparent customers (Cárdenas et al., 2003).[2] Mian (2006) finds that in Pakistan foreign banks shy away from lending to informationally difficult firms, especially if the cultural and geographical distance between management and loan officers is large. He also shows that foreign banks are at a disadvantage at recovering value from local firms' projects and assets in the event of firms' default. Giannetti and Ongena (2012) and Degryse et al. (2012) obtain evidence that in Eastern European countries small, informationally opaque firms are penalized by multinational banks relative to large firms. Clarke et al. (2006) and Gormley (2010) uncover analogous evidence for other countries.

The paper also relates to the evidence on the aggregate effects of multinational banks. Kalemli-Ozcan et al. (2013) study the effect of banking integration on the transmission of international business cycles for developed countries. The evidence on the impact of

[2]Foreign banks often have a shorter history in lending to local firms than domestic banks and may also have a more limited understanding of local insolvency practices. This is especially the case in emerging countries, where bankruptcy laws are often porous (Hermalin et al., 1999; Rajan and Zingales, 1998). Foreign lenders may also have to resort to expensive local experts (Hermalin et al., 1999). According to a survey on lending practices to SMEs (Jenkins, 2002), international banks have little interest in the market for small firms loans. The survey respondents reported that high administrative costs and lack of network and personnel were strong deterrents to engage in such business.

multinational banks on the macroeconomic stability of host countries is still mixed, with the results suggesting that multinational banks can be a buffer or an amplifier depending on conditions and types of shocks. Multinational banks have been shown to maintain credit amidst a negative financial shock in a host country thanks to cross-border internal flows (Cetorelli and Goldberg, 2012a).[3] Claessens and van Horen (2014) document that the impact of foreign banks on a country's stability depends on banks' capitalization and liquidity. De Haas and Van Lelyveld (2014) conclude that during the 2008-09 global financial crisis the affiliates of multinational banks acted as destabilizers by curtailing credit more than domestic banks.

2.2 Related theoretical studies

There is a growing theoretical literature on the macroeconomic impact of multinational banks. A strand of studies investigate the role of these banks in the international transmission of shocks and in international business cycle synchronization.[4] Kollmann et al. (2011), Guerrieri et al. (2012), Lakdawala et al. (2018), Meier (2013), Iacoviello and Minetti (2006), and Niepmann (2016) stress the "common lender effect" of multinational banks, that is, their lending to customers of multiple countries and, hence, their impact on the cross-country business cycle comovement. Unlike this class of models which highlight the common lender aspect of multinational banks, we focus on the behavior of multinational banks in transferring liquidity across borders and allocating this liquidity to local customers. This uncovers a novel mechanism of influence of multinational banks on the macroeconomic stability of host countries.

Our model is also related to a handful of papers that study the decision-making process of multinational banks in aggregate settings. De Blas and Russ (2013) put forward a model of cross-border loan flows through multinational affiliates or arms-length lending. They find that the gains from foreign bank entry depend on the financial development of the host country.[5] Fillat et al. (2017) differentiate between branches and subsidiaries of global banks. They also assume monopolistic competition in the loan market and introduce a deposit insurance premium on a risk basis. These papers do not focus on business cycle propagation.

[3] See Rai and Kamil (2010) for analogous evidence on multinational bank affiliates in Latin America.

[4] For earlier work on the role of financial factors in cross-country business cycle comovement, see, e.g., Kehoe and Perri (2002).

[5] Dell'Ariccia et al. (1999) explore theoretically the consequences of the limited knowledge of banks entering a new market.

3 The Model Economy

3.1 Environment

Preferences. Time is discrete and the horizon infinite. The economy consists of two countries, the host country and the foreign country. There are a continuum of representative households and a continuum of representative entrepreneurs in each country. The preferences of households are given by

$$\mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \frac{\left(C_t - \frac{H_t^{1+\epsilon}}{1+\epsilon}\right)^{1-\gamma} - 1}{1-\gamma}, \quad \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \frac{\left(C_t^* - \frac{H_t^{*,1+\epsilon}}{1+\epsilon}\right)^{1-\gamma} - 1}{1-\gamma},$$

where C_t and C_t^* denote households' consumption in the host country and the foreign country, and H_t and H_t^* denote labor. The preferences of entrepreneurs are given by

$$\mathbb{E}_0 \sum_{t=0}^{\infty} \beta_e^t \frac{(C_t^e)^{1-\gamma_e} - 1}{1-\gamma_e}, \qquad \mathbb{E}_0 \sum_{t=0}^{\infty} \beta_e^t \frac{\left(C_t^{e,*}\right)^{1-\gamma_e} - 1}{1-\gamma_e}.$$

To generate an incentive for entrepreneurs to borrow, we assume that they are less patient than households, i.e., $\beta_e < \beta$.

Technology. Entrepreneurs in each country have access to a constant-returns-to-scale production technology that uses labor and capital to produce goods used for consumption and investment:

$$Y_t = A_t K_{t-1}^{\alpha} H_t^{1-\alpha}, \tag{1}$$

$$Y_t^* = A_t^* K_{t-1}^{*\alpha} H_t^{*1-\alpha}. \tag{2}$$

There is a capital-good production firm in each country, which is owned by the representative household in the respective country. The capital-good producer in the host country can invest in I_t units of capital goods, which cost $I_t \left[1 + f\left(\frac{I_t}{I_{t-1}}\right)\right]$ units of consumption goods. $f(.)$ captures the adjustment cost in the capital-producing technology, and satisfies $f(1) = 0$, $f'(1) = 0$, and $f''(.) > 0$. The technology of the capital-good production firm in the foreign country is analogous.

Capital accumulation follows the laws of motion

$$K_t = (1-\delta)K_{t-1} + I_t, \tag{3}$$

$$K_t^* = (1-\delta)K_{t-1}^* + I_t^*, \tag{4}$$

where δ denotes the capital depreciation rate.

3.2 Banks

Within the representative household there are two types of agents, workers and bankers. Each worker supplies labor in a competitive labor market and earns wage income. Each banker operates a bank that gathers deposits from households and extends loans to entrepreneurs. Every period, a fraction $1-\sigma$ of bankers exit their business and become workers, while an equal mass of workers become bankers. The exiting bankers transfer retained earnings to the household. Within the household there is perfect consumption insurance.

There are two types of banks. The first is a bank whose business is inherently local, denoted by superscript l. A local bank in the host country gathers deposits from host-country households and extends loans to host-country entrepreneurs (and analogously for a local bank in the foreign country). The second type is a global (or multinational) bank, denoted by superscript g. A global bank consists of a parent that operates (gathers deposits and extends loans) in the foreign country and an affiliate that operates in the host country.[6] It is run by a pair of bankers from the foreign country household. To capture the linkage between the parent and the affiliate, we posit that a global bank can make transfers between the parent and the affiliate subject to a cost. When the bankers exit, they terminate the business at both the parent and the affiliate.

The sequence of events in period t is the following. First, aggregate shocks realize. Then, production takes place. Thereafter, banks learn whether they exit and new banks enter the business. Finally, surviving banks take deposits from households and extend loans to entrepreneurs. Global banks also make transfers between the parent and the affiliate.

3.2.1 Global banks' problem

We first describe the decision problem of the affiliate of a global bank. After the aggregate shocks realize, the affiliate chooses loans to entrepreneurs in the host country X_t^g and deposits D_t^g to maximize the expected discounted sum of profits it distributes to the household in the foreign country

$$
\begin{aligned}
V_t^g \equiv \max_{\{X_{t+j}^g, D_{t+j}^g\}_{j\geq 0}} \quad & \mathbb{E}_t \sum_{j=0}^{\infty} (1-\sigma)\sigma^j \Lambda_{t,t+j+1}^* N_{t+j+1}^g \\
\text{s.t.} \quad & X_t^g = N_t^g + Z_t^g + D_t^g, && [\lambda_t^g] \qquad (5) \\
& R_t^D D_t^g + \theta Z_t^g \leq \xi \left[(1-\phi) R_t^{X,g} X_t^g + \phi R_t^{X,g,*} X_t^{g,*} \right], && [\mu_t^g] \qquad (6)
\end{aligned}
$$

where $\Lambda_{t,t+j+1}^*$ is the foreign household's stochastic discount factor, R_t^D is the gross deposit rate, $R_t^{X,g}$ is the gross loan rate charged by the affiliate, and net worth is defined as

[6] Therefore, our model economy closely resembles the case where one country exports banking services to another country, e.g., the case of German banks entering the Czech Republic or Spanish banks entering Argentina (rather than, e.g., the banking relationship between Germany and the United States).

$N^g_{t+1} = R^{X,g}_t X^g_t - R^D_t D^g_t$.[7] The affiliate takes as given the parent bank's portfolio choice and the transfer Z^g_t it receives from the parent bank (or makes to the parent, if $Z^g_t < 0$). Equation (5) is the flow of funds (resource) constraint with an associated shadow value of λ^g_t. Equation (6) is a collateral constraint on external fund raising, which requires that the weighted sum of bank liabilities (deposits and transfers received from the parent) cannot exceed a fraction ξ of bank assets. The constraint (partially) consolidates the collateral assets of the affiliate and the parent bank, where the weight on the parent is $\phi \leq 0.5$. $\phi = 0.5$ implies full consolidation; $\phi = 0$ implies complete separation.[8] $\theta \leq 1$ captures the assumption that the transfer Z^g_t from the parent to the affiliate may require less collateral than deposits $R^D_t D^g_t$, to the extent that the transfer consists of an equity injection by the parent, rather than a loan. Constraint (6) can also be interpreted as a (regulatory or market) capital constraint, and henceforth we refer to it as the bank capital constraint.

