Global Banking and Macroeconomic Stability: Liquidity, Control, and Monitoring*

Elton Beqiraj† Qingqing Cao‡ Ralph De Haas§ Raoul Minetti¶

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JEL codes: E32, E44, F23, F36, F65, G21

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

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†Sapienza University of Rome.

‡Michigan State University.

§EBRD, KU Leuven and CEPR.

¶Michigan State University. Corresponding author: minetti@msu.edu.

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1 Introduction

The emergence of multinational banking conglomerates is one of the major developments in the international financial landscape in recent decades. In response, a growing literature has started to explore the macroeconomic implications of global banking.[1] Most of this literature, however, appears to neglect the internal decision processes that characterize complex financial institutions. Global banks routinely have to make choices regarding the allocation of funding as well as monitoring resources. These decisions not only have important implications for the lending behavior of these banks' headquarters but also of their local affiliates. Studying the allocation of liquidity and monitoring resources, on the one hand, and multinational banks' lending decisions, on the other hand, is therefore critical to better understand how multinational banks influence local macroeconomic stability. This has become even more important now that multinational bank affiliates hold dominant positions in many emerging markets and developing countries (Claessens and Van Horen (2014); Claessens (2017)).

[1] See, for example, Morgan et al. (2004); Cetorelli and Goldberg (2011, 2012a,b); Morelli et al. (2022).

The aim of this paper is to understand how multinational banks influence the transmission and propagation of local shocks, with a special focus on how the organizational structure and business model of global banks shape this relationship. To this end, we conduct both an empirical and a theoretical analysis. We first investigate empirically how the organizational structure of global banks shapes the response of their loan monitoring, liquidity allocation and, ultimately, their lending to aggregate shocks. We leverage rich bank-level data for 34 countries from the Banking Environment and Performance Survey (BEPS), conducted by the European Bank for Construction and Development through 400 face-to-face interviews with the "ultimate bank insiders", their CEOs. These unique data allow us to construct bank-level variables describing key aspects of global banks' business models and behavior, in particular whether and how these banks operate internal capital markets and the extent to which they actively shape the monitoring function of individual foreign affiliates. By combining this information with data on affiliate lending, we can verify whether the patterns predicted by our theoretical model, described below, are consistent with those detected in the data.

We document that a large fraction of global banks provide liquidity support to their foreign affiliates and actively engage in the loan monitoring efforts of these affiliates. We then show that, during crises in host countries, global banks tend to countercyclically increase their lending, and step up their liquidity and monitoring support of host-country affiliates. This countercyclical response is stronger when global banks feature a tighter, centralized control of affiliates' monitoring activities and a more centralized management of their internal capital markets.

We next develop a two-country dynamic general equilibrium model in which multinational banks operate alongside local banks in the credit market of each country. There are two key components of banks in the model. First, banks perform active monitoring (due diligence) of loans by hiring loan officers. This loan monitoring activity enhances the pledgeability of their loans to bank financiers, enabling banks to relax their capital constraints, gather additional loanable funds, and extend more credit. Local (domestic) banks always rely on local loan officers for this monitoring activity. Global banks, by contrast, either rely on loan officers hired by local affiliates or instead use loan officers hired and controlled centrally by the bank's headquarters (possibly subject to some inefficiency due to the functional distance between conglomerates and host-country affiliates). Second, global banks transfer liquidity between parents and local affiliates through internal capital markets.

We allow multinational banks to either decentralize their monitoring and liquidity decisions or to operate a centralized model. Under a centralized monitoring model, global banks mostly hire loan officers at the parent level, financing their wage bill through dedicated "strings attached" transfers to affiliates. In contrast, under a decentralized monitoring model, global banks delegate the hiring of loan officers to host-country affiliates. Similarly, under a centralized liquidity model, global banks engage in reallocation of liquidity across their conglomerate through "no strings attached" liquidity transfers, while under a decentralized liquidity model, local affiliates can receive such transfers from parent banks only at a high cost.[2]

We calibrate the model to the macro- and bank-level data used in our empirical analysis and then ask the following questions: how do global banks affect the transmission and propagation of financial and real 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 the allocation of liquidity through internal capital markets interact with banks' monitoring, and hence influence the transmission of shocks under different business models?

