Global Banking and Macroeconomic Stability. Liquidity, Control, and Monitoring

Elton Beqiraj
Sapienza University of Rome

Qingqing Cao
Michigan State University

Ralph De Haas
European Bank for Reconstruction and Development and Tilburg University

Raoul Minetti*
Michigan State University

We present here an extended abstract with the overview and description of the paper. We also append the draft in progress of the paper.

Overview Banking has increasingly become a global activity. As global banks enter host countries, they may choose different modes of entry and different organizations of their affiliate networks (subsidiaries and branches). This ultimately shapes the functional distance between parent banks and affiliates and the degree of control within global banking groups. Little is known, however, on the way the structural organization of global banking activities can influence macroeconomic stability. We address this question theoretically and empirically. We develop a two-country dynamic general equilibrium model with global banks, and test its key predictions using granular bank-level data from a survey of multinational banks conducted by the European Bank for Reconstruction and Development matched with aggregate country-level data. The dynamic general equilibrium model highlights two interrelated structural features of multinational banks: the functioning of their internal capital markets and the organization of their loan monitoring activities. We investigate how different structures of global banks influence the propagation of financial (bank net worth) and real (productivity and capital quality) shocks as well as the macroeconomic resilience to such shocks. Tight, centralized control of loan monitoring activities and of liquidity transfers at the parent bank level enhance global banks' ability to internalize the cross-country effects of aggregate shocks on the loan portfolios of the banking conglomerates. However, such central-

*Corresponding author: minetti@msu.edu

ized control of liquidity and loan monitoring diminishes global banks' ability to exploit local expertise on loans in host countries. The results reveal that whether global banks moderate or amplify the effects of local (host country) financial and real shocks is heavily influenced by the structural organization of their global conglomerates, the functioning of their internal capital markets and the degree of monitoring control exerted by parent banks.

Model Description We have developed a two-country dynamic stochastic general equilibrium model with multinational banks. In both the host and foreign countries, there are two types of banks: local banks and global bank affiliates. Good-producing firms in each country obtain credit from both types of banks. Banks intermediate liquidity by accepting deposits from households and providing loans to firms. Additionally, they engage in information production on the loans they extend to firms, using loan officers as an input in their loan monitoring activities. The hiring of loan officers enables banks to conduct due diligence on loans, thereby increasing their recovery value in case of default and enhancing their pledgeable value to financiers.

A global bank engages in liquidity management and control within its conglomerate. Specifically, it can transfer funds between affiliates across countries through internal capital markets in the form of intra-group loans, offered at a reduced interest rate relative to the deposit rate. The global bank can also hold (partial) control over the hiring of loan officers in its affiliates. Consequently, loan officers at an affiliate comprise of those independently hired by the local offices and those hired by the bank conglomerate itself. We allow the intra-group loans to have two components: a "no-strings-attached" component that does not involve any control by the banking conglomerate over the monitoring decisions of the affiliate, and a "strings-attached" component that serves to finance the wage bill of loan officers hired by the conglomerate.

Global banking conglomerates face a key trade-off when choosing the level of loan monitoring and due diligence at affiliates. On the one hand, a conglomerate may have worse local knowledge than the local offices when hiring and managing loan officers. On the other hand, the conglomerate internalizes the impact of the pledgeability of an affiliate's loans on the capital constraint and liquidity market access of all foreign affiliates in the conglomerate because of balance sheet consolidations. In equilibrium, this choice is influenced by several factors, including the level of balance sheet consolidation, the efficiency of conglomerates relative to local affiliates in selecting and training loan officers, and the shadow value of liquidity for affiliates in both countries.

Results (preliminary and in progress) We study the effects of real (productivity and capital quality) and financial (bank net worth) shocks. The results suggest that the stabilizing or propagating effects of global banks are heavily influenced by the functioning of

internal capital markets and by the degree of loan monitoring control exerted by parent banks. That is, not only global banks, but also the structural organization of global banking matter. Following a negative net worth shock hitting both local and global banks, in spite of the reduction of their net worth, global banks expand countercyclically their lending to firms in the host economy, unlike local banks which instead shrink their loans. The stabilizing, countercyclical behavior of global banks' lending reflects a countercyclical behavior of their loan monitoring intensity, financed by substantial liquidity support (transfers) from parent banks through internal capital markets. This effect manifests primarily when global banks have a centralized control of loan monitoring decisions, and thus internalize the negative effects of the shock on the whole banking conglomerate.

The effects of global banks' lending become more nuanced when considering the impact of negative productivity shocks in the host country. The reduction in firm productivity directly erodes global banks' incentive to extend loans in the host country. Nonetheless, the inflow of transfers through internal capital markets enables global banks to expand their loan monitoring. This, in turn, tends to boost global banks' lending in the host country. The cyclical behavior of global banks' lending depends on whether the former or the latter effects dominate. The structure of global banks contributes to determining the net balance between the two opposite forces. We obtain that when global banks exert centralized control over their monitoring decisions, their countercyclical monitoring dominates over the direct impact of lower productivity, while the reverse occurs when loan monitoring is decentralized at the level of local affiliates.

Global Banking and Macroeconomic Stability. Liquidity, Control, and Monitoring

Elton Beqiraj
Sapienza University of Rome

Qingqing Cao
Michigan State University

Ralph De Haas
European Bank for Reconstruction and Development and Tilburg University

Raoul Minetti*
Michigan State University

In Progress. This Draft: October 10, 2023

Abstract

JEL classification: E32, E44

Keywords: Global banks; Business cycle dynamics; Monitoring; Liquidity.

1 Introduction (In Progress)

This is in progress. Please refer to the proposal for a polished description of the motivation and content of the analysis.

The expansion of global banking has represented one the major developments in the macro financial landscape in recent decades. The way global banks have penetrated host countries has progressively shifted from a predominantly cross-border lending model to a more direct local presence of global banks. A growing literature in macro banking has

*Corresponding author: minetti@msu.edu

increasingly explored the macroeconomic implications of global banks. Most of this literature, however, appears to neglect the articulated decision process that characterizes complex financial institutions, such as multinational banks. This gap in our understanding is particularly relevant if we consider the increased local presence of multinational banks' branches and subsidiaries in host countries. Global banks routinely make complex decision regarding the allocation of monitoring resources and liquidity funds across their global conglomerate. These decisions also have implications for the allocation and control between global banks' headquarters and local affiliates. Studying the allocation of monitoring, liquidity and control on the one side and multinational banks' lending decisions on the other side is thus critical for understanding the role of multinational banks in the propagation of shocks and in macroeconomic stability.

In this paper we aim at understanding how multinational banks can affect the transmission of domestic and international shocks, with a special focus on how the organization structure and business models of multinational banks can shape this influence. To this end, we conduct both an empirical and a theoretical analysis. We first investigate how the organizational structure of global banks affects the response of their lending, deposit taking and liquidity allocation to aggregate shocks and draw inferences on the patterns of the response of global banks. We next develop a two-country dynamic general equilibrium model where multinational banks coexist with local banks in the credit market of each country. There are two key components of banks in the model. First, banks conduct active monitoring (due diligence) of loans, by hiring loan officers. Local banks inherently rely on local loan officers. Global banks, by contrast, can either rely on loan officers hired by local affiliates or instead rely on officers hired and controlled at the centralized level by the multinational bank conglomerate (possibly subject to some inefficiency due to the functional distance between conglomerates and host country affiliates). Secondly, following a broad literature, we allow global banks to transfer liquidity between parents and local affiliates through internal capital markets. We allow multinational banks to either decentralize their decisions (delegating the choice of loan officers hiring to local affiliates) or instead operate on a centralized model (choosing loan officer hiring at the parent level). To capture the degree of control of the global conglomerates over their affiliates we allow for two different types of liquidity transfers. The first ("strings attached" transfers) en-

tails a formal control of the conglomerate on the affiliate through the hiring of local loan officers. The second ("no strings attached" transfers) is a mere reallocation of liquidity across the conglomerate.

We calibrate our model to rich bank-level data from the European Bank for Reconstruction and Development as well as the aggregate data on a set of European countries. We then ask our analysis the following key questions: how do global banks affect the transmission and propagation of financial, productivity, and asset value shocks? And, especially, under what model of control, monitoring and liquidity allocation, do global banks play a more (de)stabilizing role for the macroeconomy? Is a centralized or a decentralized business model more conducive to macroeconomic stability? And how does internal capital markets liquidity interact with banks' loan due diligence activities, and hence influence the transmission of shocks, under different business models?

We use the rich data from the European Bank for Reconstruction and Development BEPS 2012 and 2020 survey waves to verify whether the patterns predicted by the model are consistent with those detected in the data. The analysis, as noted, can provide relevant policy implications regarding the diffusion of global banks and insights into regulations that could enhance the stabilizing role of global banking.

The rest of the paper is organized as follows. Section 2 relates the paper to the literature. Section 2 presents the motivating empirical evidence. In Section 3, we lay out the model and solve for agents' decisions. Section 4 discusses the calibration and previews the key mechanisms. In Section 5, we present simulation results. Section 6 extends the baseline environment while Section 7 concludes. Details on data and model derivations are in the Online Appendices.

Related literature In contrast, Scharfstein and Stein (2000) show that division-level rent-seeking behavior coupled with agency problems between headquarters and external capital markets can lead to wasteful overinvestment in poor projects at the expense of good ones...

Furthermore, since managers of single segment firms are more independent than divisional managers and have greater control over the cash flow produced, their utility from cash flows is greater than that of divisional managers. Finally, we assume that contract-

ing is incomplete. In particular, similar to the Scharfstein and Stein (2000), managers derive their utility from resources under their control.

2 Empirical Evidence (In Progress)

In this section we present evidence on the behavior of multinational banks using granular bank-level data from a large survey conducted by the European Bank for Reconstruction and Development, matched with country-level information on selected macroeconomic indicators. The BEPS survey data cover banks in a set of 34 countries, in Central and Eastern Europe, Central Asia, Russia, Turkey, and the Mediterranean regions. There are two survey waves relevant for our purposes: the BEPS II, conducted in 2012 with reference to the 2005-2011 period, and the BEPS III, conducted in 2020 with reference to the 2012-2019 period. In total, 345 banks were interviewed in each survey wave, covering about 75 per cent of all banking assets of the countries, on average.[1] The questionnaires were sent to the banks' chief executive officers and heads of credit.

The survey data provide detailed information on topics such as banks' lending and monitoring activities (e.g., hiring of loan officers for loan examination and extension purposes), lending technologies, and the competitive environment. They also provide details on banks' balance sheets and on the usage of internal capital markets, such as the provision of liquidity support through transfers within banking groups. A relevant feature of the BEPS survey is that it gives information on the role played by parent banks as well as the degree of reliance of local affiliates on their parents in their lending and monitoring decisions.

2.1 A first look at the data

In Table 1, we present summary statistics for key variables of interest. Panel A summarizes demographic characteristics of the sample of banks used in the empirical analysis. Among foreign bank subsidiaries, about 44% are owned by a foreign bank for more than 50% of shares.

[1] To form the target sample, banks were ranked from largest to smallest in each country and the largest banks were selected until 95 per cent of each country's total banking assets were included. The questionnaire targeted commercial, cooperative and savings banks active at the time of sampling.

Panel B reports summary statistics for the behavior of global banks along three dimensions: the degree of centralization of decisions within the conglomerate; the degree of liquidity support provided by the parent bank to the subsidiary, capturing the depth of internal capital markets; and the degree of direct involvement of the global bank in the hiring, selection and training of local loan officers. Consider first the extent of centralization. About 84% of the subsidiaries declare that their parent bank sets targets in terms on credit growth, while in roughly 50% of the cases the parent bank sets direction in terms of market shares or operates a centralized treasury department or desk.

Looking at internal capital markets, 59% of the foreign subsidiaries in the sample declare that they receive liquidity support from their parent bank. Finally, three questions speak to a direct involvement of parent banks in the selection and training of local loan officers. In more than 89% of cases the parent bank directly provides training to managers of the subsidiary, and in 86% of cases the parent participates directly in the selection of local managers. The number of call with the headquarters of the parent bank is approximately twelve per month.