The first order conditions w.r.t. X^g_t and D^g_t are

$$[\partial X^g_t]: \quad -\lambda^g_t + \xi(1-\phi)\mu^g_t R^{X,g}_t + \mathbb{E}_t \Lambda^*_{t,t+1}\left(1-\sigma+\sigma\lambda^g_{t+1}\right) R^{X,g}_t = 0, \tag{7}$$

$$[\partial D^g_t]: \quad \lambda^g_t - \mu^g_t R^D_t - \mathbb{E}_t \Lambda^*_{t,t+1}\left(1-\sigma+\sigma\lambda^g_{t+1}\right) R^D_t = 0. \tag{8}$$

Equation (7) equalizes the marginal cost of granting loans to their marginal benefit. The marginal cost is given by a tightening of the current resource constraint (λ^g_t). The marginal benefit is given by a relaxation of the current-period capital constraint (μ^g_t) and the next-period resource constraint (λ^g_{t+1}). Similarly, equation (8) equalizes the marginal cost of deposits to their marginal benefit.

The envelope condition reads:

$$[Z^g_t]: \quad \frac{\partial V^g_t}{\partial Z^g_t} = \lambda^g_t - \theta\mu^g_t. \tag{9}$$

It states that a larger transfer received from the parent relaxes the resource constraint of the affiliate but can tighten its capital constraint by a factor θ.

The parent bank maximizes the discounted sum of profits of the parent bank and the affiliate. Besides deposit taking and loan extension in the foreign country, the parent bank also chooses the transfer to make to the affiliate (or receive from the affiliate) operating in the host country:

$$\max_{\{Z^{g,*}_{t+j}, Z^g_{t+j}, X^{g,*}_{t+j}, D^{g,*}_{t+j}\}_{j\geq 0}} \quad \mathbb{E}_t \sum_{j=0}^{\infty} (1-\sigma)\sigma^j \Lambda^*_{t,t+j+1} N^{g,*}_{t+j+1} + V^g_t,$$

[7] As we discuss below, because of different collateral liquidation technologies, the loan rates charged by multinational banks and by local banks may differ.

[8] This is a natural way to introduce consolidation of balance sheets of parents and affiliates in our setting. It is straightforward to show that, if we allowed the parameter ϕ to also multiply liabilities in (6), given that we impose a symmetric constraint for the parent, then this would imply decoupling the balance sheets of parent and affiliate. Formal details are available from the authors.

$$\text{s.t.} \quad Z_t^{g,*} + Z_t^g = 0, \qquad [\gamma_t^{g,*}] \qquad (10)$$

$$X_t^{g,*} = N_t^{g,*} + Z_t^{g,*} - \frac{\psi}{2}\left(Z_t^{g,*} - \bar{Z}^{g,*}\right)^2 + D_t^{g,*}, \qquad [\lambda_t^{g,*}] \qquad (11)$$

$$R_t^{D,*} D_t^{g,*} + \theta Z_t^{g,*} \leq \xi \left[(1-\phi) R_t^{X,g,*} X_t^{g,*} + \phi R_t^{X,g} X_t^g\right], \qquad [\mu_t^{g,*}] \qquad (12)$$

where net worth is defined as $N_{t+1}^{g,*} = R_t^{X,g,*} X_t^{g,*} - R_t^{D,*} D_t^{g,*}$. Similar as before, the capital constraint (12) (partially) consolidates the balance sheets of the parent and the affiliate, where $\phi \leq 0.5$ is the weight on the affiliate. Transfers between the parent and the affiliate incur a quadratic cost as in the flow of funds constraint (11). Chinn and Ito (2008) discuss frictions in moving funds in and out of a given banking location (see below for further examples of such costs).[9]

The first order conditions for loans and deposits are isomorphic to those of the affiliate. As for the transfer choice,

$$\begin{aligned} [\partial Z_t^{g,*}]: &\quad \lambda_t^{g,*} - \psi\left(Z_t^{g,*} - \bar{Z}^{g,*}\right)\lambda_t^{g,*} - \theta\mu_t^{g,*} + \gamma_t^{g,*} = 0, \\ [\partial Z_t^{g}]: &\quad \frac{\partial V_t^g}{\partial Z_t^g} + \gamma_t^{g,*} = 0. \end{aligned}$$

Combining the FOC of $Z_t^{g,*}$ and Z_t^g with the affiliate's envelope condition (9), we obtain

$$\lambda_t^{g,*} - \theta\mu_t^{g,*} - \psi\left(Z_t^{g,*} - \bar{Z}^{g,*}\right)\lambda_t^{g,*} = \lambda_t^g - \theta\mu_t^g. \qquad (13)$$

When $\psi = 0$ (there is no adjustment cost of making transfers) and $\theta = 0$ (transfers from the parent are not subject to a capital requirement), the shadow value of net worth is equalized between the parent and the affiliate ($\lambda_t^{g,*} = \lambda_t^g$).

3.2.2 Local banks' problem

Local banks make decisions on deposit taking and loan extension to maximize their value. In the host country, the local banks solve the following problem

$$V_t^l \equiv \max_{\{X_{t+j}^l, D_{t+j}^l\}_{j\geq 0}} \mathbb{E}_t \sum_{j=0}^{\infty} (1-\sigma)\sigma^j \Lambda_{t,t+j+1} N_{t+j+1}^l,$$

$$\text{s.t.} \quad X_t^l = N_t^l + D_t^l, \qquad [\lambda_t^l] \qquad (14)$$

$$R_t^D D_t^l \leq \xi R_t^{X,l} X_t^l, \qquad [\mu_t^l] \qquad (15)$$

[9] The cost of making transfers partly depends on the subsidiary-branch structure. In particular, it may be higher for subsidiaries. However, ring-fencing provisions may limit the responsibility of a parent bank to support its branches. Such provisions, adopted by several banks in recent years, establish that a parent bank is not required to assist a foreign branch if it becomes illiquid due to extreme circumstances. On the other hand, concerns about loss of reputation can lead banks to support their subsidiaries, although they are not legally bound to do so.

where net worth is defined as $N_{t+1}^l = R_t^{X,l} X_t^l - R_t^D D_t^l$. The local banks' problem differs from the global banks' in that (i) the local banks do not receive or make any transfer; (ii) their capital constraint (15) only involves their own balance sheets. The first order conditions are

$$[\partial X_t^l]: \quad -\lambda_t^l + \xi \mu_t^l R_t^{X,l} + \mathbb{E}_t \Lambda_{t,t+1} \left(1 - \sigma + \sigma \lambda_{t+1}^l\right) R_t^{X,l} = 0, \tag{16}$$

$$[\partial D_t^l]: \quad \lambda_t^l - \mu_t^l R_t^D - \mathbb{E}_t \Lambda_{t,t+1} \left(1 - \sigma + \sigma \lambda_{t+1}^l\right) R_t^D = 0. \tag{17}$$

The local banks in the foreign country solve a symmetric problem.

3.3 Entrepreneurs

The representative entrepreneur in the host country uses labor H_t and capital K_t to produce output Y_t. To finance the purchase of capital and their own consumption, entrepreneurs can take loans from global banks (X_t^g) and local banks (X_t^l) that operate in the host country by pledging capital stocks as collateral. Collateral is necessary because of enforcement problems (see, e.g., Kiyotaki and Moore, 1997).

To capture the disadvantage of global banks due to their more limited experience and inside information about local firms in the host country, we posit different collateral liquidation technologies of global and local banks. In case of debt repudiation, local banks can liquidate a fraction κ^l of the collateral; global banks can liquidate a fraction $\kappa^g > \kappa^l$ of the collateral, but they also need to pay a convex liquidation cost. That is, global banks are more efficient at liquidating collateral when the amount of collateral is small (perhaps because of their more sophisticated lending technologies), but their liquidation technology exhibits decreasing returns to scale.[10] Below, we further elaborate on this specification.

The entrepreneur solves the following problem:

$$\max_{\{H_t, C_t^e, K_t, X_t^g, X_t^l, f_t\}_{t \geq 0}} \quad \mathbb{E}_0 \sum_{t=0}^{\infty} \beta_e^t \frac{(C_t^e)^{1-\gamma_e} - 1}{1 - \gamma_e}$$

$$\text{s.t.} \quad C_t^e + Q_t K_t + R_{t-1}^{X,g} X_{t-1}^g + R_{t-1}^{X,l} X_{t-1}^l = X_t^g + X_t^l + Y_t - W_t H_t + (1-\delta) Q_t K_{t-1},$$

[10] There is a broad literature in banking that analyzes banks' technology for collateral liquidation and monitoring (see, e.g., Minetti, 2011, and references therein). Aiyagari and Gertler (1991) assume that, while "households" are not specialists and face quadratic costs in trading assets, "traders" are specialists and face proportional costs (normalized to zero). One can think that in our economy, if their local experience and knowledge were as abundant as for local banks, multinational banks would have a linear liquidation technology with a lower average liquidation cost than local banks. Yet they suffer from diseconomies of scale. Hence, for sufficiently high values of collateral, the advantage due to their organized offices is offset by the disadvantage due to their limited local experience.

$$R_t^{X,g} X_t^g \leq \kappa^g \left[(1-f_t) Q_t K_t - \frac{\nu}{2\bar{Q}\bar{K}} (1-f_t)^2 Q_t^2 K_t^2 \right], \qquad [\omega_t^g] \qquad (18)$$

$$R_t^{X,l} X_t^l \leq \kappa^l \left(f_t Q_t K_t \right), \qquad [\omega_t^l] \qquad (19)$$

where f_t is the fraction of capital stock that is pledged as collateral to the local bank, $1-f_t$ is the fraction that is pledged to the multinational bank, Q_t is the price of capital, and $W_t H_t$ is the wage bill. In the constraint for borrowing from global banks (18), the marginal pledgeability of capital declines as the entrepreneur borrows more from global banks.