We show that three main forces govern the behavior of global banks following host-country shocks. First, changes in investment return opportunities, which directly drive responses of global bank lending. Second, the tightness of bank liquidity and capital constraints, which drives the allocation of global banks' monitoring resources and liquidity. Third, changes in loan portfolio quality, which most directly influence loan monitoring incentives.

Together, these forces ensure that following negative shocks to banks' net worth, and, to a lesser extent, shocks to firms' total factor productivity (TFP), global banks exert a stabilizing influence on host economies. They do so by supplanting the now scarcer loans of local banks: global banks boost their monitoring in the host country, transfer liquidity to host-country affiliates, and consequently expand their local lending in a countercyclical fashion. Crucially, the influence of global banks on macroeconomic stability is less benign after shocks that directly impair loan portfolio quality. Following capital quality shocks, in fact, the monitoring incentive

[2] To effectively 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) entails a formal control of the conglomerate over the affiliate through the hiring of local loan officers. The second ("no strings attached" transfers) merely involves the reallocation of liquidity across the conglomerate.

and effort of global banks' affiliates declines, driving down their lending in the host economy in a procyclical fashion.

An important result is that centralization has an ambiguous effect on the (de)stabilizing role of global banks, with clearly distinct roles for liquidity and monitoring centralization. Monitoring centralization tends to amplify the response of global banks' monitoring efforts following shocks. In contrast, liquidity centralization, while easing liquidity transfers within global bank conglomerates, tends to dilute the response of global banks' monitoring. That is, when global banks allocate substantial transfers to host-country affiliates through their internal capital markets, thus directly supporting these affiliates' lending capacity, they also undermine the monitoring incentives of these very same affiliates.

As a result of these mechanisms, when monitoring rises countercyclically—such as following shocks to banks' net worth or to firms' TFP—monitoring centralization will be more conducive to stabilization than liquidity centralization (though both have a stabilizing influence in the end). Indeed, in response to such shocks, monitoring intensity rises substantially more under monitoring centralization while its response is weakened under liquidity centralization. In contrast, when monitoring drops procyclically—such as following capital quality shocks—monitoring centralization exacerbates instability, while liquidity centralization instead exerts a mitigating influence. In this case, in fact, monitoring centralization exacerbates the reduction in monitoring incentives. Liquidity centralization, on the other hand, facilitates the repatriation of global banks' liquidity to parent countries, thus better sustaining monitoring incentives and the lending response of local affiliates. Overall, the relative benefits of monitoring and liquidity centralization are then reversed after capital quality shocks, relative to bank net worth shocks.

We apply the model to study the implications of global banks and their business models on the business cycle dynamics of Hungary, a country in our empirical sample that has exhibited a large presence of global banks since its financial reforms of the mid-1990s. Calibrating the host economy to Hungarian data, we perform a quantitative assessment of the (de)stabilizing effects of a centralized business model of global banks. We obtain that in the net, due to the above contrasting forces, following capital quality shocks the influence of liquidity and monitoring centralization on the (de)stabilizing behavior of global banks is significantly smaller than their stabilizing influence following bank net worth shocks.

In the last part of the paper, we investigate how the (de)stabilizing influence of global banks depends on salient organizational characteristics, namely, the degree of balance sheet consolidation (for example, due to the relative importance of branches and subsidiaries in host countries) and the distribution of monitoring skills between parents and affiliates (for example, due to the functional distance between both). The results reveal that, in the aftermath of bank net worth shocks, a more homogeneous distribution of monitoring skills within global bank conglomerates, and a lower balance sheet consolidation, reinforce the stabilizing influence of a centralized liquidity and monitoring business model of global banking.