2.2 Global banks behavior and response to shocks

The general equilibrium model yields predictions on two fronts. The response of global banks' lending, monitoring (loan officer employment and usage of other monitoring resources), and liquidity transfers to real and financial shocks, and how these responses depend on the degree of centralization of global banks, the degree of inefficiency/distance of parent headquarters relative to local affiliates, and the degree of control/interference of global parents' headquarters onto their affiliates' decisions.

The second type of predictions regards the influence of the behavior of global banks' decisions or presence on the transmission of shocks. The generic regression for testing the first set of predictions, run cross-sectionally on one survey wave or on a pool of the two cross-section), reads:

$$Len_{jit} \ (or \ Liq_{jit}, \ or \ Mon_{jit}) = \alpha_t + \alpha_i + \beta Y_{it} + \underbrace{\gamma X_j \times Y_{it}}_{Key \ term \ of \ interest} + \delta X_j + \zeta Z_i + \epsilon_j \quad (1)$$

or, if it is purely cross-sectional,

$$Len_{ji} \ (or \ Liq_{ji}, \ or \ Mon_{ji}) = \alpha_i + \underbrace{\gamma X_j \times Y_i}_{Key \ term \ of \ interest} + \delta X_j + \zeta Z_i + \epsilon_j \qquad (2)$$

where Len_{jit} denotes the indicator of lending activity, Liq_{ji} denotes the indicator for liquidity received from parent, Mon_{jit} denotes the indicator of monitoring activity (hiring of loan officers, use technology for screening, etc.); α_t, α_i are, respectively, time and country fixed effects; Y_{it} is the cyclical indicator of aggregate economic activity (GDP) or aggregate real or financial shock (this indicator could be at the country or region level); X_j is the set of key characteristics of the global bank and its relationship with the parent, capturing the degree of centralization of global banks, the degree of inefficiency/distance of parent headquarters relative to local affiliates, and the degree of control/interference of global parents' headquarters onto their affiliates' decisions; Z_i is a set of other control variables for the bank; and ϵ_j is the residual.

As described in the appendix, the key indicators in X_j include:...

3 The Model

Motivated by the empirical evidence, we develop a dynamic general equilibrium model with two countries ("host" and "foreign"). In each country there are three sectors: households; firms, divided between final good producers and capital producers; and banks, divided between global and local banks. Households consume and supply labor services to firms and to banks operating in their country. They also hold deposits in banks operating in the country. Final good producers use capital and labor in production, financing capital purchases with bank funding. Banks intermediate liquidity between households and firms. They also perform information production on the loans they extend to firms, using labor (loan officers) as an input in their loan monitoring activity. The characterizing feature of our economy consists of the presence, organizational structure, and governance of global banks. In particular, as we describe below, global banks exert control on, and manage liquidity across, their offices operating in the two countries.

In what follows, we present agents' decision problems focusing on the host country.

The foreign country is symmetric, unless otherwise stated. Variables referring to the foreign country are denoted by a (*).

3.1 Households

For tractability, we posit a representative household in each country. Within the household, a fraction $(1-f)$ of household members consist of workers while a fraction f consist of bankers. Each banker operates a bank and transfers dividends to the household. Each worker can work in final good production or as loan officers for bankers. There is perfect consumption insurance within the household. As in Gertler and Kiyotaki (2010) and Gertler and Karadi (2011), we assume an exogenous turnover between bankers and workers to limit bankers' ability to save to overcome financial constraints. In every period, bankers exit with an i.i.d. probability $(1-\sigma)$, in which case they transfer retained earnings to the household.[2] In turn, in each period a mass of $(1-\sigma)f$ workers randomly become bankers. Each new banker receives a transfer from the household, equal to a small, exogenous fraction ς of the total assets of exiting bankers.

Households in the host country choose consumption C_t, deposits D_t at local banks, deposits D_t^g at host-country affiliates of global banks, as well as their labor supply to final good producers (H_t), to local banks (L_t), and to global bank affiliates (L_t^g). They maximize their expected lifetime utility

$$\max_{\{C_t, D_t, D_t^g, H_t, L_t, L_t^g\}_{t\geq 0}} E_0 \sum_{t=0}^{\infty} \beta^t U(C_t, H_t, L_t, L_t^g)$$

$$\text{s.t.} \qquad C_t + D_t + D_t^g = R_{t-1}^D D_{t-1} + R_{t-1}^{D,g} D_{t-1}^g + W_t^H H_t + W_t^L L_t + W_t^{L,g} L_t^g + \Pi_t, \tag{3}$$

where β is the discount factor, W_t^H is the wage rate in the goods sector, W_t^L ($W_t^{L,g}$) is the wage rate at local (global) banks, R_{t-1}^D ($R_{t-1}^{D,g}$) is the gross deposit rate on deposits held in local (global) banks, and Π_t are profits earned from owning firms and local banks. We

[2]This guarantees that bankers cannot grow out of their collateral constraints. As capital constraints bind for bankers around the steady state, bankers will always retain earnings while in business and pay dividends upon exiting.

posit a GHH utility function

$$U_t = \frac{\left(C_t - hC_{t-1} - v_H \frac{H_t^{1+\varphi}}{1+\varphi} - v_L \frac{L_t^{1+\gamma}}{1+\gamma} - v_{L,g} \frac{L_t^{g\,1+\gamma}}{1+\gamma}\right)^{1-\sigma_c} - 1}{1-\sigma_c}, \tag{4}$$

where h denotes external consumption habits; φ and γ are the inverse of Frisch elasticity for workers employed in final good production and as loan officers, respectively. v_H and v_L ($v_{L,g}$) govern labor disutility in the final good sector and the local (global) banks, respectively.

Households' optimization yields equations (5) for the supply of labor to final good producers and to banks and the Euler equations (6) for consumption:

$$-\frac{U_{H_t}}{U_{C_t}} = W_t^H, \quad -\frac{U_{L_t}}{U_{C_t}} = W_t^L, \quad -\frac{U_{L_t^g}}{U_{C_t}} = W_t^{L,g}, \tag{5}$$

$$1 = E_t \Lambda_{t,t+1} R_t^D = E_t \Lambda_{t,t+1} R_t^{D,g}, \tag{6}$$

where $\Lambda_{t,t+1} = \beta E_t \frac{U_{C_{t+1}}}{U_{C_t}}$ is the stochastic discount factor. The equations in (6) imply the equality between the deposit rate paid by local banks and by global banks' affiliates, $R_t^D = R_t^{D,g}$.

3.2 Firms

3.2.1 Final Goods Producers

There is a unit continuum of final good producers that use physical capital and labor to produce final goods. Capital and labor are not mobile across countries. To finance purchases of capital, final good producers can issue state-contingent securities X_t, at a market price Q_t, and sell them to banks operating in the country (whether local banks or global banks' affiliates).[3] Their constant-returns-to-scale technology reads

$$Y_t = A_t K_{t-1}^{\alpha} H_t^{1-\alpha} \tag{7}$$

[3]We abstract from cross-border banking in our setting.

where Y_t is output, K_t is the stock of capital, and A_t is the total factor productivity (TFP). The TFP follows an $AR(1)$ process

$$A_t = \rho_A A_{t-1} + \varepsilon_t^A, \tag{8}$$

where ε_t^A is a white noise process and ρ_A measures the shock persistence. Letting δ denote the capital depreciation rate and I_t denote investment, the law of motion of capital is

$$K_t = I_t + (1-\delta)K_{t-1}. \tag{9}$$

Standard firm profit maximization yields the demand curves for labor and capital

$$W_t^H = (1-\alpha)\frac{Y_t}{H_t}, \tag{10}$$

$$R_t^k = \alpha\frac{Y_t}{K_{t-1}}, \tag{11}$$

where R_t^k is the return to capital.

3.2.2 Capital Producers

A capital producer can invest in I_t units of capital goods, which cost $\left[1 + F\left(\frac{I_t}{I_{t-1}}\right)\right] I_t$ units of consumption goods. $F(.)$ captures the adjustment cost in the capital producing technology, and satisfies $F(1) = F'(1) = 0$, and $F''(1) > 0$.

A capital producer chooses investment to maximize the expected present value of profits

$$\max_{\{I_t\}_{t\geq 0}} E_0 \sum_{t=0}^{\infty} \Lambda_{0,t} \left\{ Q_t I_t - \left[1 + F\left(\frac{I_t}{I_{t-1}}\right)\right] I_t \right\}, \tag{12}$$

where $Q_t I_t$ is the price of the capital when sold to final good producers. In equilibrium the price of capital is equal to the marginal cost of producing capital:

$$Q_t = 1 + F\left(\frac{I_t}{I_{t-1}}\right) + \frac{I_t}{I_{t-1}} F'\left(\frac{I_t}{I_{t-1}}\right) - E_t \Lambda_{t,t+1} \left(\frac{I_{t+1}}{I_t}\right)^2 F'\left(\frac{I_{t+1}}{I_t}\right). \tag{13}$$

3.3 Banks

Banks intermediate liquidity between households and firms. There are two types of banks. The first is a local bank which collects deposits from host-country households and acquires shares issued by host-country firms (and analogously for a local bank in the foreign country). The second type of bank is a global bank. This consists of a parent (variables of which denoted by superscript g^*) that gathers deposits from foreign households and acquires shares issued by foreign firms in the foreign country, and an affiliate (denoted by superscript g) that gathers deposits from host-country households and acquires shares issued by firms in the host country. A global bank is run by a pair of bankers from the foreign country household. When the bankers exit, both the parent and the affiliate terminate their business.

3.3.1 Liquidity and Control in the Banking Sector

Similar, e.g., to Gertler and Kiyotaki (2010) and Gertler and Karadi (2011), bankers can engage in strategic default and renege on the repayment of their liabilities. When a banker defaults, the financiers can trigger liquidation of the defaulting banker and seize a fraction of the liquidation value of the banker's assets. Due to this risk of strategic default, the access to retail liquidity of all banks (local and global) is subject to a collateral (capital) constraint: the value of their borrowing cannot exceed the pledgeable value of their assets. By hiring loan officers, banks perform due diligence on loans, raising their recovery value in case of default and, hence, their pledgeable value to financiers.

A global bank can engage in liquidity management and control within its conglomerate. In particular, it can transfer funds between the parent and the affiliate through internal capital markets (liquidity management). We model such liquidity transfers within the global bank's internal capital market as intra-group loans at a reduced interest rate, relative to the deposit rate. The global bank can also engage in (partial) control over the hiring of loan officers in its parent and affiliate offices. In particular, loan officers employed in the affiliate office comprise those autonomously hired by the affiliate and those hired by the conglomerate itself. We will elaborate below on liquidity management and control within global banks.

Events in a period t unfold as follows. First, aggregate shocks realize. Then, pro-

duction takes place. Thereafter, banks learn whether they exit and new banks enter the business. Finally, surviving banks gather deposits from households, receive transfers, hire loan officers, and purchase shares issued by firms.

3.3.2 Local Banks' Problem

Local banks in the host country decide their deposit taking, D_t, host-country households, purchases of shares, X_t, issued by host-country firms, and hiring of loan officers, L_t, to maximize the expected discounted sum of dividends they distribute to the host-country household

$$V_t \equiv \max_{\{X_{t+j}, D_{t+j}, L_{t+j}\}_{j\geq 0}} \quad E_t \sum_{j=0}^{\infty} (1-\sigma)\sigma^j \Lambda_{t,t+j+1} N_{t+j+1}, \tag{14}$$

$$\text{s.t.} \quad Q_t X_t = N_t + D_t - W_t^L L_t, \qquad [\lambda_t] \tag{15}$$

$$R_t^D D_t \leq \xi \mathcal{P}(Q_t X_t, L_t) Q_t X_t, \qquad [\mu_t] \tag{16}$$

where N_t is the local bank's net worth and $\mathcal{P}(\cdot)Q_t X_t$ is the pledgeable, recovery value of firm shares in case of strategic default. The pledgeable value of firm shares is a function of the intensity of due diligence activities performed by the local bank, as determined by the number of loan officers L_t it employs. We can equivalently interpret $[1-\mathcal{P}(\cdot)]Q_t X_t$ as the haircut applied to the market value of the portfolio of firm shares of the local bank. λ_t and μ_t denote the Lagrange multipliers for the resource constraint ant the collateral constraint of the local bank, respectively.