The first order conditions are

$$[\partial H_t] \quad \frac{(1-\alpha) Y_t}{H_t} = W_t, \qquad (20)$$

$$[\partial K_t] \quad -Q_t U_{c^e,t} + \kappa_t^g \omega_t^g \left[(1-f_t) Q_t - \frac{\nu}{\bar{Q}\bar{K}} (1-f_t)^2 Q_t^2 K_t \right] + \kappa^l \omega_t^l f_t Q_t,$$
$$+ \beta_e \mathbb{E}_t \left[(1-\delta) Q_{t+1} + \frac{\alpha Y_{t+1}}{K_t} \right] U_{c^e,t+1} = 0, \qquad (21)$$

$$[\partial f_t] \quad f_t = 1 - \frac{\bar{Q}\bar{K}}{\nu Q_t K_t} \frac{\kappa^g \omega_t^g - \kappa^l \omega_t^l}{\kappa^g \omega_t^g}, \qquad (22)$$

$$[\partial X_t^g] \quad U_{c^e,t} - \omega_t^g R_t^{X,g} - \beta_e \mathbb{E}_t R_t^{X,g} U_{c^e,t+1} = 0, \qquad (23)$$

$$[\partial X_t^l] \quad U_{c^e,t} - \omega_t^l R_t^{X,l} - \beta_e \mathbb{E}_t R_t^{X,l} U_{c^e,t+1} = 0. \qquad (24)$$

The foreign country's representative entrepreneur solves a symmetric problem.[11] Equation (22) shows that the choice of pledging collateral to borrow from local versus multinational banks depends on the tightness of the collateral constraints as well as on the value of collateral ($Q_t K_t$).

To recapitulate, in our model economy global and local banks differ in two dimensions. At the liquidity origination stage, global banks have the advantage that the affiliates can quickly obtain funds from the parent offices (or repatriate liquidity to the parents) through the transfer. At the liquidity allocation stage, global banks have a collateral liquidation technology that is initially more efficient than local banks but exhibits decreasing returns to scale. As noted, large multinational banks may count on more sophisticated lending techniques when financing high-end projects and borrowers, such as large and internationally active companies in a host country. However, as they delve deeper into the local credit market, turning to fund smaller, locally oriented and informationally opaque businesses, their scarce experience and inside information about local borrowers and assets may kick in, hindering their credit provision (Detragiache et al., 2008).[12] We capture this by positing

[11] One may argue that the liquidation technology of the parent in the foreign country is more efficient than that of the affiliate in the host country. In the Appendix, we conduct robustness analysis by allowing multinational banks to experience lower diseconomies to scale in collateral liquidation in the foreign economy than in the host economy. The results remain virtually unchanged.

[12] Stiglitz (2003, p.69) summarizes these points as follows: "while the [foreign] banks easily provide funds to multinationals, and even large domestic forms, small and medium-size firms complained of a lack of

that multinational banks suffer from diseconomies of scale in monitoring and liquidating the collateral assets of local firms.

3.4 Capital good producers

The rest of the model is standard. The capital-good producer in the host country chooses investment to maximize the present discounted value of lifetime profits, that is

$$\max_{\{I_t\}_{t\geq 0}} \quad \mathbb{E}_0 \sum_{t=0}^{\infty} \Lambda_{0,t} \left\{ Q_t I_t - \left[1 + f\left(\frac{I_t}{I_{t-1}} \right) \right] I_t \right\}.$$

From the profit maximization condition, the price of capital goods is equal to the marginal cost of producing capital goods:

$$Q_t = 1 + f\left(\frac{I_t}{I_{t-1}} \right) + \frac{I_t}{I_{t-1}} f'\left(\frac{I_t}{I_{t-1}} \right) - \mathbb{E}_t \Lambda_{t,t+1} \left(\frac{I_{t+1}}{I_t} \right)^2 f'\left(\frac{I_{t+1}}{I_t} \right).$$

The capital good producer in the foreign country solves a similar problem.

3.5 Households

The representative household in the host country maximizes its lifetime utility by choosing consumption C_t, deposits D_t, and labor supply H_t. It solves the following problem

$$\begin{aligned} \max_{\{C_t, H_t, D_t\}_{t\geq 0}} \quad & \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \frac{\left(C_t - \frac{H_t^{1+\epsilon}}{1+\epsilon} \right)^{1-\gamma} - 1}{1-\gamma}, \\ \text{s.t.} \quad & C_t = W_t H_t + \Pi_t + R_{t-1}^D D_{t-1} - D_t, \end{aligned} \tag{25}$$

where Π_t is the profits transferred to the households by bankers and capital-good producers. The first order conditions read

$$[\partial H_t] \quad H_t^{\epsilon} = W_t, \tag{26}$$

$$[\partial D_t] \quad 1 = \mathbb{E}_t \Lambda_{t,t+1} R_t^D. \tag{27}$$

The household in the foreign country solves a symmetric problem.

3.6 Closing the model

Each period, a fraction $1-\sigma$ of bankers exit, and an equal mass of workers become bankers. Bankers who enter receive $\frac{\zeta}{1-\sigma}$ of total asset values of existing bankers. The following are

access to capital. International banks' expertise - and information base - lies in lending to their traditional clients."

the evolution of the aggregate net worth of the four types of bankers, the affiliates in the host country, the parents, the local banks in the host country, and the local banks in the foreign country:

$$N_{t+1}^{g} = \sigma\left(R_t^{X,g} X_t^{g} - R_t^{D} D_t^{g}\right) + \zeta R_t^{X,g} X_t^{g}, \tag{28}$$

$$N_{t+1}^{g,*} = \sigma\left(R_t^{X,g,*} X_t^{g,*} - R_t^{D,*} D_t^{g,*}\right) + \zeta R_t^{X,g,*} X_t^{g,*}, \tag{29}$$

$$N_{t+1}^{l,*} = \sigma\left(R_t^{X,l,*} X_t^{l,*} - R_t^{D,*} D_t^{l,*}\right) + \zeta R_t^{X,l,*} X_t^{l,*}, \tag{30}$$

$$N_{t+1}^{l} = \sigma\left(R_t^{X,l} X_t^{l} - R_t^{D} D_t^{l}\right) + \zeta R_t^{X,l} X_t^{l}. \tag{31}$$

Market clearing conditions for the deposit market in each country are

$$D_t = D_t^{g} + D_t^{l}, \tag{32}$$

$$D_t^{*} = D_t^{g,*} + D_t^{l,*}. \tag{33}$$

The profits earned by the host country's household come from local banks and capital good producers:

$$\Pi_t = (1-\sigma)\left(R_t^{X,l} X_t^{l} - R_t^{D} D_t^{l}\right) - \zeta R_t^{X,l} X_t^{l} + Q_t I_t - \left[1 + f\left(\frac{I_t}{I_{t-1}}\right)\right] I_t.$$

The profits earned by the foreign country's household come from local and global banks and capital good producers:

$$\begin{aligned}\Pi_t^{*} =& (1-\sigma)\left(R_t^{X,g,*} X_t^{g,*} - R_t^{D,*} D_t^{g,*}\right) + (1-\sigma)\left(R_t^{X,g} X_t^{g} - R_t^{D} D_t^{g}\right) \\ &+ (1-\sigma)\left(R_t^{X,l,*} X_t^{l,*} - R_t^{D,*} D_t^{l,*}\right) - \zeta(R_t^{X,g,*} X_t^{g,*} + R_t^{X,g} X_t^{g} + R_t^{X,l,*} X_t^{l,*}) \\ &+ Q_t^{*} I_t^{*} - \left[1 + f\left(\frac{I_t^{*}}{I_{t-1}^{*}}\right)\right] I_t^{*}.\end{aligned} \tag{34}$$

The social resource constraint requires that world goods markets clear:

$$C_t + C_t^{*} + C_t^{e} + C_t^{e,*} + I_t\left[1 + f\left(\frac{I_t}{I_{t-1}}\right)\right] + I_t^{*}\left[1 + f\left(\frac{I_t^{*}}{I_{t-1}^{*}}\right)\right] + \frac{\psi}{2}\left(Z_t^{g^{*}} - \bar{Z}^{g,*}\right)^2 = Y_t + Y_t^{*}.$$

4 Results

In this section, we study the impulse responses of the model economy. We are especially interested in understanding under what conditions multinational banks act as shock amplifiers or absorbers in the host economy. From the results below, it will become clear that the presence of multinational banks induces a trade-off between the immediate response of the host economy to shocks and the pace of the recovery after negative shocks. This

trade-off stems from the interaction between the ability of multinational banks to transfer liquidity through internal capital markets and their difficulty in allocating this liquidity to local entrepreneurs.

4.1 Calibration

The model is solved numerically by locally approximating around the non-stochastic steady state. Parameters are shown in Table 1. We use standard values for most parameters regarding agents' preferences and production technology. We set the discount factor of entrepreneurs β_e to 0.98, smaller than the household discount factor β, which is set to 0.99. This is necessary to generate borrowing of entrepreneurs from bankers in the household. We let entrepreneurs be risk neutral and set $\gamma_e = 0$. Following Gertler et al. (2012), we set $f''(1) = 1$, so that the steady-state elasticity of capital price to investment is 1.