Related literature. This paper relates to two main strands of the literature. First, our work speaks to a growing literature on the macroeconomic implications of multinational banking. Kalemli-Ozcan et al. (2013), Morelli et al. (2022), Fillat et al. (2023), and Niepmann (2023) demonstrate how banking groups operating in multiple countries can propagate shocks across borders but can also allow for diversification in response to shocks.[3]

Our contribution is to investigate how the organizational structure of global banks shapes the way they transmit and propagate shocks. In particular, we shed new light on the role of internal capital markets and of the allocation of monitoring resources within such banks (Houston et al., 1997; Campello, 2002; De Haas and Van Lelyveld, 2010; Cetorelli and Goldberg, 2012b). We show that the (de-)centralized organization of internal capital markets interacts in important ways with how global banks organize their monitoring activity. Our results indicate that the centralization of internal capital markets can weaken the resilience of global banks' monitoring after negative banking shocks, by diluting the incentives of local affiliates to monitor loans. As a result, the centralization of internal capital markets has a priori ambiguous effects on the cyclical response of global banks' lending: it directly enhances the resilience of lending by facilitating affiliates' access to liquidity, but it can undermine such resilience by reducing their monitoring efforts. On the other hand, the centralization of monitoring resources better enhances the resilience of global banks' lending following negative banking shocks, while potentially exacerbating the effects of negative capital quality shocks.

Second, we add to the literature on monitoring inside banking organizations, investigating

[3] A rich empirical literature documents shock transmission through multinational banking groups, for example Peek and Rosengren (2000); Chava and Purnanandam (2011); Cetorelli and Goldberg (2011); Cetorelli and Goldberg (2012a); Chor and Manova (2012); Popov and Udell (2012); Schnabl (2012); De Haas and Van Horen (2012); De Haas and Van Horen (2013); Paravisini et al. (2015) and Ongena et al. (2015).

the case of internationally active banks. One set of studies investigates the effect of bank monitoring and lending standards on borrowers' creditworthiness (Manove et al., 2001; Broecker, 1990; Ogura, 2006). From a macroeconomic perspective, Dell'Ariccia and Marquez (2006) show that banks' incentive to monitor borrowers can get diluted during economic expansions.[4] Our specification of monitoring broadly follows Goodfriend and McCallum (2007) and is in line with Cao et al. (2022). Goodfriend and McCallum (2007) develop a dynamic general equilibrium economy in which banks employ labor to produce loans, thus affecting the returns to lending. In our economy, banks conduct due diligence of (potential) borrowers and, in doing so, loan officers raise the recovery value of loans and, hence, their pledgeability in markets for liquidity. In the spirit of Scharfstein and Stein (2000), we posit that within global banks contracting about local affiliates' loan monitoring is incomplete.[5]

We organize the rest of the paper as follows. Section 2 provides an introduction to the inner workings of global banks and presents motivating empirical evidence. Section 3 lays out the model and solves for agents' decisions, after which we discuss the calibration and preview key mechanisms in Section 4. Section 5 presents our full simulation results and Section 6 concludes. Online Appendices contain more details about our data and model derivations as well as additional results.

2 Empirical Evidence

This section first provides background information on the internal organization of multinational banking groups. It then presents evidence on the lending, loan monitoring and liquidity allocation behavior of such banks using granular data from a large-scale survey of bank CEOs conducted by the European Bank for Reconstruction and Development and Tilburg University. We merge these unique data with bank-level information on annual credit growth and other bank balance sheet variables as well as selected macroeconomic indicators.

[4] See also Gorton and Ordoñez (2020) and Perri and Quadrini (2018).

[5] However, we do not introduce private benefits of control. In contrast, Scharfstein and Stein (2000) consider a setting where divisional rent-seeking behavior, coupled with agency problems between headquarters and external capital markets, can lead to wasteful overinvestment.