The local bank's net worth at time t is the gross payoff from assets funded at $t-1$, net of borrowing costs:

$$N_t = \left[R_t^k + (1-\delta)Q_t\right] X_{t-1} - R_{t-1}^D D_{t-1} + nw_t \tag{17}$$

where nw_t is an exogenous shock to the local bank's net worth.

Equation (15) is the resource constraint. Net worth and deposits are used to invest in firm shares and to pay wages to loan officers. Equation (16) is the collateral (capital) constraint which requires that the value of the local bank's liabilities (deposits) cannot exceed a fraction of the pledgeable value of its assets. The parameter ξ is a weight

governed by capital requirements. We specify the recoverable portion of the portfolio of firm shares as:

$$\mathcal{P}(Q_t X_t, L_t) = \left(\frac{L_t}{Q_t X_t} \right)^{1-\phi}, \tag{18}$$

where $1-\phi$ is the weight on bank due diligence in the recovery function. This is an increasing and concave function of the labor of loan officers, per unit of firm shares. Using (18), we obtain the recovery value of firm shares:

$$\mathcal{P}(Q_t X_t, L_t) Q_t X_t = (Q_t X_t)^{\phi} (L_t)^{1-\phi}. \tag{19}$$

The constant return to scale function in (19) allows to abstract from the distribution of net worth across local banks. Taking the FOCs for X_t, D_t, L_t, and combining them with the corresponding envelope conditions, we obtain:

$$\begin{aligned}
[\partial X_t]: \quad & -\lambda_t Q_t + \mu_t \xi \phi (L_t)^{1-\phi} (Q_t)^{\phi} (X_t)^{\phi-1} + \\
& + E_t \Lambda_{t,t+1} \left[R^k_{t+1} + (1-\delta) Q_{t+1} \right] (1 - \sigma + \sigma \lambda_{t+1}) = 0, \qquad (20) \\
[\partial D_t]: \quad & \lambda_t - \mu_t R^D_t - E_t \Lambda_{t,t+1} (1 - \sigma + \sigma \lambda_{t+1}) R^D_t = 0, \qquad (21) \\
[\partial L_t]: \quad & -\lambda_t W^L_t + \mu_t \xi (1-\phi) (L_t)^{-\phi} (Q_t X_t)^{\phi} = 0. \qquad (22)
\end{aligned}$$

Consider (20) for example. Acquiring firm shares tightens the current resource constraint (λ_t) of the local bank, but relaxes its current capital constraint (μ_t) and the future resource constraint (λ_{t+1}). The relaxation of the current capital constraint depends on the intensity of due diligence performed by loan officers (L_t). Consider next (22). By hiring loan officers, the local bank tightens its current resource constraint (λ_t) but raises its loan due diligence and pledgeable value of its assets, thus relaxing its collateral (capital) constraint (μ_t).

3.3.3 Global Banks: Affiliates' and Parents' Problem

Global affiliates After the aggregate shocks realize, the global bank affiliate chooses shares, X^g_t, to purchase in the host country, deposits, D^g_t, to gather from host-country households, and the number of loan officers L^a_t to hire, to maximize the expected dis-

counted sum of the dividends distributed to the foreign household

$$V_t^g \equiv \max_{\left\{X_{t+j}^g, D_{t+j}^g, L_{t+j}^a\right\}_{j\geq 0}} E_t \sum_{j=0}^{\infty} (1-\sigma)\sigma^j \Lambda_{t,t+j+1}^* N_{t+j+1}^g, \tag{23}$$

$$\text{s.t.} \quad Q_t X_t^g = N_t^g + D_t^g - W_t^{L,g} L_t^g + \mathcal{Z}_t^g, \qquad [\lambda_t^g] \tag{24}$$

$$R_t^D D_t^g + \theta R_t^D \mathcal{Z}_t^g \leq \xi \left[(1-\eta)\mathcal{P}^g(Q_t X_t^g, L_t^a, L_t^c) Q_t X_t^g + \eta \mathcal{P}^{g^*}(Q_t^* X_t^{g^*}, L_t^{a*}, L_t^{c*}) Q_t^* X_t^{g^*} \right] \quad [\mu_t^g] \tag{25}$$

$$L_t^g = L_t^a + L_t^c. \tag{26}$$

The net worth of the affiliate bank is

$$N_t^g = \left[R_t^k + (1-\delta)Q_t\right] X_{t-1}^g - R_{t-1}^D D_{t-1}^g - \theta R_{t-1}^D \mathcal{Z}_{t-1}^g. \tag{27}$$

$\Lambda_{t,t+j+1}^*$ is the foreign country stochastic discount factor, $L_t^g = L_t^a + L_t^c$ is the total number of host-country loan officers employed in due diligence by the global affiliate, L_t^a denotes the number of loan officers autonomously hired by the affiliate, and L_t^c is the number of loan officers directly hired (or indirectly managed) by the global bank conglomerate.[4] The conglomerate can thus exert control through its hiring of loan officers in the host country. In (25), L_t^{a*} and L_t^{c*} denote the loan officers of the parent bank abroad.

In the resource constraint of the affiliate, (24), $\mathcal{Z}_t^g$ is the total liquidity transfer received from the conglomerate. As noted, this transfer takes the form of an intra-group loan extended to the affiliate at a reduced cost of θR_t^D per unit of loan, where $(1-\theta) < 1$ governs the per-unit saving relative to retail deposits gathered in the host country. λ_t^g denotes the Lagrange multiplier for the resource constraint. The global bank affiliate takes as given the parent's portfolio choice, the intra-group loan $\mathcal{Z}_t^g$ from the parent (or extended to the parent, if $\mathcal{Z}_t^g < 0$), which is determined at the conglomerate level; and the number of loan officers directly chosen by the conglomerate (L_t^c).

Equation (25) is the collateral constraint (with Lagrange multiplier given by μ_t^g). The collateral constraint consolidates the assets of the affiliate and the parent. In particular,

[4] In a model extension, we will distinguish between direct and indirect forms of management of loan officers on the part of the conglomerate.

the right hand side of (25) is the weighted sum of two terms: the first, $\mathcal{P}^g(Q_t X_t^g, L_t^a, L_t^c) Q_t X_t^g$, is the recovery value of the firm shares held by the affiliate, whereas the second term, $\mathcal{P}^{g^*}(Q_t^* X_t^{g^*}, L_t^{a*}, L_t^{c*}) Q_t^* X_t^{g^*}$, is the recovery value of the firm shares held by the parent. The weight on the parent, η, governs the degree of consolidation of the affiliate's and parent's balance sheets, as determined, among other things, by the distribution of subsidiaries and branches of the global bank conglomerate. For example, a higher share of branches will entail a higher degree of consolidation of balance sheets across the conglomerate. A value of $\eta = 0$ implies complete separation, whereas $\eta = 0.5$ implies full consolidation.

As noted, due to partial sharing of control between affiliate and parent, the loan officers employed at the affiliate (L_t^g) are the sum of those autonomously chosen by the affiliate itself (L_t^a) and those chosen by the conglomerate (L_t^c), that is, $L_t^g = L_t^a + L_t^c$. The recoverable portion of liquidated assets held by the affiliate bank depends on the due diligence performed by loan officers hired autonomously (L_t^a) and by loan officers managed by the conglomerate (L_t^c) according to the following due diligence function

$$\mathcal{P}^g(Q_t X_t^g, L_t^a, L_t^c) = \left(\frac{\mathcal{L}_t}{Q_t X_t^g} \right)^{1-\phi}. \tag{28}$$

Taking a leaf from a broad literature in labor, we posit a CES aggregator of loan officers ($\mathcal{L}_t$)

$$\mathcal{L}_t = \left[(1-\chi) \left(L_t^a \right)^{\frac{\tau-1}{\tau}} + \chi (L_t^c)^{\frac{\tau-1}{\tau}} \right]^{\frac{\tau}{\tau-1}}. \tag{29}$$

τ denotes the elasticity of substitution between loan officers controlled by the affiliate and loan officers controlled by the conglomerate, while χ governs the productivity weights on the two categories of loan officers. In particular, when managing loan officers in the host country, the conglomerate may have worse local knowledge than the affiliate, and hence the due diligence of the loan officers it controls could be less effective than that of the loan officers hired by the affiliate ($\chi < 1/2$). For example, the conglomerate could have lower understanding of the local market for bank managers and officers, and hence end up hiring partially unsuitable loan officers. Using (28), the recovery value of the assets of the global bank affiliate is

$$\mathcal{P}^g(Q_t X_t^g, L_t^a, L_t^c) Q_t X_t^g = (Q_t X_t^g)^{\phi} (\mathcal{L}_t)^{1-\phi}. \tag{30}$$

As noted, the term $\mathcal{P}^{g^*}(Q_t^* X_t^{g^*}, L_t^{a*}, L_t^{c*}) Q_t^* X_t^{g^*}$ in (25) indicates the recovery value of assets for the parent bank operating in the foreign country. Positing a due diligence function analogous to that of local banks and global banks' affiliates, this has the following form

$$\mathcal{P}^{g^*}(Q_t^* X_t^{g^*}, L_t^{a*}, L_t^{c*}) Q_t^* X_t^{g^*} = (Q_t^* X_t^{g^*})^{\phi} (\mathcal{L}_t)^{1-\phi}, \tag{31}$$

where $\mathcal{L}_t^* = \left[(1-\chi)\left(L_t^{a^*}\right)^{\frac{\tau-1}{\tau}} + \chi (L_t^{c^*})^{\frac{\tau-1}{\tau}}\right]^{\frac{\tau}{\tau-1}}$ denotes the agggregated loan officers of the parent bank in the foreign country.

Combining the FOCs for X_t^g, D_t^g, L_t^a with the corresponding envelope conditions, we obtain the optimizing conditions for the loans extended by the global bank affiliate in the host economy

$$\begin{aligned}[\partial X_t^g]: \quad & -\lambda_t^g Q_t + \mu_t^g \xi (1-\eta)\phi \left[(1-\chi)\left(L_t^a\right)^{\frac{\tau-1}{\tau}} + \chi (L_t^c)^{\frac{\tau-1}{\tau}}\right]^{\frac{\tau(1-\phi)}{\tau-1}} (Q_t)^{\phi} (X_t^g)^{\phi-1} \\ & + E_t \Lambda_{t,t+1}^* \left[R_{t+1}^k + (1-\delta) Q_{t+1}\right] \left(1 - \sigma + \sigma \lambda_{t+1}^g\right) = 0, \end{aligned} \tag{32}$$

for the deposits gathered in the host economy

$$[\partial D_t^g]: \quad \lambda_t^g - \mu_t^g R_t^D - E_t \Lambda_{t,t+1}^* \left(1 - \sigma + \sigma \lambda_{t+1}^g\right) R_t^D = 0, \tag{33}$$

and for the loan officers directly hired by the local affiliate

$$\begin{aligned}[\partial L_t^a]: \quad & -\lambda_t^g W_t^{L,g} + \mu_t^g \xi (1-\eta)(1-\phi) \left[(1-\chi)\left(L_t^a\right)^{\frac{\tau-1}{\tau}} + \chi (L_t^c)^{\frac{\tau-1}{\tau}}\right]^{\frac{1-\tau\phi}{\tau-1}} \\ & \times (1-\chi)\left(L_t^a\right)^{-\frac{1}{\tau}} (Q_t X_t^g)^{\phi} = 0. \end{aligned} \tag{34}$$

The interpretation for (32) is analogous to that for the corresponding condition of the local bank in (20). Acquiring firm shares tightens the current resources constraint (λ_t^g) of the global affiliate, but relaxes its current capital constraint (μ_t^g) and future resource constraint (λ_{t+1}^g). The relaxation of the current capital constraint depends on the intensity of due diligence performed by loan officers employed at the affiliate. Consider next (44). From the perspective of the affiliate, hiring more loan officers tightens its current resource constraint (λ_t^g) but relaxes its capital constraint (μ_t^g). The latter effect depends on the productivity of loan officers hired by the affiliate ($1-\chi$) and on the degree of consolidation

between affiliate and parent $(1-\eta)$, among other things. Observe that, when choosing the loan officers to hire, the affiliate does not account for the impact that the pledgeability of its loans will have on the capital constraint (liquidity market access) of the parent. This will give rise to one of the key mechanisms at work in our economy.