The parameters governing the tightness of the bank capital constraints are the bankers' probability of survival σ, the fraction of assets brought by new bankers ζ, and the fraction of bank assets pledged as collateral ξ. We choose $\xi = 0.880$, so that the bank leverage equals 8.33 in steady state, consistent with bank capital to total assets for the United States in the FRED database. Following Gertler et al. (2012), we set $\sigma = 0.969$, implying that bankers survive for eight years on average. We set the percentage of assets brought in by new bankers, ζ, such that the steady-state spread between the loan rate and the deposit rate is 100 basis points per year. The parameters κ^L, κ^G and ν dictate the tightness of entrepreneurs' collateral constraints. We set $\kappa^L = 0.6$ to match the loan-to-value ratio for U.S. firms. We set $\kappa^G = 0.65$, higher than κ^L, and we set ν such that local bank loans are about three times as large as global bank loans.[13]

The parameter ϕ governs the degree of consolidation of global bank balance sheets: as noted, $\phi = 0.5$ indicates full consolidation; $\phi = 0$ indicates complete separation. We interpret ϕ as especially reflecting the share of multinational bank loans accounted for by foreign branches (rather than subsidiaries): under this interpretation, full consolidation emerges when affiliates consist only of branches and no subsidiaries; complete separation emerges when there are only subsidiaries and no branches in the host country. Empirically the share of branches relative to subsidiaries varies depending on the specific host country (Fiechter et al., 2011). For example, a pattern generally observed is that in emerging countries (e.g., Eastern European countries) foreign subsidiaries account for a larger share of bank assets than foreign branches. Based on this observation, and on the figures in Allen et al. (2013), in the benchmark calibration we pick a value of ϕ such that the share of bank foreign assets held by branches equals 0.4 (that is, $\phi = 0.286$).[14] We also show the sensitivity of results as ϕ varies from 0 to 0.5. The parameter θ is the weight of transfers in

[13] In 2007, the world foreign bank assets represented about 25% of total bank assets (Global Financial Development Database, World Bank).

[14] Allen et al. (2013) document substantial variation in the share of assets accounted for by foreign branches vs. subsidiaries. For example, in 2009, the share of bank foreign assets held by branches equaled 37.0% in Greece, 53.5% in Netherlands, and 27.4% in Estonia.

the bank capital constraint. Data on the composition of liquidity flows in internal capital markets are scarce and, when available, refer to a small sample of banks. These studies (see, e.g., Allen et al., 2013; Vujić, 2015) conclude that loans generally account for the largest share of transfers between parents and affiliates. We calibrate θ to 0.6.[15]

In steady state, the net export of the host country is 0.46% of the GDP. The steady-state value of the transfer is 0.

4.2 Host country liquidity shocks

In this section, following prior studies (see e.g., Gertler and Karadi, 2011; Guerrieri et al., 2012) we experiment with a one-time (i.e., serially uncorrelated) unexpected drop of 5% in the net worth of local banks in the host country (N_t^l). This can be thought as a domestic liquidity (credit) supply shock originating in the local banking sector.[16] The results are presented in Figures 1-3. To better grasp the role of multinational banks, we compare the responses in our economy with two benchmark settings. The first benchmark is an economy where multinational banks cannot make transfers, that is, internal capital markets are shut down (Figure 2). In this case, the only links between host and foreign country are that the affiliates of the multinational banks in the host country are owned by the households in the foreign country,[17] and that the parents' and affiliates' balance sheets are partially consolidated. The two countries are decoupled otherwise. The second benchmark is an economy where entrepreneurs cannot alter the allocation of collateral pledges between local and multinational banks, that is, f_t is constant (Figure 3).

A reduction in the net worth of local banks in the host country tightens their capital constraint and thereby lowers their loan supply (see Figure 1). This, in turn, causes the marginal value of liquidity in the affiliate offices of multinational banks to rise. The parents thus make a transfer to the affiliates (Z_t^g), boosting their loanable liquidity and loan supply. As a result of the lower loan supply of local banks and the larger loan supply of multinational banks' affiliates, entrepreneurs respond by lowering the share f_t of collateral that they pledge to local banks. In the short run (the first few quarters after the shock) the presence of multinational banks thus works to mitigate the impact of the shock on investment, capital and output. Thanks to the increase in the loan supply of multinational banks' affiliates, facilitated by the transfers from the parents, the collateral constraint for entrepreneurs is relaxed and they can afford to cut their demand for capital and investment by less during the first few periods after the shock. This can be immediately grasped by

[15] According to data in Allen et al. (2013), for example, on average in 2007-2009, for Unicredit, a major Italian banking group with a large network of affiliates in Eastern Europe, the flows between Polish affiliates and the parent bank consisted for about 57% of loans and other non-equity flows. For Citigroup, in 2007, the flows between Polish affiliates and the parent bank consisted for about 60% of loans and other non-equity flows.

[16] The shock can represent (in reduced form) a wave of defaults hitting banks' portfolios or a drop in banks' asset values. In the Appendix we show that the results remain virtually unaffected if we posit that the shock takes the form of a transfer from local banks to entrepreneurs and households, rather than a deadweight loss for the local banking sector.

[17] Therefore, bank profits in the host country are transferred to foreign households.

comparing the impulse responses in our economy (solid lines in Figure 2) with those of the economy in which the transfers of multinational banks are muted (dashed-dotted lines in Figure 2).

In the medium-long run, however, the presence of multinational banks acts towards amplifying the effects of the shock, turning into a drag on the recovery. In fact, as entrepreneurs reduce their pledges to local banks (lower f_t), their collateral gets reallocated towards multinational banks. Since multinational banks exhibit decreasing returns in collateral monitoring and liquidation, this progressively reduces the average pledgeability of capital as collateral. There is also a general equilibrium effect: since the marginal value of capital as collateral keeps dropping as entrepreneurs switch to the less efficient collateral monitors and liquidators, entrepreneurs' demand for collateral tends to drop, too. This makes the collateral price Q_t recover more slowly than in the benchmark setting with muted transfers of multinational banks, causing a more persistent output contraction in the host country. The direct and the general equilibrium effects interact with the endogenous bank net worth accumulation.

Both the stabilization effect through the "liquidity origination advantage" and the amplification effect through the "liquidity allocation disadvantage" work at the same time and in every period after the shock. However, the stabilization effect works quicker (as soon as the transfer takes place) whereas the amplification effect builds up over time (because it depends on the endogenous persistence of banks' net worth). Thus, the stabilization effect dominates at the beginning and the amplification effect starts dominating after some quarters. This is clear from the comparison between the baseline and the no-transfer impulse responses in Figure 2.

The role of multinational banks can be alternatively grasped by comparing our economy with a second benchmark economy in which the share of capital pledged to local banks as collateral (f_t) is fixed at its steady-state value. The comparison is displayed in Figure 3. The impulse response functions show a milder short-run negative effect, and a larger long-run negative effect, in our model relative to the benchmark model with a fixed f_t. This is because, ultimately, global banks end up becoming less efficient at liquidating entrepreneurs' collateral.

The first three columns of Table 2 show the cumulative percentage change in response to the shock of both investment and output after eight, sixteen and twenty-eight quarters, respectively. The last column of Table 2 shows the first quarter in which the difference between the baseline model and the alternative model with either no transfers or with fixed allocation of entrepreneurs' collateral flips sign. In our economy, the fact that we allow for multinational banks' internal capital markets mitigates the effects of shocks in the short run. However, the amplification effect induced by the liquidity allocation disadvantage of multinational banks dominates in the medium-long run, slowing down the recovery.

4.3 Host country TFP shocks

In this section, we experiment with a negative 1% shock to total factor productivity in the host country. We assume that $\log(A_t)$ follows an AR(1) process:

$$\log(A_t) - \log(\bar{A}) = \rho^A \left[\log(A_{t-1}) - \log(\bar{A})\right] + e_t^A.$$

The results of this experiment are displayed in Figure 4 for both the baseline case (solid line) and an alternative benchmark model where multinational banks' transfers are fixed at their steady-state value. In the host country, lower TFP reduces the marginal product of capital and leads to a fall in the capital price Q_t. As a result, the collateral value of entrepreneurs falls, causing them to take fewer loans from both global and local banks and contract their investment. In our model economy, the parents repatriate funds from the affiliates in the host country (negative Z_t^g). Therefore, loans by multinational banks drop by more than in the benchmark economy. Loans by local banks decrease by less to compensate for the global banks' loan cut, but the overall loan supply still decreases by more in our model economy. In line with the findings of the empirical literature, following a drop in returns in the host country, multinational banks act as a destabilizer of the negative shock because they repatriate liquidity to their parent offices.

Again, however, a trade-off arises between the short run and the medium-long run. In our model economy, entrepreneurs in the host country now pledge a larger fraction of collateral to the local banks (f_t increases). This sustains the demand for capital (since its marginal value as collateral is now higher), causing the value of collateral to drop but less than in the benchmark setting. As a result, entrepreneurs' collateral constraints tighten by less in our model economy than in the benchmark, which in turn helps the host economy to recover faster from the TFP shock. In conclusion, in this case the presence of multinational banks acts as an amplifier of the shock in the short run but as a stabilizer in the medium-long run.

5 Structural and Cyclical Policies

In recent decades, an intense debate has developed over the regulation of multinational banks, including their mode of entry into host economies (e.g., through branches or subsidiaries) and their ability to pool assets or carry out transfers (see, e.g., the debate on ring-fencing regulations). Analogously, especially after the outbreak of the global financial crisis, policy makers of various countries faced the choice of whether to implement credit policies to influence credit market developments and, if so, whether to especially target domestic or foreign banks. In this section, we investigate how structural features of the banking sector and cyclical policies affect the mechanisms of the model. Our goal is to understand whether policy makers can enact structural banking sector reforms or cyclical interventions that ameliorate the trade-off induced by the presence of multinational banks.

Throughout the section, we focus on the case of a host country liquidity shock, although the insights can easily be adapted to the case of a TFP shock.