2.1 Global banks: A primer

2.1.1 Internal capital markets in global banks

The academic literature on global banks treats these banks' internal capital markets mostly as a black box. Some authors directly observe financial transactions between parent banks and foreign affiliates, while others infer the occurrence of such transactions from correlational patterns in lending across different parts of the banking conglomerate. However, how banks organize internal capital markets, and whether there is meaningful organizational variation across banks, has not been studied in much detail.[6] De Haas and Naaborg (2006) conduct semi-structured in-person interviews with a large number of bank CEOs in Central and Eastern Europe. To set the stage for the analysis in the rest of this paper, this section summarizes their evidence on the organization of internal capital markets in global banks.

Global banks can inject equity or provide debt funding to foreign affiliates. In a frictionless world, the redistribution of capital between a parent bank and its affiliates is inconsequential if the bank holding is managed and supervised (by the home-country authority) on a consolidated basis. In reality, global banks do allocate capital to foreign subsidiaries for two main reasons. First, in many settings, global bank subsidiaries need to comply with host-country minimum capital requirements. When their capitalization gets close to these minimum levels, parent banks typically step in to replenish local capital with additional Tier 1 or 2 capital. A second reason for global banks to allocate capital to foreign subsidiaries are local large exposure limits. Such limits specify the maximum amounts, expressed as percentages of local capital, that local banks are allowed to lend to an individual counterparty. If a subsidiary is not permitted to lend more than a certain percentage of its own capital to a single client, this will encourage parent banks to increase local capital. This approach to internal capital allocation is regulatory-driven and therefore quite passive. In practice, banks' capital allocation systems lie on a continuum between passive and more active approaches (Matten, 2000, p. 316). As part of a more active approach, global banks also use the internal allocation of scarce capital to measure affiliate performance, compensate managers, and steer business directly.

Global banks can also support foreign affiliates with debt funding, especially to help them achieve credit-growth objectives. Importantly, the level of centralization of treasury activities

[6] The practitioners' literature, for example Matten (2000), fills this gap only partially.

differs widely among banks. Some banks follow a decentralized approach in which subsidiaries are required to fund themselves with senior debt through their own treasury desks. Such a decentralized approach is more attractive if affiliates' local funding base is sufficiently deep and when parent banks worry that providing cheap central funding would lead to free-riding among minority shareholders of the affiliate.

Other banks operate more centralized treasuries in which the parent bank may even be the only provider of non-deposit funding to affiliates. In such an integrated treasury function, affiliates typically estimate their funding requirements for the following year—including subordinated, long-term and short-term debt—and submit this application to the group treasury. Lastly, some banks use a hybrid approach in which affiliates are allowed to partially fund themselves but have otherwise to use the central treasury.

2.1.2 Control and monitoring in global banks

Global banks not only differ in how actively they manage an internal capital market, they also exert influence by more or less directly controlling the loan screening and monitoring practices of their affiliates. There exists wide variation across global banks in how much they control and monitor their affiliates in this regard. Banks typically strike a balance between allowing foreign affiliates to be truly local and, at the same time, having sufficient control over their operations.

In terms of the screening of new clients, parent banks can exert an influence in two ways. First, control can take the form of standardizing and centralizing risk-management systems, credit-scoring systems, and IT platforms. Banks may also provide training—sometimes in the home country, sometimes by way of flying in experts—to implement these standardized systems. Second, some global banks introduce an explicit credit or exposure limit below which local affiliates can independently make lending decisions (in some cases using the standardized credit-scoring systems rolled out throughout the banking group). In contrast, loans to local clients that exceed the credit limit are pre-screened by local risk officers but will then need to be vetted by the central credit committee of the parent bank. Some other banks take a more decentralized approach, in which loan proposals are screened locally and exposures above a certain threshold only need to be reported to (but not vetted by) the parent bank.

Looking at monitoring practices, some global banks also standardize the way local affiliates monitor their client portfolio. Banks sometimes implement signalling systems that follow customers during the life span of the loan to ensure that certain covenanted financial ratios remain fulfilled. In this way, affiliate exposures can be measured in a standardized manner and hence be included in group-level exposure indicators and risk metrics. Other parent banks, instead, prefer to actively monitor affiliates' portfolios through local credit committees.