Global parents The parent bank solves a problem similar to the affiliate, taking as given the transfer (intra-group loan) $Z_t^{g^*}$ and the level of due diligence $L_t^{g^*}$, which are decided at the conglomerate level:

$$V_t^{g^*} \equiv \max_{\left\{X_{t+j}^{g^*}, D_{t+j}^{g^*}\right\}_{j\geq 0}} E_t \sum_{j=0}^{\infty} (1-\sigma)\sigma^j \Lambda_{t,t+j+1}^* N_{t+j+1}^{g^*}, \tag{35}$$

$$\text{s.t.} \quad Q_t^* X_t^{g^*} = N_t^{g^*} + D_t^{g^*} - W_t^{L,g,*} L_t^{g^*} + \mathcal{Z}_t^{g^*} - \frac{\psi}{2}\left(Z_t^{g^*} - \overline{Z}^{g^*}\right)^2, \quad [\lambda_t^{g^*}] \tag{36}$$

$$R_t^{D^*} D_t^{g^*} + \theta R_t^D \mathcal{Z}_t^{g^*} \leq \xi \left[(1-\eta)\mathcal{P}^{g^*}(Q_t^* X_t^{g^*}, L_t^{a^*}, L_t^{c^*}) Q_t^* X_t^{g^*} + \eta \mathcal{P}^g(Q_t X_t^g, L_t^a, L_t^c) Q_t X_t^g\right], \ [\mu_t^{g^*}] \tag{37}$$

$$L_t^{g*} = L_t^{a*} + L_t^{c*}. \tag{38}$$

where $\lambda_t^{g^*}$ and $\mu_t^{g^*}$ are, respectively, the Lagrange multipliers for the resource constraint and the collateral constraint of the parent, while $W_t^{L^*}$ is the wage earned by loan officers in the foreign country. Intra-group loans between the parent and the affiliate incur a quadratic implementation cost as in the resource constraint, where $\overline{Z}^{g^*}$ is the steady state value of the intra-group loan. The parameter ψ governs the size of this cost for making intra-group loans, as determined by the depth of internal capital markets, for instance.[5]

$$\mathcal{L}_t^* = \left[(1-\chi)\left(L_t^{a*}\right)^{\frac{\tau-1}{\tau}} + \chi (L_t^{c*})^{\frac{\tau-1}{\tau}}\right]^{\frac{\tau}{\tau-1}}. \tag{39}$$

$$\mathcal{P}^{g^*}(Q_t^* X_t^{g^*}, L_t^{a^*}, L_t^{c^*}) Q_t^* X_t^{g^*} = (Q_t^* X_t^{g^*})^{\phi} (\mathcal{L}_t^*)^{1-\phi}, \tag{40}$$

Similar to the affiliate, the capital constraint (37) of the parent consolidates the balance

[5]Note that in the above specification we are implicitly assuming that the cost (ψ) of making intra-group loans (as well as the capital intensity of the loans, as determined by the discount on intra-group loans θ) are the same across types of intra-group loans (described below). We will later relax this assumption.

sheets of the parent and the affiliate. The net worth $N_t^{g^*}$ of the parent bank is

$$N_t^{g^*} = \left[R_t^{k^*} + (1-\delta)Q_t^*\right] X_{t-1}^{g^*} - R_{t-1}^{D^*} D_{t-1}^{g^*} - \theta R_{t-1}^{D} \mathcal{Z}_{t-1}^{g^*}. \tag{41}$$

Combining the FOCs for $X_t^{g^*}$ and $D_t^{g^*}$ with the corresponding envelope conditions yields the following optimizing conditions for the loans of the global parent

$$\begin{aligned}[\partial X_t^{g^*}]: \quad & -\lambda_t^{g^*} Q_t^* + \mu_t^{g^*} \xi \phi (1-\eta) \left[(1-\chi)\left(L_t^{a*}\right)^{\frac{\tau-1}{\tau}} + \chi (L_t^{c*})^{\frac{\tau-1}{\tau}}\right]^{\frac{\tau(1-\phi)}{\tau-1}} (Q_t^*)^{\phi} (X_t^{g^*})^{\phi-1} \\ & + E_t \Lambda_{t,t+1}^* \left[R_{t+1}^{k^*} + (1-\delta)Q_{t+1}^*\right] \left(1 - \sigma + \sigma \lambda_{t+1}^{g^*}\right) = 0, \end{aligned} \tag{42}$$

and for its deposit gathering

$$[\partial D_t^{g^*}]: \quad \lambda_t^{g^*} - \mu_t^{g^*} R_t^{D^*} - E_t \Lambda_{t,t+1}^* \left(1 - \sigma + \sigma \lambda_{t+1}^{g^*}\right) R_t^{D^*} = 0. \tag{43}$$

$$\begin{aligned}[\partial L_t^{a*}]: \quad & -\lambda_t^{g*} W_t^{L,g,*} + \mu_t^{g*} \xi (1-\eta)(1-\phi) \left[(1-\chi)\left(L_t^{a*}\right)^{\frac{\tau-1}{\tau}} + \chi (L_t^{c*})^{\frac{\tau-1}{\tau}}\right]^{\frac{1-\tau\phi}{\tau-1}} \\ & \times (1-\chi)\left(L_t^{a*}\right)^{-\frac{1}{\tau}} (Q_t^* X_t^{g*})^{\phi} = 0. \end{aligned} \tag{44}$$

3.3.4 Global Banks: Liquidity Management and Control in the Conglomerate

Global banks can operate liquidity transfers, in the form of intra-group loans, between the parent and the affiliate, subject to implementation costs. These transfers are decided at the conglomerate level. In addition to managing liquidity through internal capital markets, global bank conglomerates can also exert partial control over the due diligence activities (loan officers hiring) of their affiliates.

To better understand the comparison of our economy with alternative economies later in the analysis, it is useful to think of intra-group loans as including two components. One component has "no strings attached", that is, it does not entail any control of the conglomerate over the due diligence decisions of the affiliate. The second component, instead, has "strings attached", as it serves to finance the wage bill of loan officers hired

by the conglomerate in the host country.[6] Formally,

$$\mathcal{Z}_t^g = Z_t^g + W_t^{L,g} L_t^c, \tag{45}$$

$$\mathcal{Z}_t^{g*} = Z_t^{g*} + W_t^{L,g,*} L_t^{c*}, \tag{46}$$

where $\mathcal{Z}_t^g$ denotes the total intra-group loan, Z_t^g is the "no strings attached" component of the loan, and $W_t^L L_t^c$ is the wage bill of the host-country loan officers hired by the conglomerate (recall that the affiliate also hires L_t^a in autonomy).

In addition to choosing transfers and hiring loan officers in the host country, the conglomerate can also choose the parent's loan officers, $L_t^{g^*}$.

The conglomerate thus decides the intra-group loan (Z_t^g and $Z_t^{g^*}$), the loan officers employed by the parent, L_t^{c*}, and the affiliate's loan officers L_t^c to hire in the host country solving the following optimization problem:

$$\max_{Z_t^g, Z_t^{g^*}, L_t^c, L_t^{c*}} \quad V_t^g + V_t^{g^*} \tag{47}$$

$$\text{s.t. } \underbrace{(Z_t^g + W_t^{L,g} L_t^c)}_{\mathcal{Z}_t^g} + Z_t^{g^*} + W_t^{L,g,*} L_t^{c*} = 0. \tag{48}$$

The first order condition with respect to the "no strings attached" component of transfers equalizes their marginal values at the parent $\left(\frac{\partial V_t^{g^*}}{\partial Z_t^{g^*}}\right)$ and the affiliate $\left(\frac{\partial V_t^g}{\partial Z_t^g}\right)$. For the global bank affiliate

$$\frac{\partial V_t^g}{\partial Z_t^g} = \lambda_t^g - \theta R_t^D \mu_t^g - E_t \Lambda_{t,t+1}^* \left(1 - \sigma + \sigma \lambda_{t+1}^g\right) \theta R_t^D. \tag{49}$$

The liquidity transfer relaxes the current resource constraint of the affiliate (λ_t^g), but it tightens its current capital constraint (μ_t^g) and future resource constraint (λ_{t+1}^g). The tightening of the capital constraint and future resource constraint depends on the magnitude of θ, the discount associated with the intra-group loan.

[6] As it will become clear below, when global banks can make no-string attached transfers, and their implementation cost is the same as for string-attached transfers, it is immaterial whether wages of loan officers hired by the conglomerate are paid with liquidity of the parent or of the affiliate. This is not true, however, when no-string attached transfers are not feasible or have different implementation costs.

In turn, for the parent

$$\frac{\partial V_t^{g^*}}{\partial Z_t^{g^*}} = \lambda_t^{g^*}\left[1-\psi\left(Z_t^{g^*}-\overline{Z}^{g^*}\right)\right] - \theta R_t^D \mu_t^{g^*} - E_t\Lambda_{t,t+1}^*\left(1-\sigma+\sigma\lambda_{t+1}^{g^*}\right)\theta R_t^D. \quad (50)$$

Equalizing the marginal values yields

$$\begin{aligned}&\lambda_t^g - \theta R_t^D \mu_t^g - E_t\Lambda_{t,t+1}^*\left(1-\sigma+\sigma\lambda_{t+1}^g\right)\theta R_t^D \\ &= \lambda_t^{g^*}\left[1-\psi\left(Z_t^{g^*}-\overline{Z}^{g^*}\right)\right] - \theta R_t^D \mu_t^{g^*} - E_t\Lambda_{t,t+1}^*\left(1-\sigma+\sigma\lambda_{t+1}^{g^*}\right)\theta R_t^D. \quad (51)\end{aligned}$$

When equalizing the marginal values at the parent and at the affiliate, the conglomerate thus takes into account the impact of the "no strings attached" component of transfers on resource and capital constraints of parent and affiliate.

In turn, the first order condition for the conglomerate's hiring of loan officers at the affiliate level (L_t^c) (and, hence, for the "strings attached" component of intra-group loans) reads

$$\begin{aligned}[\partial L_t^c]: \quad &\xi(1-\phi)\left[\mu_t^g(1-\eta)+\mu_t^{g^*}\eta\right]\left[(1-\chi)\left(L_t^a\right)^{\frac{\tau-1}{\tau}}+\chi(L_t^c)^{\frac{\tau-1}{\tau}}\right]^{\frac{1-\tau\phi}{\tau-1}}\chi\left(L_t^c\right)^{-\frac{1}{\tau}}\left(Q_t X_t^g\right)^{\phi} \\ &-\theta\mu_t^g R_t^D W_t^{L,g} - E_t\Lambda_{t,t+1}^*\left(1-\sigma+\sigma\lambda_{t+1}^g\right)\theta R_t^D W_t^{L,g} \\ &= W_t^{L,g}\left\{\lambda_t^{g^*}\left[1-\psi\left(Z_t^{g^*}-\overline{Z}^{g^*}\right)\right] - \theta R_t^D\mu_t^{g^*} - E_t\Lambda_{t,t+1}^*\left(1-\sigma+\sigma\lambda_{t+1}^{g^*}\right)\theta R_t^D\right\}. \quad (52)\end{aligned}$$

Finally, the first order condition for the parent's hiring of loan officers ($L_t^{c^*}$) is

$$\begin{aligned}[\partial L_t^{c*}]: \quad &\xi(1-\phi)\left[\mu_t^g\eta+\mu_t^{g^*}(1-\eta)\right]\left[(1-\chi)\left(L_t^{a*}\right)^{\frac{\tau-1}{\tau}}+\chi(L_t^{c*})^{\frac{\tau-1}{\tau}}\right]^{\frac{1-\tau\phi}{\tau-1}}\chi\left(L_t^{c*}\right)^{-\frac{1}{\tau}}\left(Q_t^* X_t^{g*}\right)^{\phi} \\ &-\theta\mu_t^{g*} R_t^D W_t^{L,g,*} - E_t\Lambda_{t,t+1}^*\left(1-\sigma+\sigma\lambda_{t+1}^{g*}\right)\theta R_t^D W_t^{L,g,*} \\ &= W_t^{L,g,*}\left\{\lambda_t^{g^*}\left[1-\psi\left(Z_t^{g^*}-\overline{Z}^{g^*}\right)\right] - \theta R_t^D\mu_t^{g^*} - E_t\Lambda_{t,t+1}^*\left(1-\sigma+\sigma\lambda_{t+1}^{g^*}\right)\theta R_t^D\right\}. \quad (53)\end{aligned}$$

Consider (53). From the perspective of the conglomerate, hiring more loan officers in the host economy relaxes both the affiliate's capital constraint (μ_t^g) and the parent's capital constraint ($\mu_t^{g^*}$), due to the consolidation of balance sheets across the conglomerate. This relaxation depends on the productivity of loan officers directly managed by the con-

glomerate. Hiring more loan officers in the host economy, on the other hand, tightens the resource constraint at parent offices ($\lambda_t^{g^*}$) and affects also the capital constraints at parent ($\mu_t^{g^*}$) and affiliate offices (μ_t^g). In fact, the payment of loan officers directly managed by the parent entails a strings-attached liquidity transfer to the affiliate.