5.1 Structural features of the banking sector

We assess the sensitivity of the (de)stabilizing role of multinational banks to three structural features of the banking sector. The first consists of the cost of making transfers for multinational banks, as captured by the parameter ψ. In recent years, various countries have implemented regulatory reforms that have altered the cost of transferring funds for global banks (Nowotny et al., 2014; Allen et al., 2013). The second feature consists of the degree of consolidation of multinational banks' balance sheets, as captured by the parameter ϕ. Since consolidation happens for branches but not for subsidiaries, ϕ may be interpreted as especially reflecting the share of affiliates consisting of branches rather than subsidiaries. In some emerging countries, regulators have taken a tough stance towards applications from foreign banks to open branches, imposing a wider set of criteria than for the opening of subsidiaries (Cerutti et al., 2007). Finally, in a third experiment we consider the degree to which transfers through internal capital markets in multinational banks are subject to capital requirements, as captured by the parameter θ. Some countries discourage or even prohibit some types of transfers. For example, in Estonia the commercial code imposes restrictions on loans between parents and affiliates; in Poland, in 2009 supervisory authorities discouraged some categories of transfers between parents and affiliates.

Figure 5(a) illustrates the role of the costs of making transfers (as measured by ψ) following a host country liquidity shock. Higher costs mean smaller transfers, all else equal. Thus, the stabilizing property of transfers in the short run weakens as ψ rises. On the other hand, as ψ increases, the switch from local to global banks is dampened, too, and this means that the destabilizing effect associated with the switch to global banks and the reduction in collateral pledgeability get moderated.

Figure 5(b) illustrates the extent to which the consolidation of banks' balance sheets, as captured by ϕ, influences the (de)stabilizing role of multinational banks. The effect of ϕ is more nuanced than that of ψ. The degree of consolidation affects the evolution of the tightness of the resource and capital constraints of the multinational banks' affiliates, and this influences the incentive of their parents to make transfers. It also directly affects the degree to which affiliates incorporate changes of the values of their assets in their capital constraint. We find that for lower consolidation (lower ϕ) there is a larger initial spike in the transfer but in later periods the transfer is smaller than for higher consolidation. On the other hand, lower consolidation implies that affiliates do not share the increase in the value of their assets with parents and, hence, experience a larger relaxation of their capital constraint. This makes affiliates extend more loans following the shock, inducing a bigger reshuffling from local to multinational banks. In turn, this slows down the recovery, as noted. All in all, higher consolidation entails no short-run cost and a less extreme reshuffling of borrowing, and hence a lower medium-run cost in terms of lower speed of the

recovery. Since ϕ may reflect the share of branches (relative to subsidiaries), an interesting implication of this finding is that the entry of multinational banks through branches may reinforce their stabilizing role following domestic liquidity shocks.

Finally, Figure 5(c) illustrates the effects of the weight attached to transfers in the banks' capital constraint (as measured by θ). A higher θ means that transfers are subject to tighter capital requirements, e.g., consisting of loans rather than equity injections. It reduces the stabilizing role of global banks in the short run with the benefit, however, of a faster recovery. Intuitively, every time the affiliate in the host country receives a transfer, its borrowing constraint tightens more than in the case of a lower θ, so that the transfer contributes less to boosting the affiliate's lending capacity. Parent offices in the foreign country internalize this effect and, hence, transfer a smaller amount. Through this channel, a higher θ dilutes the stabilizing role of multinational banks in the short run (the "liquidity origination advantage"), at the same time also reducing the cost of multinational banks in slowing down the recovery ("liquidity allocation disadvantage").

To wrap up, the experiments of this section suggest that regulations that influence the cost of making transfers via internal capital markets or that favor some types of transfers have an ambiguous impact on the stabilization role of multinational banks. For example, following a host country liquidity shock, they can make multinational banks better short-run stabilizers but also stronger shock amplifiers in the medium-long run. Interestingly, the experiments instead suggest that regulations that push towards a more branch-based network of multinational bank affiliates might lead to an overall increase in macroeconomic stability, at least following domestic liquidity shocks. This could lend support to recent policy proposals aimed at incentivizing global banks to open up branches rather than subsidiaries in emerging countries (Allen et al., 2013).

5.2 Cyclical policies

In Section 5.1, we examined the effects of a host country liquidity shock for different structural features of the banking sector. In this section, we study to what extent cyclical policies can ameliorate the trade-off we uncovered in the model. Inspired by the experience of some emerging countries in recent years (see, e.g., Bierut et al., 2015, for the case of Poland), we model the policy as an adjustment of the loan-to-value ratio required from firms in the host country. We consider both a policy that discriminates between the loans of local and global banks and a policy that instead treats the two types of loans equally. Under the former, we assume that when a firm borrows from global banks its loan-to-value ratio is adjusted according to the following rule contingent on the output of the economy

$$\tilde{\kappa}_t^g = \chi \tilde{Y}_t,$$

where $\tilde{\kappa}_t^g$ and $\tilde{Y}_t$ denote percentage deviations from the steady-state values. We focus on counter-cyclical policies by setting $\chi < 0$; that is, the loan-to-value ratio is increased

in a recession, and viceversa in an expansion. We assume that the foreign country's κ^g remains constant. Figure 6(a) shows the responses to a local bank net worth shock in the host country. It compares the countercyclical-policy scenario (dash-dotted line) with the baseline one where κ^g is constant (solid line). We set $\chi = -5$ in the countercyclical-policy scenario, that is, κ^g increases by 5% from its steady-state value (0.65) when output drops by 1%. As output gradually declines after the shock, κ^g gradually increases. The higher κ^g has the direct effect of expanding the credit supply; it also has the indirect effect of inducing firms to switch from local banks to global banks (a decrease in f_t).[18] In the initial few quarters after the shock, the indirect effect dominates, which makes the counter-cyclical policy counter-productive in those periods. Intuitively, firms are induced to borrow more from global banks, which at the margin have a less efficient technology for repossessing and liquidating firms' collateral. As noted, this tends to depress the access to credit of the local firms. However, after a few periods (about 7 quarters in Figure 6(a)) the direct effect of the policy gains strength and induces a relaxation of the collateral constraint faced by local firms, implying a faster recovery from the shock.

Next, we experiment with an alternative LTV policy which does not differentiate between the loans of local and global banks but relaxes the loan-to-value ratio of borrowing from the two types of banks in the same way. That is, we assume that

$$\tilde{\kappa}_t^g = \chi \tilde{Y}_t, \quad \text{and} \quad \tilde{\kappa}_t^l = \chi \tilde{Y}_t.$$

Figure 6(b) shows again the responses to a local bank net worth shock in the host economy. In this experiment we make the elasticity of the policy smaller by setting $\chi = -1.25$, as the policy affects the loans of both local and global banks (recall that in steady state multinational bank loans are about one third of local bank loans, so that a χ of -1.25 implies that the overall responsiveness of the policy is similar to the previous experiment). We envisage three effects of this policy: the first is the direct effect of relaxing loan-to-value ratios, which acts as a stabilizer. The second effect consists of the reduced incentive of entrepreneurs to demand capital for collateral purposes, since now the borrowing constraint is looser. This tends to depress the collateral price. Finally, the depressed collateral price incentivizes entrepreneurs to switch towards multinational banks, which are less efficient liquidators anyway. The latter two effects tend to slow down the recovery. The impulse responses suggest that the direct effect is dominated both in the short and the medium-long run, which implies a larger negative response of the economy when this policy is implemented.

To main takeaway of the experiments of this section is that, in order to ameliorate the trade-off induced by multinational banks, a policy maker should implement countercyclical policies that especially target multinational banks. By contrast, countercyclical policies

[18] The switch is exacerbated by a larger decline in asset prices Q_t. As k^g increases, firms have a lower demand for collateral assets, exacerbating the fall in Q_t.

that target uniformly local and multinational banks appear to have no clear benefit.[19]

6 Conclusion

This paper has studied the impact of multinational banks on the macroeconomic stability of host economies. The analysis builds on two well-documented findings of the empirical banking literature regarding the liquidity management and lending of multinational banks. Multinational banks can swiftly transfer liquidity across borders through their internal capital markets but may encounter difficulties in allocating this liquidity to local firms. We have found that the interaction between these two forces is the source of a trade-off between the short-run and the medium-run response of the economy to domestic shocks. For example, following a domestic liquidity shock, multinational banks partially insulate the economy from the shock in the short run but slow down the subsequent recovery.

Although there appears to be no free-lunch cyclical policy in our setting, we have found that a countercyclical macroprudential (credit) policy targeting multinational banks can be beneficial in mitigating the trade-offs induced by the presence of multinational banks. Perhaps more surprisingly, the analysis suggests that structural reforms affecting the mode of entry of multinational banks can enhance the stabilizing role of multinational banks in host countries. By capturing in reduced form entry via subsidiaries or branches, we have taken a first step towards investigating this aspect. However, multinational banks can also enter host countries via brownfield investments (e.g., acquiring local banks) rather than greenfield entry, and this might also have implications for multinational banks' behavior over the business cycle. We leave this and other issues to future research.

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[19] While the regulatory framework might prevent from explicitly applying discriminatory regulations to different types of institutions, policy makers can enact policies that differentially target different categories of loans (e.g., based on the loan currency denomination or maturity). By so doing, they can target loans that are more likely to be granted by multinational banks.

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Table 1: Calibration

		Value	Target/Source
Preferences			
Household discount factor	β	0.990	
Household CRRA	γ	2.000	
Inverse Frisch elasticity	ϵ	1.000	
Entrepreneur discount factor	β_e	0.980	
Entrepreneur CRRA	γ_e	0.000	
Technology			
Capital share of output	α	0.330	
Capital depreciation	δ	0.025	
Inverse elasticity of investment to capital price	$f''(1)$	1.000	Gertler et al. (2012)
Bankers			
% bank asset as collateral	ξ	0.880	Leverage=8.33
Weight of foreign assets in constraint	ϕ	0.286	
Adjustment cost to transfers	ψ	0.100	
Weight on transfers in the constraint	θ	0.600	
% assets liquidated by local banks	κ^l	0.600	Loan-to-Value 60%
% assets liquidated by global banks	κ^g	0.650	
Cost of global bank liquidation	ν	0.308	$\bar{X}^G/\bar{X}^L = 1/3$
% assets brought by new bankers	ζ	$1.358e-04$	
Probability of surviving bankers	σ	0.969	Gertler et al. (2012)

Table 2: Short-Run vs Long-Run Effects

	8 Q	**16 Q**	**28 Q**	**first quarter**
Investment	-1.817	-2.500	-3.003	
Output	-0.085	-0.269	-0.561	
		No transfer		
Investment	-2.140	-2.596	-2.937	7
Output	-0.106	-0.306	-0.589	18
		Fix f		
Investment	-1.808	-1.938	-1.836	5
Output	-0.094	-0.252	-0.433	9

Note: the first three columns show the cumulative percentage change. The last column shows the first quarter in which the difference between the full model and the benchmark flips sign.

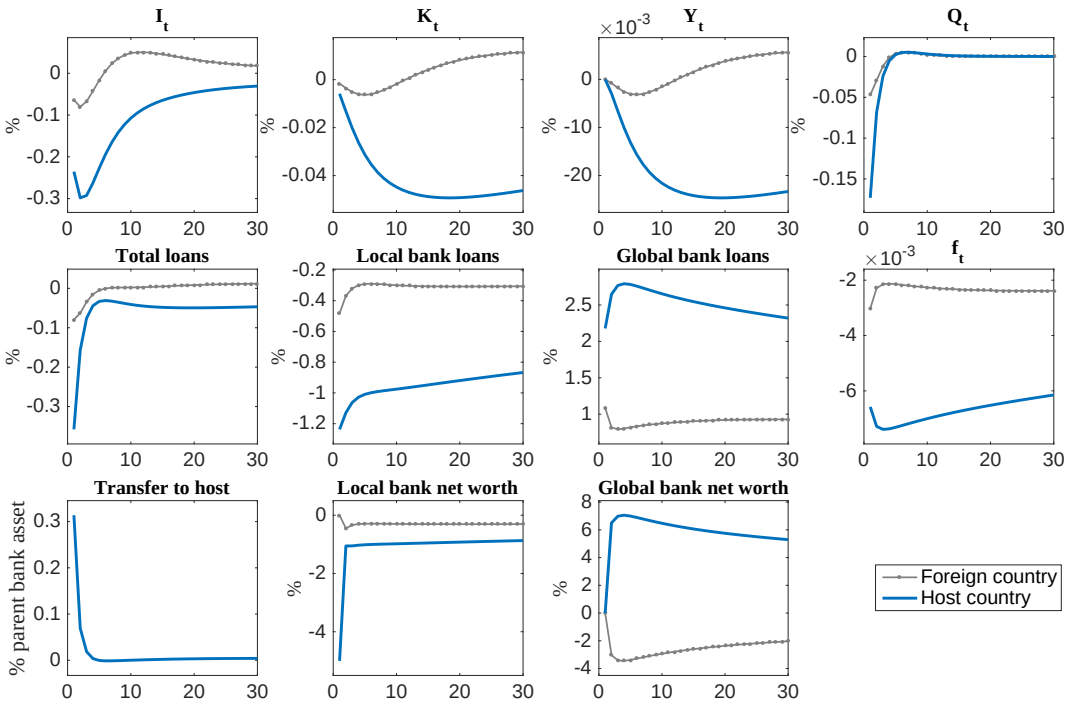


Figure 1: Benchmark Model: IRFs to a 5% negative shock to net worth of local banks in the foreign/host country.

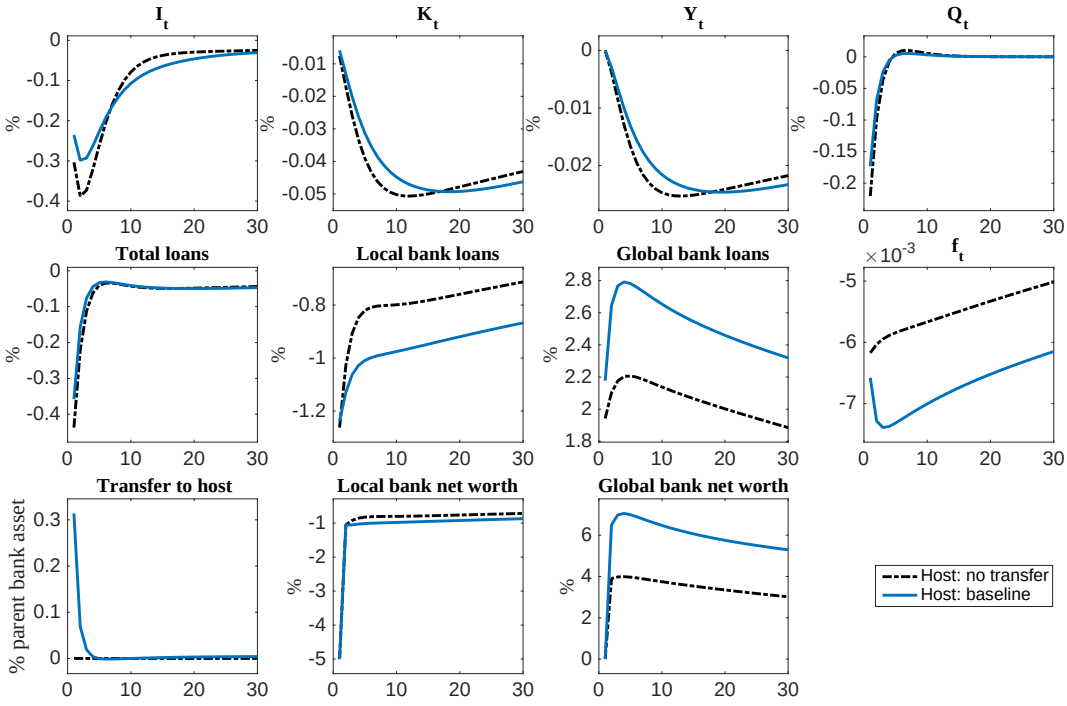


Figure 2: Shutdown the internal capital market of multinational banks. The figure shows impulse responses to a negative 5% local bank net worth shock in the host country.

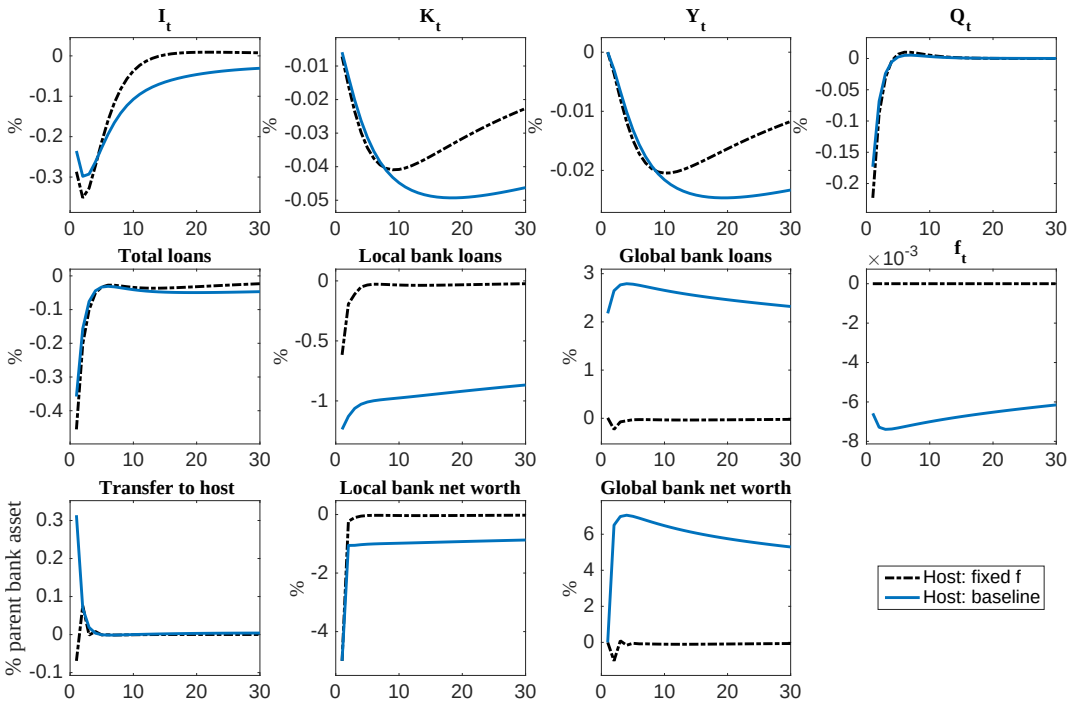


Figure 3: Shutdown the collateral reallocation between local and multinational banks. The figure shows impulse responses to a negative 5% local bank net worth shock in the host country.