We will come back below to the mechanisms of interaction between internal capital markets interacts and the control exerted by global banks.

3.4 Market Clearing

In the general equilibrium, both in the host economy and in the foreign economy the deposit market, the loan market, and the labor markets for local loan officers and final good workers must clear. In particular, in the host economy

$$K_t = X_t + X_t^g \tag{54}$$

$$L_t^s = L_t + L_t^a + L_t^c \tag{55}$$

$$D_t^s = D_t + D_t^g. \tag{56}$$

Consider (54) for instance: the total firm shares held by local banks and global banks' affiliates must equal the total capital stock of firms.

Analogously, in the foreign economy

$$K_t^* = X_t^* + X_t^{g^*} \tag{57}$$

$$L_t^{s^*} = L_t^* + L_t^{a*} + L_t^{c*} \tag{58}$$

$$D_t^{s^*} = D_t^* + D_t^{g^*}. \tag{59}$$

Observe that in equilibrium the global social resource constraint will also hold.

4 Steady State and Calibration (In Progress)

We calibrate the model referring to the data on multinational banks used in the empirical analysis. We match moments obtained as the average of the country specific moments observed in the data set. More specifically, there are 20 parameters to be calibrated. A

first set of parameters relate to households' preferences and firms' technology and are calibrated following previous models in the macro-banking literature. The parameters for preferences include β (households' discount factor), h (habit formation), υ_h and υ_L (labor disutility for workers employed in the final good sector and in the banking sector, respectively), φ and γ (the inverse of the Frisch elasticity for final good workers and loan officers, respectively), and σ_c (households' relative risk aversion coefficient). The parameters governing firms' technology include κ (the investment adjustment cost), α (the capital share in the Cobb-Douglas production function), δ (the depreciation rate of capital), and ρ_A (the degree of persistence of the productivity shock).

A second group of parameters instead relate to the banking sector. For some of these parameters we refer to previous macro-banking studies, while the others are calibrated according to banking data (including our database). Namely, the former set includes: σ (the survival probability of bankers), ς (the small startup fund received by a new banker), ξ (the regulatory parameter for banks' collateral constraint), and ψ (the adjustment cost for implementing transfers). The latter set includes θ (the cost saving associated with intra-group loans) and η (the degree of balance sheet consolidation), which are calibrated referring to aggregate banking data. We instead use our multinational bank database to calibrate ϕ (the Cobb-Douglas parameter on due diligence), τ (substitution/complementarity in the CES aggregator between locally controlled conglomerate-controlled loan officers), and χ (relative productivity of loan officers directly hired by the global banks' affiliates).

Table # summarizes our calibrated parameters.

4.1 A Preview of Key Mechanisms

Inspection of banks' decisions reveals the key trade-offs that we expect to shape banks' response to aggregate shocks and, hence, the transmission of the shocks to the macroeconomy. A key trade-off arises in the choice of banks' monitoring, between the internalization of the effects on the whole conglomerate and the (possibly lower) efficiency of loan officers.

In the model economy, investors' perception of the financial health of a global bank conglomerate, and hence the access of global banks' affiliates and parents to liquidity markets, depends on the status of loans across the multiple countries in which the conglomerate operates. An example can help fix ideas. Suppose that a global conglomerate

has a bad loan portfolio status in Poland. This will also affect the perception of investors in the Czech Republic, raising skepticism about the stability of the conglomerate. However, local affiliates in Poland will mostly pay attention to the local situation in Poland, not internalizing correctly the consequences of their choices across the whole conglomerate. In other words, an agency problem arises between the headquarters of the conglomerate and its local affiliates: the conglomerate cannot make its local affiliates fully internalize the consequences of decisions made at the local level.

On the other side of the trade-off, controlling decisions in a centralized way, i.e., through the direct hiring of loan officers from headquarters, encounters the problem that headquarters can understand local conditions less, thus leading to a lower productivity of loan officers managed centrally, at the conglomerate level.

More precisely, compare the first order conditions for L_t^a and L_t^c in (44) and (53), respectively. When the conglomerate of the global bank makes decisions about loan due diligence (choosing L_t^c), it internalizes the positive effect that loan officers have not only on the pledgeability of local loans, for lending in the host country, but also on the pledgeability of loans for foreign lending, in the parent offices. By contrast, the choice made by the local affiliate (L_t^a) neglects the partial consolidation of the balance sheets of the global bank, thus failing to internalize spillovers across the conglomerate. On the other hand, comparing the FOCs for L_t^a and L_t^c, it emerges also the second key leg of the trade-off. There is a inherent inefficiency of loan officers hired and trained by the conglomerate in monitoring loans (with this relative inefficiency being governed by the parameter χ).

To better grasp the trade-off, it is insightful to derive an expression for the ratio between L_t^c and L_t^a. After some algebra, in equilibrium

$$\left(\frac{L_t^c}{L_t^a}\right)^{-\frac{1}{\tau}} = \underbrace{\frac{1-\chi}{\chi}}_{Efficiency} \underbrace{\frac{\mu_t^g(1-\eta)}{\mu_t^g(1-\eta)+\mu_t^{g^*}\eta}}_{Externality}. \tag{60}$$

As (60) shows, the larger is the degree of consolidation, and hence the larger the external effects of due diligence, the higher will be L_t^c relative to L_t^a. In fact, local affiliates will fail to internalize a large effect of their due diligence on the conglomerate. This will be especially

true when the capital constraint on the other banks in the conglomerate is tighter ($\mu_t^{g^*}$ is higher). In an opposite direction, the higher the inefficiency of conglomerates relative to local affiliates in selecting and training loan officers (i.e., the smaller is $1-\chi$), the lower will be the ratio of L_t^c to L_t^a. In steady state, since $\mu^g = \mu^{g^*}$, the above reduces to

$$\left(\frac{L^c}{L^a}\right)^{-\frac{1}{\tau}} = \frac{(1-\chi)(1-\eta)}{\chi}.$$

As we now turn to elaborate, global banks' due diligence choice interacts with the functioning of their internal capital markets.

The interaction with internal capital markets Internal capital markets (a finite ψ) allow global banks to make both "string-attached" and "no string-attached" liquidity transfers. This ability affects the trade-off between inefficiency and internalization outlined above, subject to the costs associated with implementing the transfers. On top of affecting the trade-off between inefficiency and internalization, the usage of internal capital markets can have indirect implications for monitoring activities. In fact, the pure provision of "no string-attached" liquidity (Z_t^g) can dilute the monitoring incentive of local affiliates by reducing the tightness of liquidity constraints. Observe, in fact, from the FOC of loan officers L^a in (44), that this incentive is tied to the tightness of the capital constraint, as captured by μ_t^g. To the extent that cheap intra-group loans replace more costly retail deposits gathered from households, the tightness of the capital constraint will be affected too.

More in particular, the following observations emerge from the comparison between our economy and alternative model economies. If one considers a comparison economy where internal capital markets are partially shut down and it is not possible for global banks to implement "no string-attached" liquidity transfers (mere liquidity shifts), but only to carry out "string-attached" liquidity transfers, then there will be no equalization of the marginal value of liquidity across locations, that is,

$$\begin{aligned} &\lambda_t^g - \theta R_t^D \mu_t^g - E_t \Lambda_{t,t+1}^* \left(1 - \sigma + \sigma \lambda_{t+1}^g\right) \theta R_t^D \neq \\ &\neq \lambda_t^{g^*} \left[1 - \psi \left(Z_t^{g^*} - \overline{Z}^{g^*}\right)\right] - \theta R_t^D \mu_t^{g^*} - E_t \Lambda_{t,t+1}^* \left(1 - \sigma + \sigma \lambda_{t+1}^{g^*}\right) \theta R_t^D . \end{aligned} \tag{61}$$

Therefore,

$$\left(\frac{L_t^c}{L_t^a}\right)^{-\frac{1}{\tau}} = \underbrace{\frac{\lambda_t^{g^*}\left[1-\psi\left(Z_t^{g^*}-\overline{Z}^{g^*}\right)\right]+\theta R_t^D(\mu_t^g-\mu_t^{g^*})+\Upsilon_t}{\lambda_t^g}}_{Cost\ of\ Liquidity}\ \underbrace{\frac{1-\chi}{\chi}}_{Efficiency}\ \underbrace{\frac{\mu_t^g(1-\eta)}{\mu_t^g(1-\eta)+\mu_t^{g^*}\eta}}_{Externality} \tag{62}$$

where $\Upsilon_t \equiv E_t\Lambda_{t,t+1}^*\left(\lambda_{t+1}^g-\lambda_{t+1}^{g^*}\right)\sigma\theta R_t^D$.

The choice of loan officers can then be distorted relative to considerations of efficiency and internalization. In fact, at least partly, loan officers hired by the parent will paid with resources transferred by the parent. But if there is no equalization of the value of liquidity across locations, then the value of liquidity could be higher or lower in the affiliate than in the parent.[7] In this case there would be more or less propensity to hire loan officers at the parent level, which will imply more or less internalization of the effects but also more or less productivity losses. Note in particular, that it could even be

$$\left\{\lambda_t^{g^*}\left[1-\psi\left(Z_t^{g^*}-\overline{Z}^{g^*}\right)\right]+\theta R_t^D(\mu_t^g-\mu_t^{g^*})+\Upsilon_t\right\}\mu_t^g(1-\eta) > \lambda_t^g\left[\mu_t^g(1-\eta)+\mu_t^{g^*}\eta\right]. \tag{63}$$

If one shuts down centralization, then the parent bank may induce monitoring of the affiliate by reducing liquidity transfers.

5 The Response to Shocks (In Progress)

We investigate the response of the economy to financial and real (TFP) shocks. Financial shocks take the form of shocks to the net worth of banks. We compare our economy with two benchmark economies. The first benchmark economy is a "decentralized control" economy, in which global banks can implement "no-string attached" transfers, but do not influence the hiring of loan officers by their affiliates. Formally, in this first benchmark economy we posit $\chi = 0$ (i.e., loan officers hired directly by the global bank conglomerate have zero productivity), while ψ is positive and finite. The second benchmark economy is a "decentralized liquidity" economy, in which global banks can influence the hiring of loan officers by their affiliates and have to implement "string attached" transfers to finance

[7] Observe from (44) that for the affiliate the marginal cost of spending one additional unit of final good for hiring loan officers autonomously is given by λ_t^g.

their wage bill, but cannot implement "no-string attached" transfers. To capture this second benchmark economy, we posit a different cost for implementing string-attached and no-string attached transfers, i.e., (36) becomes

$$Q_t^* X_t^{g^*} = N_t^{g^*} + D_t^{g^*} - W_t^{L^*} L_t^{g^*} + Z_t^{g^*} - \frac{\psi_1}{2}\left(Z_t^g - \overline{Z}^g\right)^2 - \frac{\psi_2}{2}\left(W_t^L L_t^c - \overline{W^L L^c}\right)^2 \quad (64)$$

and we let ψ_1 be infinite and ψ_2 be positive but finite.