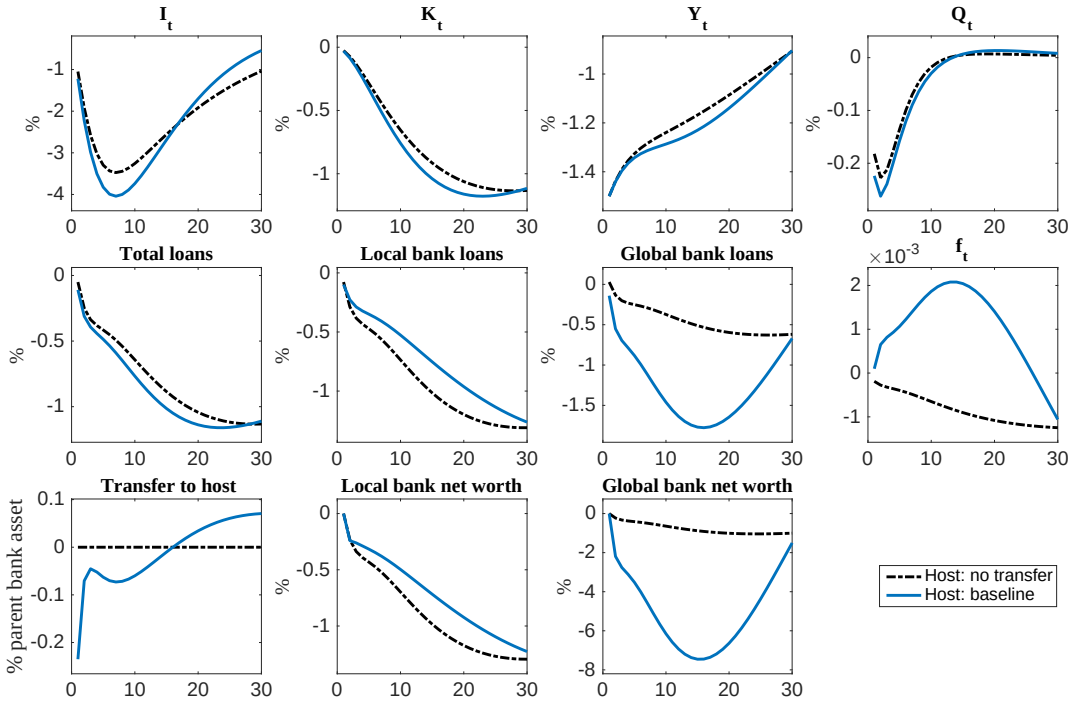
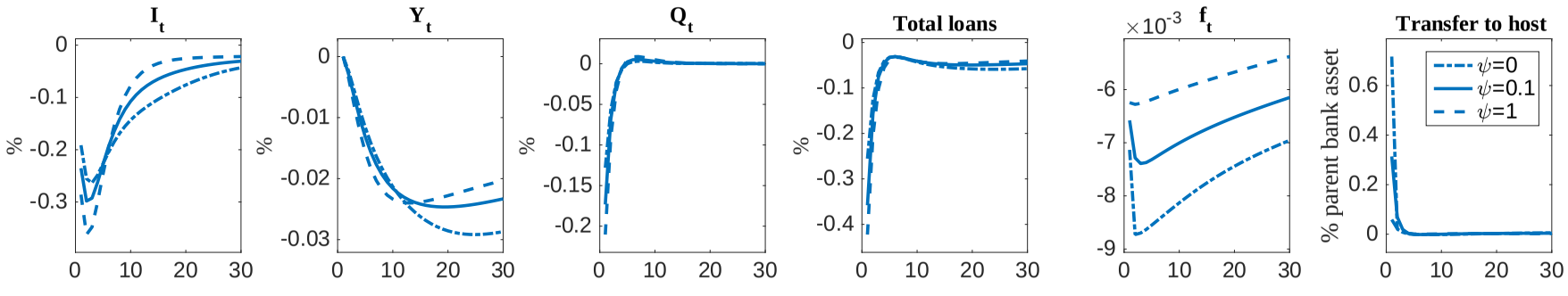
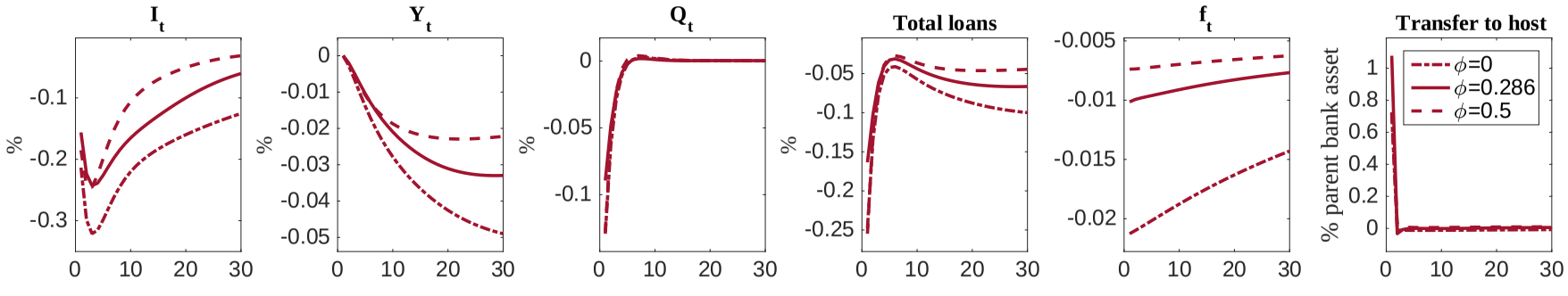


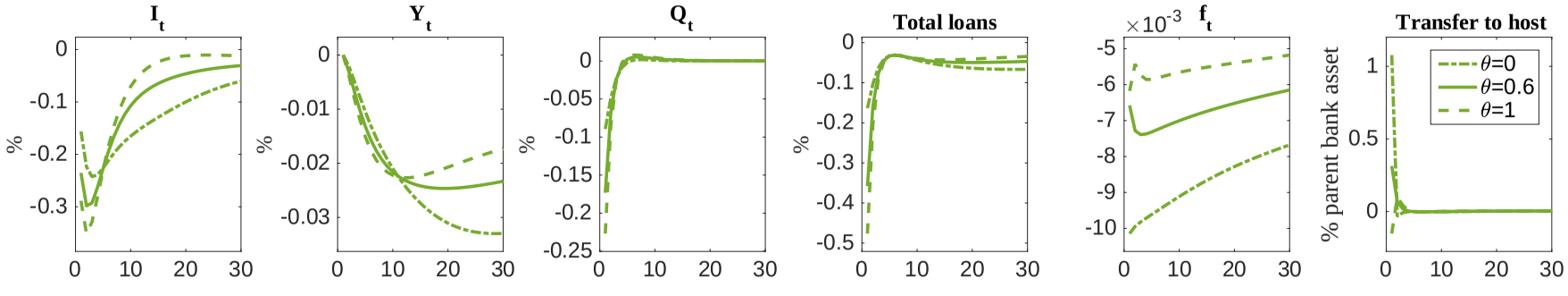
Figure 4: IRFs to a 1% negative shock to TFP in the host country



(a) Cost of making transfers ψ

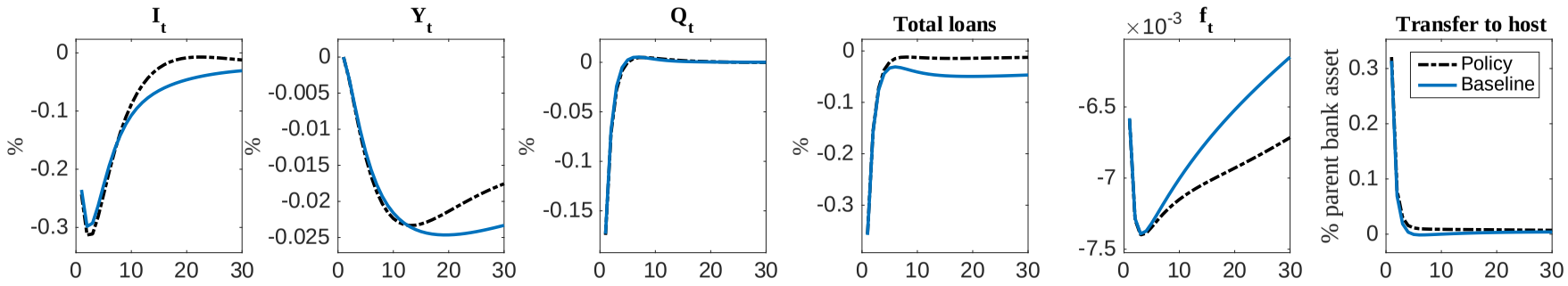


(b) Balance sheets consolidation ϕ

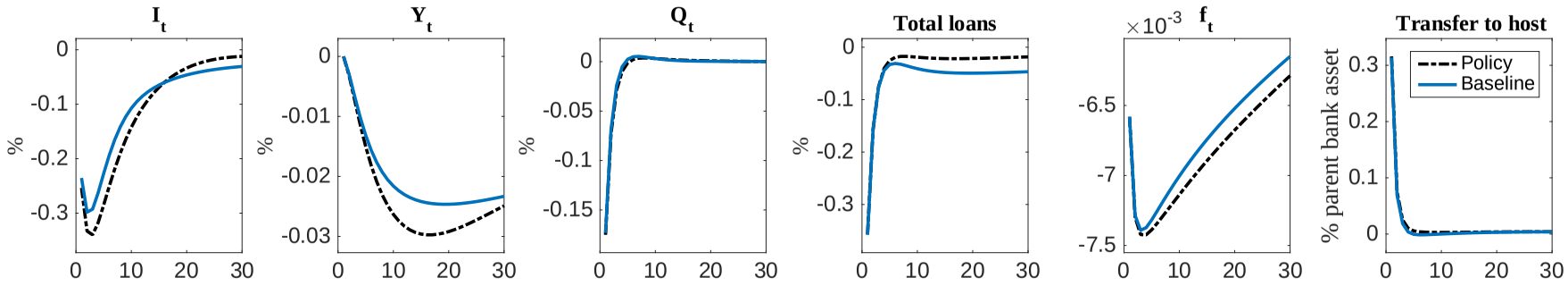


(c) Weight of transfers in global banks' capital constraint θ

Figure 5: The role of structural features. The figure shows impulse responses to a negative 5% local bank net worth shock in the host country.