5.1 Financial (bank net worth) shocks

We study the effects of real (productivity and capital quality) and financial (bank net worth) shocks. The results suggest that the stabilizing or propagating effects of global banks are heavily influenced by the functioning of internal capital markets and by the degree of loan monitoring control exerted by parent banks. That is, not only global banks, but also the structural organization of global banking matter. Following a negative net worth shock hitting both local and global banks, in spite of the reduction of their net worth, global banks expand countercyclically their lending to firms in the host economy, unlike local banks which instead shrink their loans. The stabilizing, countercyclical behavior of global banks' lending reflects a countercyclical behavior of their loan monitoring intensity, financed by substantial liquidity support (transfers) from parent banks through internal capital markets. This effect manifests primarily when global banks have a centralized control of loan monitoring decisions, and thus internalize the negative effects of the shock on the whole banking conglomerate.

5.2 Real (productivity and capital quality) shocks

The effects of global banks' lending become more nuanced when considering the impact of negative productivity shocks in the host country. The reduction in firm productivity directly erodes global banks' incentive to extend loans in the host country. Nonetheless, the inflow of transfers through internal capital markets enables global banks to expand their loan monitoring. This, in turn, tends to boost global banks' lending in the host country. The cyclical behavior of global banks' lending depends on whether the former or the latter effects dominate. The structure of global banks contributes to determining

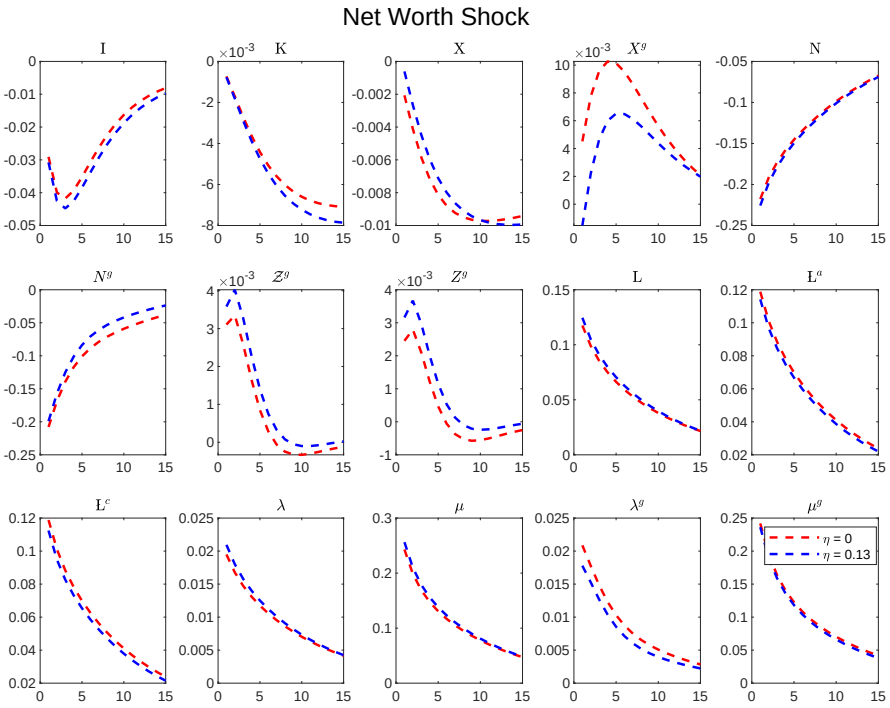


Figure 1: Impulse Responses of the Host Country Economy

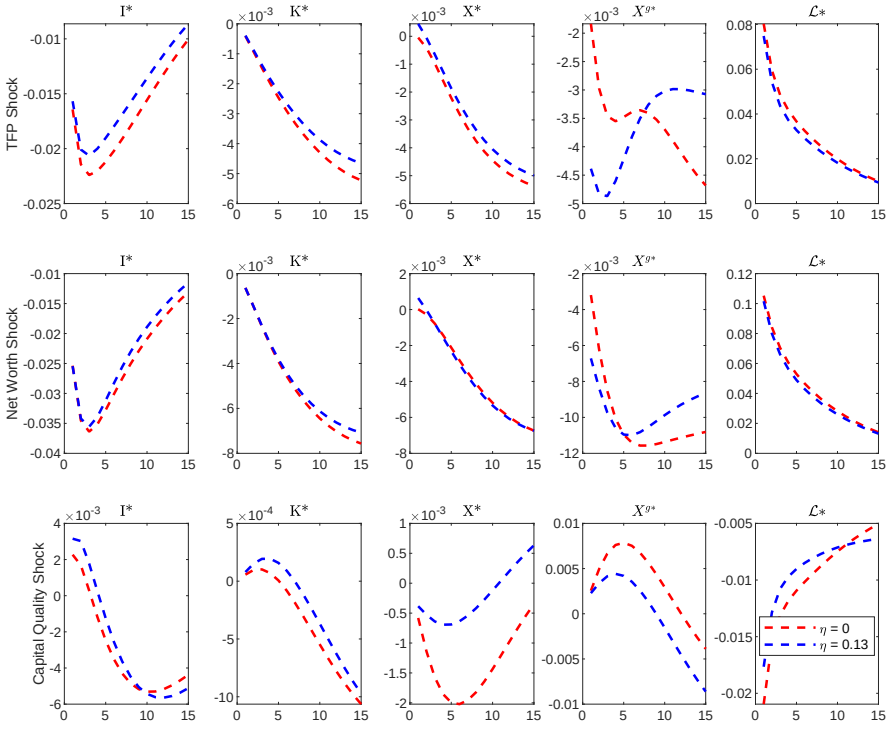


Figure 2: Impulse Responses of the Foreign Country Economy

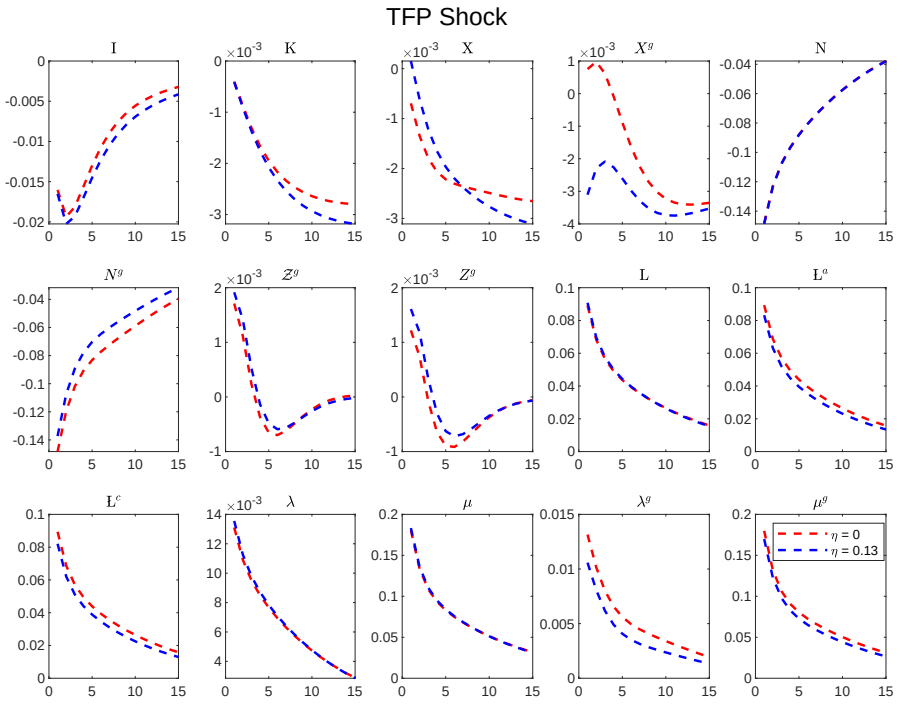


Figure 3: Impulse Responses of the Host Country Economy

the net balance between the two opposite forces. We obtain that when global banks exert centralized control over their monitoring decisions, their countercyclical monitoring dominates over the direct impact of lower productivity, while the reverse occurs when loan monitoring is decentralized at the level of local affiliates.

6 Extensions (In Progress)

6.1 Direct and Indirect Control of Global Banks

In the main setting, we assumed that the management of loan officers on the part of global banks' headquarters entails intervention in hiring or training loan officers in the host country. In this extension, we enrich our setting by distinguishing between loan officers hired and trained by the global bank locally, in the host country, and loan officers hired and trained in the global bank's origin country but that are allocated to monitoring host country loans.

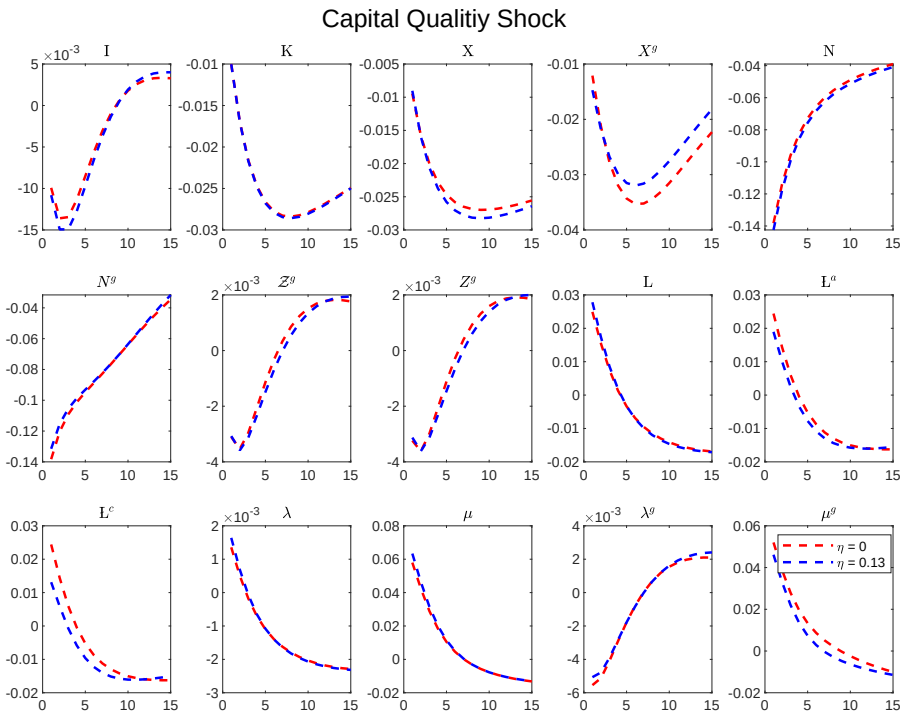


Figure 4: Impulse Responses of the Host Country Economy

6.2 Control of Global Banks and Liquidity Constraints

Online Appendices

7 Appendix A: Model Details

7.1 Details on Derivations

Local Banks

The local bank's objective function can be written in the following recursive form:

$$V_{t-1}(X_{t-1}, D_{t-1}, L_{t-1}) = E_{t-1}\Lambda_{t-1,t}\left[(1-\sigma)N_t + \sigma \max_{X_t, D_t, L_t} V_t(X_t, D_t, L_t)\right].$$

Then, the Lagrangian can be written as

$$\Upsilon = E_{t-1}\Lambda_{t-1,t}\left\{(1-\sigma)N_t + \sigma \max_{X_t, D_t, L_t}\left[V_t(D_t, X_t, L_t) + \lambda_t(...) + \mu_t(...)\right]\right\}.$$

The first order conditions are:

$$\begin{aligned}
[\partial X_t]: \quad & \sigma\frac{\partial V_t}{\partial X_t} - \sigma\lambda_t Q_t + \sigma\mu_t\xi\phi(L_t)^{1-\phi}(Q_t)^{\phi}(X_t)^{\phi-1} = 0, \\
[\partial D_t]: \quad & \sigma\frac{\partial V_t}{\partial D_t} + \sigma\lambda_t - \sigma\mu_t R_t^D = 0, \\
[\partial L_t]: \quad & -\sigma\lambda_t W_t^L + \sigma\mu_t\xi(1-\phi)(L_t)^{-\phi}(Q_t X_t)^{\phi} = 0.
\end{aligned}$$

The envelope conditions are:

$$\begin{aligned}
\frac{\partial V_{t-1}}{\partial X_{t-1}} &= E_{t-1}\Lambda_{t-1,t}\left[R_t^k + (1-\delta)Q_t\right](1-\sigma+\sigma\lambda_t), \\
\frac{\partial V_{t-1}}{\partial D_{t-1}} &= -E_{t-1}\Lambda_{t-1,t}(1-\sigma+\sigma\lambda_t)R_{t-1}^D.
\end{aligned}$$