(a) Countercyclical policy ($\chi = -5$) on global banks in the host country



(b) Countercyclical policy ($\chi = -1.25$) on both global and local banks in the host country:

Figure 6: Credit policy. The figure shows impulse responses to a negative 5% local bank net worth shock in the host country.

Appendix (Not for Publication)

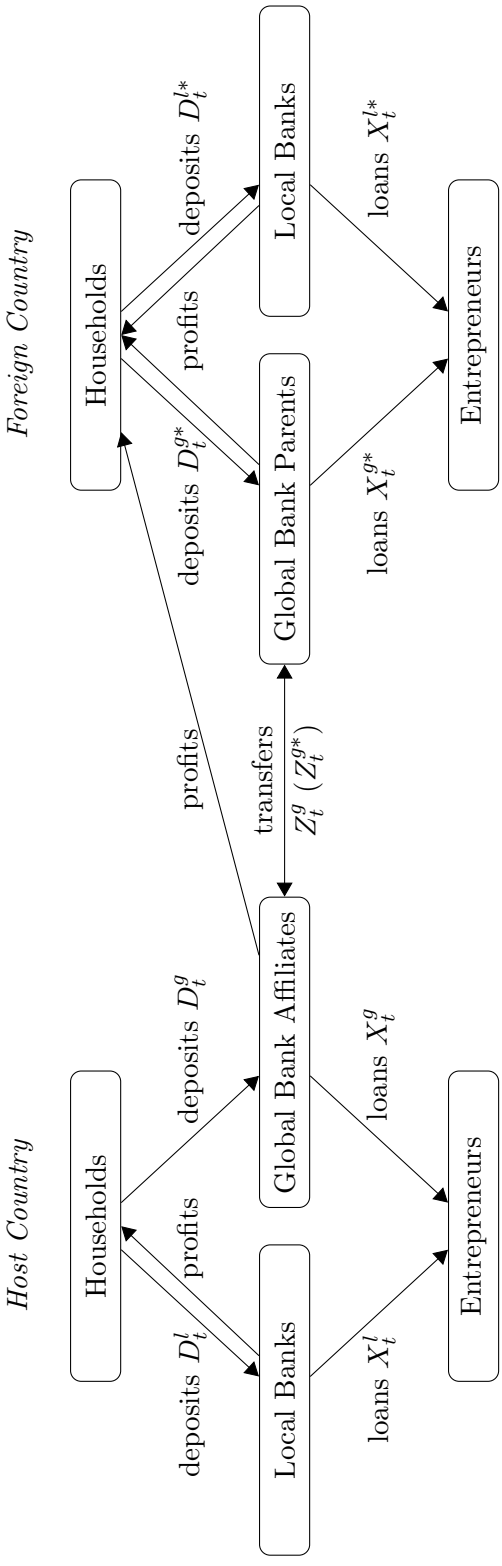
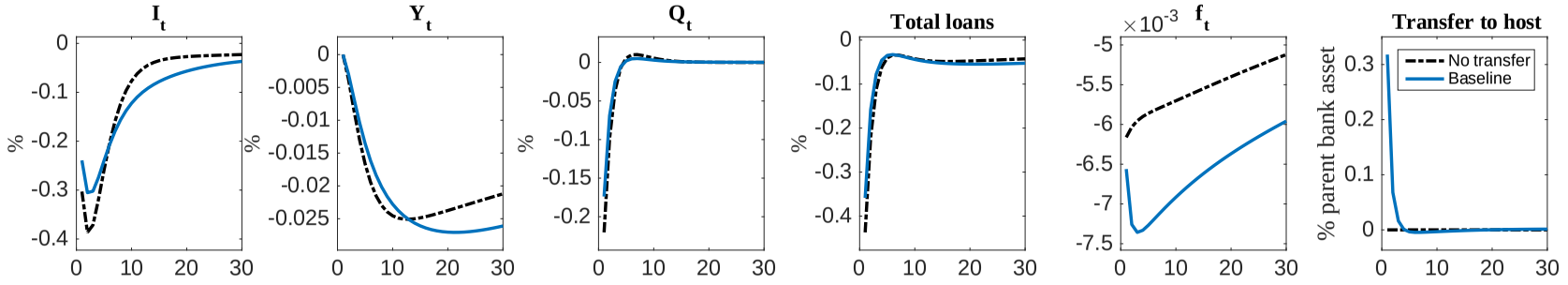
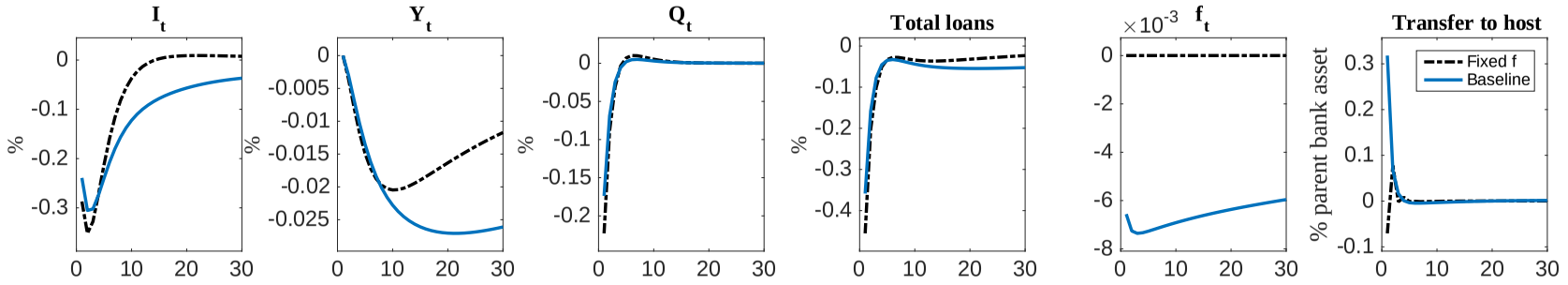


Figure A.1: Financial flows in the model economy

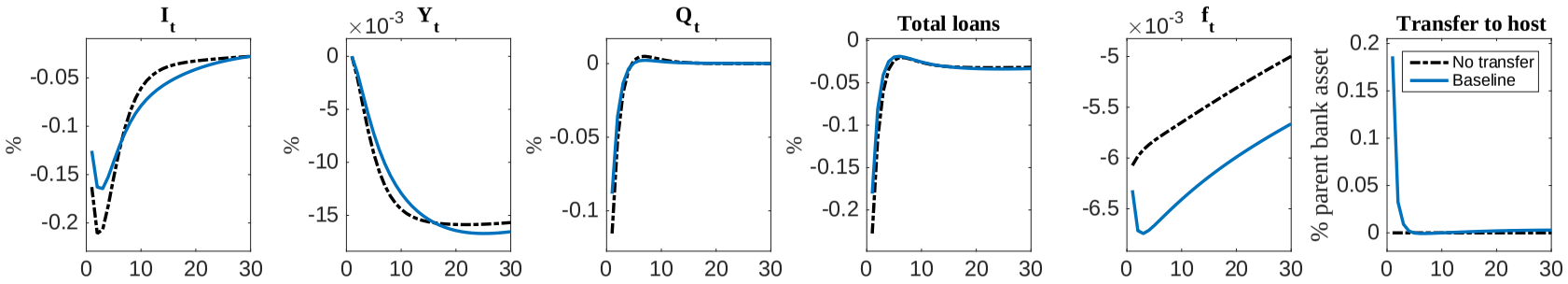


(a): Shut down the internal capital market of multinational banks.

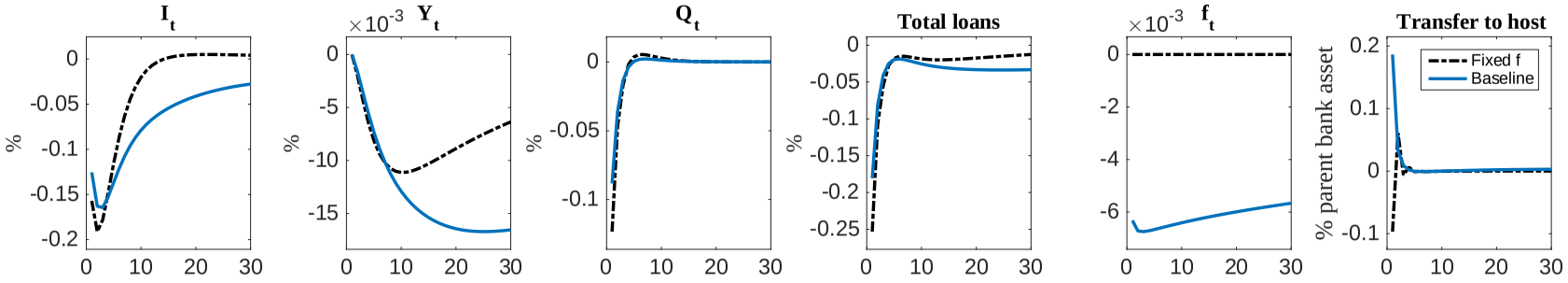


(b): Shut down the collateral reallocation between local and multinational banks.

Figure A.2: Robustness: the liquidation technology of the multinational bank in the foreign country is assumed to have less curvature ($\nu = 0.129$; κ^g is calibrated to 0.62 to so that local loans are three times as large as foreign loans). The figure shows impulse responses to a negative 5% local bank net worth shock in the host country.



(a): Shut down the internal capital market of multinational banks.



(b): Shut down the collateral reallocation between local and multinational banks.

Figure A.3: Robustness: assume that local bank transfers half net worth loss to the household and half to entrepreneurs. The figure shows impulse responses to a negative 5% local bank net worth shock in the host country.