Combining the FOC for X_t, D_t, L_t with the corresponding envelope conditions, we get:

$$\begin{aligned}
[\partial X_t]: \quad & -\lambda_t Q_t + \mu_t\xi\phi(L_t)^{1-\phi}(Q_t)^{\phi}(X_t)^{\phi-1} + \\
& + E_t\Lambda_{t,t+1}\left[R_{t+1}^k + (1-\delta)Q_{t+1}\right](1-\sigma+\sigma\lambda_{t+1}) = 0, \qquad (65) \\
[\partial D_t]: \quad & \lambda_t - \mu_t R_t^D - E_t\Lambda_{t,t+1}(1-\sigma+\sigma\lambda_{t+1})R_t^D = 0, \qquad (66) \\
[\partial L_t]: \quad & -\lambda_t W_t^L + \mu_t\xi(1-\phi)(L_t)^{-\phi}(Q_t X_t)^{\phi} = 0. \qquad (67)
\end{aligned}$$

The total net worth for the local bank, N_t, equals the sum of the net worth of existing bankers $N_{o,t}$ (o for old) and of entering bankers $N_{y,t}$ (y for young):

$$N_t = N_{o,t} + N_{y,t}.$$

Net worth of existing bankers equals earnings on assets net debt payments made in the previous period, multiplied by the fraction of bankers who survive until the current period, σ:

$$N_{o,t} = \sigma\left\{\left[R_t^k + (1-\delta)Q_t\right]X_{t-1} - R_{t-1}^D D_{t-1}\right\}.$$

Because the arrival of the investment opportunity is independent across time, interbank loans are netted out in the aggregate. As for entering bankers, the entry of each new banker is accompanied by a net transfer from the household equal to a small and exogenous fraction $(\varsigma/(1-\sigma))$ of the total value of the assets of exiting bankers:

$$N_{y,t} = \varsigma \left[R_t^k + (1-\delta)Q_t\right] X_{t-1}.$$

Putting things together, the total bank net worth $N_t = N_{o,t} + N_{y,t}$ evolves as

$$N_t = (\sigma + \varsigma)[R_t^k + (1-\delta)Q_t]X_{t-1} - \sigma R_{t-1}^D D_{t-1}. \tag{68}$$

Global Affiliates

The affiliate bank's objective function can be written in the following recursive form:

$$V_{t-1}^g(X_{t-1}^g, D_{t-1}^g, L_{t-1}^a) = E_{t-1}\Lambda_{t-1,t}^* \left[(1-\sigma)N_t^g + \sigma \max_{X_t^g, D_t^g, L_t^a} V_t^g(X_t^g, D_t^g, L_t^a)\right].$$

The Lagrangian could be written as:

$$\Upsilon^g = E_{t-1}\Lambda_{t-1,t}^* \left\{(1-\sigma)N_t^g + \sigma \max_{X_t^g, D_t^g, L_t^a} [V_t^g(D_t^g, X_t^g, L_t^a) + \lambda_t^g(...) + \mu_t^g(...)]\right\},$$

The first order conditions are:

$$[\partial X_t^g] : \sigma\frac{\partial V_t^g}{\partial X_t^g} - \sigma\lambda_t^g Q_t + \sigma\mu_t^g\xi(1-\eta)\phi\left[(1-\chi)\left(L_t^a\right)^{\frac{\tau-1}{\tau}} + \chi(L_t^c)^{\frac{\tau-1}{\tau}}\right]^{\frac{\tau(1-\phi)}{\tau-1}}(Q_t)^\phi(X_t^g)^{\phi-1} = 0,$$

$$[\partial D_t^g] : \sigma\frac{\partial V_t^g}{\partial D_t^g} + \sigma\lambda_t^g - \sigma\mu_t^g R_t^D = 0,$$

$$[\partial L_t^a] : -\sigma\lambda_t^g W_t^L + \sigma\mu_t^g\xi(1-\eta)(1-\phi)\left[(1-\chi)\left(L_t^a\right)^{\frac{\tau-1}{\tau}} + \chi(L_t^c)^{\frac{\tau-1}{\tau}}\right]^{\frac{1-\tau\phi}{\tau-1}}(1-\chi)\left(L_t^a\right)^{-\frac{1}{\tau}}(Q_t X_t^g)^\phi = 0.$$

The envelope conditions are:

$$\frac{\partial V_{t-1}^g}{\partial X_{t-1}^g} = E_{t-1}\Lambda_{t-1,t}^*\left[R_t^k + (1-\delta)Q_t\right](1-\sigma+\sigma\lambda_t^g),$$

$$\frac{\partial V_{t-1}^g}{\partial D_{t-1}^g} = -E_{t-1}\Lambda_{t-1,t}^*(1-\sigma+\sigma\lambda_t^g)R_{t-1}^D.$$

Combining the FOC for X_t^g, D_t^g, L_t^a with the corresponding envelope conditions, we could get:

$$[\partial X_t^g]: \quad -\lambda_t^g Q_t + \mu_t^g \xi(1-\eta)\phi \left[(1-\chi)\left(L_t^a\right)^{\frac{\tau-1}{\tau}} + \chi(L_t^c)^{\frac{\tau-1}{\tau}}\right]^{\frac{\tau(1-\phi)}{\tau-1}} (Q_t)^{\phi}(X_t^g)^{\phi-1} + \\ + E_t\Lambda_{t,t+1}^* \left[R_{t+1}^k + (1-\delta)Q_{t+1}\right]\left(1-\sigma+\sigma\lambda_{t+1}^g\right) = 0, \tag{69}$$

$$[\partial D_t^g]: \quad \lambda_t^g - \mu_t^g R_t^D - E_t\Lambda_{t,t+1}^*\left(1-\sigma+\sigma\lambda_{t+1}^g\right)R_t^D = 0, \tag{70}$$

$$[\partial L_t^a]: \quad -\lambda_t^g W_t^L + \mu_t^g \xi(1-\eta)(1-\phi)\left[(1-\chi)\left(L_t^a\right)^{\frac{\tau-1}{\tau}} + \chi(L_t^c)^{\frac{\tau-1}{\tau}}\right]^{\frac{1-\tau\phi}{\tau-1}} \times \\ \times (1-\chi)\left(L_t^a\right)^{-\frac{1}{\tau}}(Q_t X_t^g)^{\phi} = 0. \tag{71}$$

Similarly to the case of the local bank, the total net worth, N_t^g, is the sum of the net worth of existing bankers $N_{o,t}^g$ and of entering bankers $N_{y,t}^g$:

$$N_t^g = (\sigma+\varsigma)\left[R_t^k + (1-\delta)Q_t\right]X_{t-1}^g - \sigma R_{t-1}^D(D_{t-1}^g + \theta\mathcal{Z}_{t-1}^g). \tag{72}$$

Global Parent

The Lagrangian could be written as:

$$\Upsilon^{g^*} = E_{t-1}\Lambda_{t-1,t}^* \left\{(1-\sigma)N_t^{g^*} + \sigma \max_{X_t^{g^*}, D_t^{g^*}} \left[V_t^{g^*}(X_t^{g^*}, D_t^{g^*}) + \lambda_t^{g^*}(...) + \mu_t^{g^*}(...)\right]\right\}.$$

from which

$$[\partial X_t^{g^*}]: \quad \sigma\frac{\partial V_t^{g^*}}{\partial X_t^{g^*}} - \sigma\lambda_t^{g^*}Q_t^* + \sigma\mu_t^{g^*}\xi\phi(1-\eta)(L_t^{g^*})^{1-\phi}(Q_t^*)^{\phi}(X_t^{g^*})^{\phi-1} = 0,$$

$$[\partial D_t^{g^*}]: \quad \sigma\frac{\partial V_t^{g^*}}{\partial D_t^{g^*}} + \sigma\lambda_t^{g^*} - \sigma\mu_t^{g^*}R_t^{D^*} = 0.$$

The envelope conditions are:

$$\frac{\partial V_{t-1}^{g^*}}{\partial X_{t-1}^{g^*}} = E_{t-1}\Lambda_{t-1,t}^*\left[R_t^{k^*} + (1-\delta)Q_t^*\right]\left(1-\sigma+\sigma\lambda_t^{g^*}\right),$$

$$\frac{\partial V_{t-1}^{g^*}}{\partial D_{t-1}^{g^*}} = -E_{t-1}\Lambda_{t-1,t}^*\left(1-\sigma+\sigma\lambda_t^{g^*}\right)R_{t-1}^{D^*}.$$

Combining the FOC for X_t^g, D_t^g with the corresponding envelope conditions, we get:

$$\begin{aligned}[\partial X_t^{g^*}]: \quad & -\lambda_t^{g^*} Q_t^* + \mu_t^{g^*} \xi \phi (1-\eta)(L_t^{g^*})^{1-\phi}(Q_t^*)^{\phi}(X_t^{g^*})^{\phi-1} + \\ & + E_t \Lambda_{t,t+1}^* \left[R_{t+1}^{k^*} + (1-\delta)Q_{t+1}^*\right]\left(1-\sigma+\sigma\lambda_{t+1}^{g^*}\right) = 0, \qquad (73) \\ [\partial D_t^{g^*}]: \quad & \lambda_t^{g^*} - \mu_t^{g^*} R_t^{D^*} - E_t \Lambda_{t,t+1}^* \left(1-\sigma+\sigma\lambda_{t+1}^{g^*}\right) R_t^{D^*} = 0. \qquad (74)\end{aligned}$$

The total net worth, $N_t^{g^*}$, is the sum of the net worth of existing bankers $N_{o,t}^{g^*}$ and of entering bankers $N_{y,t}^{g^*}$:

$$N_t^{g^*} = (\sigma+\varsigma)\left[R_t^{k^*} + (1-\delta)Q_t^*\right] X_{t-1}^{g^*} - \sigma(R_{t-1}^{D^*} D_{t-1}^{g^*} + \theta R_{t-1}^{D} Z_{t-1}^{g^*}). \qquad (75)$$

7.2 Summary and Steady State

Parameters: $\underbrace{\beta, h, \upsilon_h, \upsilon_L, \varphi, \gamma, \sigma_c}_{Preferences}$ $\underbrace{\rho_A, \rho_{nw}, \alpha, \delta, \kappa,}_{Technology}$ $\underbrace{\sigma, \varsigma, \psi, \theta,}_{Banking from\ literature}$ $\underbrace{\eta}_{Bran/Subs}$, $\underbrace{\xi}_{capital\ regulation}$, ϕ, τ, χ, $\overline{Z}^{g^*}$ (22 parameters).

Endogenous: C_t, C_t^*, R_t^D, $R_t^{D^*}$, W_t^H, $W_t^{H^*}$, W_t^L, $W_t^{L^*}$, H_t, H_t^*, L_t, L_t^*, L_t^s, $L_t^{s^*}$, Π_t, Π_t^*, U_{C_t}, $U_{C_t}^*$, $\Lambda_{t,t+1}$, $\Lambda_{t,t+1}^*$, Y_t, Y_t^*, K_t, K_t^*, R_t^k, $R_t^{k^*}$, I_t, I_t^*, Q_t, Q_t^*, $\mathcal{Z}_t^g$, Z_t^g, $Z_t^{g^*}$, L_t^c, L_t^a, L_t^g, $L_t^{g^*}$, N_t, N_t^*, N_t^g, $N_t^{g^*}$, X_t, X_t^*, X_t^g, $X_t^{g^*}$, λ_t, μ_t, λ_t^*, μ_t^*, λ_t^g, μ_t^g, $\lambda_t^{g^*}$, $\mu_t^{g^*}$, D_t, D_t^*, D_t^g, $D_t^{g^*}$, A_t, nw_t (59 endogenous).

Exogenous: ε_t^A, ε_t^{nw} (2 shocks).

Households' and firms' blocks

$$R^D = R^{D^*} = \frac{1}{\beta}$$

$$Q = Q^* = 1$$

$$\Lambda = \Lambda^* = \beta$$

$$R^k = \frac{\text{loan spread}}{4} + \frac{1}{\beta} - 1 + \delta$$

$$\frac{Y}{K} = \frac{R^k}{\alpha}$$

$$\frac{H}{K} = \left(\frac{R^k}{\alpha A}\right)^{\frac{1}{1-\alpha}}$$

$$W^H = (1-\alpha)A\left(\frac{H}{K}\right)^{-\alpha}$$

$$H = \left(\frac{W^H}{\nu_H}\right)^{\frac{1}{\gamma}}$$

$$Y = AK^{\alpha}H^{1-\alpha}$$

$$I = \delta K$$

$$i_y = \frac{I}{Y}$$

$$c_y = 1 - i_y$$

$$C = c_y Y$$

Local Banks' Block

Block in L, X, μ as function of prices R^k,W

$$R^k = \frac{1}{\beta} - 1 + \delta + \underbrace{\frac{\mu(1-\sigma)\left[\frac{1}{\beta} + \frac{\phi}{1-\beta}\left(\frac{W^L L}{X} - R^k + \delta\right)\right]}{\beta - \sigma\beta + \sigma\mu}}_{Loan\ spread} \quad (76)$$

$$\mu\xi(1-\phi)(L)^{-\phi}(X)^{\phi} = \left[\frac{\mu}{(1-\sigma)\beta} + 1\right] W^L \quad (77)$$

$$\xi(L)^{1-\phi}(X)^{\phi-1} = \frac{1}{1-\beta}\left(R^k - \delta - \frac{W^L L}{X}\right) \quad (78)$$

Block solves for λ, D, N (79)

$$\lambda = \frac{\mu}{(1-\sigma)\beta} + 1 \quad (80)$$

$$D = \beta\xi(L)^{1-\phi}(X)^{\phi} \quad (81)$$

$$N = \left[R^k + (1-\delta)\right] X - \frac{D}{\beta} \quad (82)$$

μ, λ, L, X, N, D as function of prices R^k, W^L. That is multipliers μ, λ, bank labor L, loans X, deposits D, net worth N.

Global banks' block:

$$
\begin{aligned}
\text{Block} \quad &: \quad \mathrm{L}^{g^*},\mathrm{X}^{g^*},\mathrm{L}^{a},\mathrm{X}^{g},\mu^g \text{ as function of prices } R^{k^*}, R^k, W^{L^*}, W^L \\
\xi(1-\phi)(L^{g^*})^{-\phi}(X^{g^*})^{\phi} &= \left(\frac{1}{\beta(1-\sigma)}+\frac{1}{\mu^g}\right) W^{L^*} \\
W^{L^*}L^{g^*} &= X^{g^*}(R^{k^*}-\delta)+\xi\left[(1-\eta)\mathcal{P}^{g^*}(.)X^{g^*}+\eta\mathcal{P}^{g}(.)X^{g}\right](\beta-1) \\
\left(\frac{\mu^g}{\beta(1-\sigma)}+1\right) W^L &= \mu^g\xi(1-\eta)(1-\phi)\left[(L^a)^{\frac{\tau-1}{\tau}}\left(1-\chi+\chi\Omega^{\frac{\tau-1}{\tau}}\right)\right]^{\frac{1-\tau\phi}{\tau-1}}(1-\chi)\,(L^a)^{-\frac{1}{\tau}}\,(X^g)^{\phi} \\
W^L L^a(1+\Omega) &= X^g(R^k-\delta)+\xi\left[(1-\eta)\mathcal{P}^{g}(.)X^{g}+\eta\mathcal{P}^{g^*}(.)X^{g^*}\right](\beta-1) \\
\beta\left(1-\sigma+\sigma\lambda^g\right)\left(R^{k^*}-R^k\right) &= \mu^g\xi(1-\eta)\phi\left\{\left[(L^a)^{\frac{\tau-1}{\tau}}\left((1-\chi)+\chi\Omega^{\frac{\tau-1}{\tau}}\right)\right]^{\frac{\tau(1-\phi)}{\tau-1}}(X^g)^{\phi-1}-(L_t^{g^*})^{1-\phi}(X_t^g\right.
\end{aligned}
$$

Block solves for $\lambda^g, \lambda^{g^*}, L^c, Z^g, Z^{g^*}, D^g, D^{g^*}, N^g, N^{g^*}$

$$
\begin{aligned}
\mathcal{Z}^g &= Z^{g^*}=0, \quad Z^g=-W^L L^c \\
\mu^g &= \mu^{g^*}, \qquad \lambda^g=\lambda^{g^*}=\frac{\mu^g}{\beta(1-\sigma)}+1 \\
L^c &= \Omega L^a \qquad\qquad where\ \Omega=\frac{1}{\left(\frac{(1-\chi)(1-\eta)}{\chi}\right)^{\tau}}
\end{aligned}
$$

$$
\begin{aligned}
D^g &= \beta\xi\left[(1-\eta)\mathcal{P}^{g}(.)X^{g}+\eta\mathcal{P}^{g^*}(.)X^{g^*}\right] && (83)\\
D^{g^*} &= \beta\xi\left[(1-\eta)\mathcal{P}^{g^*}(.)X^{g^*}+\eta\mathcal{P}^{g}(.)X_t^{g}\right] && (84)\\
N^g &= \left[R^k+(1-\delta)\right]X^g-\frac{D^g}{\beta} && (85)\\
N^{g^*} &= \left[R^{k^*}+(1-\delta)\right]X^{g^*}-\frac{D^{g^*}}{\beta} && (86)
\end{aligned}
$$

Market clearing conditions:

Host economy

$$
\begin{aligned}
K &= X+X^g \\
L^s &= L+L^a+L^c
\end{aligned}
$$

Foreign Economy

$$\begin{aligned} K^* &= X^* + X^{g^*} \\ L^{s^*} &= L^* + L^{g^*} \end{aligned}$$

7.3 More Details on the Calibration

We provide here more details on the calibration of the parameters τ and χ. Consider the global banks' bloc in steady state.

We have

$$\frac{L^c}{L^a} = \Omega = \frac{1}{\left(\frac{(1-\chi)(1-\eta)}{\chi}\right)^{\tau}}$$

This gives us a fist equation in the parameters τ, χ (we have a value for η). We can use the data from Ralph to get a value for the target $\frac{L^c}{L^a}$, the frequency with wich multinational banks intervene in labor and human capital choices of their affiliates abroad.

We need a second equation. Again from global banks' bloc, use first and third equations

$$\begin{aligned} \xi(1-\phi)(L^{g^*})^{-\phi}(X^{g^*})^{\phi} &= \left(\frac{1}{\beta(1-\sigma)} + \frac{1}{\mu^g}\right) W^{L^*} \\ \left(\frac{\mu^g}{\beta(1-\sigma)} + 1\right) W^L &= \mu^g \xi(1-\eta)(1-\phi) \left[(L^a)^{\frac{\tau-1}{\tau}} \left(1 - \chi + \chi\Omega^{\frac{\tau-1}{\tau}}\right)\right]^{\frac{1-\tau\phi}{\tau-1}} (1-\chi)\,(L^a)^{-\frac{1}{\tau}}\,(X^g)^{\phi} \end{aligned}$$

We have, after some algebra,

$$\underbrace{\left(\frac{W^L}{W^{L^*}}\right)}_{from\ preferences}^{1-\phi} = (1-\eta)(1-\chi)\left[\left(1-\chi+\chi\Omega^{\frac{\tau-1}{\tau}}\right)\right]^{\frac{1-\tau\phi}{\tau-1}} \underbrace{\left(\frac{W^{L^*}L^{g^*}}{X^{g^*}}\right)}_{Salaries\ over\ assets}^{\phi} \underbrace{\left[\frac{X^g\,(1+\Omega)}{W^L\,(L^a+L^c)}\right]^{\phi}}_{Assets\ over\ salaries}$$

So, in conclusion

$$\begin{aligned}
\frac{L^c}{L^a} &= \Omega = \frac{1}{\left(\frac{(1-\chi)(1-\eta)}{\chi}\right)^{\tau}} \\
\underbrace{\left(\frac{W^L}{W^{L^*}}\right)}_{from\ preferences}^{1-\phi} &= (1-\eta)(1-\chi)\left[\left(1-\chi+\chi\Omega^{\frac{\tau-1}{\tau}}\right)\right]^{\frac{1-\tau\phi}{\tau-1}} \underbrace{\left(\frac{W^{L^*}L^{g^*}}{X^{g^*}}\right)}_{Salaries\ over\ assets}{}^{\phi} \underbrace{\left[\frac{X^g\,(1+\Omega)}{W^L\,(L^a+L^c)}\right]}_{Assets\ over\ salaries}^{\phi}
\end{aligned}$$

8 Appendix B: Data

Model elements:

1) Two variables in the model, L_t^g and $L_t^{g^*}$ correspond respectively to the effort and loan officer resources used to screen and monitor loans locally (L_t^g), and to screen and monitor loans from the parent/headquarter office $L_t^{g^*}$. These can be interpreted as effort, employees, technologies, etc.

As a subpart of this, the model allows the capacity of headquarter officers to understand loans locally to be different (lower) than that of local loan officers. Or more in general it allows for some inefficiency when the effort is made at the headquarter level (multiple layers to be involved in the loan granting process, etc.). This is captured by the ω.

2) The model distinguishes between a structure in which loan granting decisions are made locally (the "decentralized structure") and a structure in which loan granting decisions are made at the headquarter/parent level ("centralized structure");

3) The model allows for liquidity transfers decisions (internal capital markets), from parents to local affiliates and viceversa. This is captured by Z_t^g.

Empirical counterparts in BEPS_II:

1) Two variables in the model, L_t^g and $L_t^{g^*}$ correspond respectively to the effort and loan officer resources used to screen and monitor loans locally (L_t^g), and to screen and monitor loans from the parent/headquarter office $L_t^{g^*}$. This can be interpreted as effort, employees, technologies etc.

Question Q6, Q10, Q23: *Please score the importance (frequency of use) of each lending technique for SME customers?* Relationship lending can especially relate to local resources.

Question Q16d, e: *Please list the top three constraints on your bank's ability to make loans to SMEs in 2011. Loan officers did not have the skills needed to evaluate credit risks Q16e Loan officers could not obtain the information needed to evaluate credit risks.*

Question 35g-j: *How important were the following in attracting new customers to your bank in 2011 and 2007? Increase in employment of the bank (not through mergers or acquisition) Q35i 2011 - Training of bank staff and personnel Q35j 2007 - Training of*

bank staff and personnel

Question Q50a-f: *How important is the influence of your parent bank in shaping the following*: Credit risk assessment of clients; etc.

As a subpart of this, the model allows the capacity of headquarter officers to understand loans locally to be different (lower) than that of local loan officers. Or more in general it allows for some inefficiency when the effort is made at the headquarter level (multiple layers to be involved etc.). This is captured by the ω.

Question Q4: *For first time SME Customers: How many hierarchical layers are involved in making a lending decision? By hierarchical layer we mean 1 an organizational hurdle that needs to be crossed in order to get a loan approved. That is, in each decision-making layer there is at least one person that can veto a loan application.*

2) The model distinguishes between a structure in which loan granting decisions are made locally (the decentralized structure) and a structure in which loan granting decisions are made at the headquarter/parent level (centralized structure):

Questions Q5, Q9, Q22: *Where are SME Customers' applications typically (highest number of loans) finally approved?*

Questions Q47d-i: *Does your parent bank set annual targets for your bank in terms of credit growth? Does your parent bank set annual targets for you in terms of market share? Does your parent bank operate a centralized treasury department or desk?*

Questions 51 e, f, h: *Please tell me to what extent you agree with the following statements: The power of decision-making with regard to risk management lies mostly with the parent bank rather than ourselves; etc.*

3) The model allows for liquidity transfers decisions (internal capital markets), from parents to local affiliates and viceversa. This is captured by Z_t^g

Questions Q47a, Q47b, Q47c: *Did your parent bank provide you at least once with internal credit lines/loans/liquidity during the period 2007-2012?*

Question Q49d: *How important would the following funding sources be in order to try to plug this gap? Please order the 6 options in decreasing order of importance: Parent bank funding*

Questions Q51a,b, g, i, j, k, l: *Please tell me to what extent you agree with the following statements: a) Financial support from our parent bank is an important determinant of our credit growth; etc.*