Lastly, in terms of hiring practices, many global banks aim for a combination of, on the one hand, centrally appointed managers and senior loan officers and, on the other hand, locally hired loan officers with an in-depth knowledge of the local market. The latter will be especially important to develop longer-term lending relationships with smaller and less transparent clients (Berger and Udell, 2002; Uchida et al., 2012). When global banks rely on locally hired loan officers to extract soft information from such clients, it is especially important that final lending decisions are made locally as well or that soft information can effectively be "hardened" and processed higher up in the global bank hierarchy (Stein, 2002).

2.2 Data and measurement

2.2.1 The BEPS survey and other data sources

The Banking Environment and Performance Survey (BEPS) covers banks in 34 countries across Central and Eastern Europe, Central Asia, Russia, Turkey, and the Southeastern Mediterranean region.[7] We draw information from two survey waves: 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). As part of these unique surveys, in-depth structured interviews were held with bank CEOs and, in the case of BEPS III, also with each bank's Head of Credit. For BEPS II (III), we focus on 30 (28) sample countries in which 591 (301) CEOs were successfully interviewed. These banks represent 76 (75) percent of all bank assets—and 80 (81) percent of all foreign bank assets—in these countries.

Interviews were conducted by senior consultants with extensive financial sector experience and followed a standardized survey instrument.[8] Crucially for our purposes, in case of multinational banks, the BEPS survey treats each subsidiary as an independent (foreign-owned) bank.

[7] See Appendix B for more details about the BEPS survey.

[8] The BEPS II surveys were conducted in person whereas the BEPS III surveys were conducted via Zoom or a similar on-line platform.

For example, the Italian bank UniCredit operates subsidiaries in several countries. Rather than interviewing the Italian CEO of UniCredit, the survey team separately interviewed the CEOs of the UniCredit subsidiaries in Bosnia and Herzegovina, Bulgaria, Czech Republic, Estonia, Latvia, Lithuania, Romania, Serbia, Slovakia, and Slovenia.

The survey provides detailed data on topics such as banks' lending and monitoring, including the hiring of loan officers and the centralized implementation of monitoring technologies. For banks that are an affiliate of a multinational bank, the data also contain unique information on how these groups organize their internal capital markets and the extent to which parent banks provide liquidity support through intra-group transfers. Information was also collected about parent banks' involvement in the hiring of local managers and in the day-to-day business of affiliates. Thus, a crucial feature of the BEPS survey is that it provides us with information on the role played by parent banks as well as the degree of reliance of local affiliates on their parents in their lending, monitoring, and liquidity gathering decisions.

We hand-match the BEPS survey data with Bureau Van Dijk's BankScope and Orbis databases for bank-level financials and with the Systemic Banking Crises Database II by Laeven and Valencia (2020). In the end, our dataset contains 248 foreign banks that were interviewed as part of the BEPS survey and that were matched with bank financials and systemic crisis data, thus creating a panel dataset for the years 2007–2017.[9]

2.2.2 A first look at the data

Table 1 provides first insights into the sample of global bank subsidiaries we use in our empirical analysis (Appendix Table B1 contains all variable definitions). There are roughly 1,700 bank-year observations in the sample, representing 248 subsidiaries in 30 countries.[10] Average annual nominal credit growth amounts to 13%, banks' average capital to asset ratio is about 14%, and their net interest margin averages around 4.7%. The median ratio between a bank's outstanding loan portfolio and its customer deposit base is 110%, although we observe wide variation in banks' use of non-deposit funding.

[9] In line with the literature, we consider a bank as foreign owned if at least 50% of its equity is owned by a foreign strategic investor (Claessens and Van Horen, 2014, p. 300).

[10] About 29% of the sample banks operate in Central Europe and the Baltic States, 19% in Eastern Europe and the Caucasus, and 31% in Southeastern Europe. The parent banks of these subsidiaries are located in Austria (16%), Italy (13%), Greece (9%), France (9%), Germany (8%), Russia (8%), Turkey (4%), the United States (3%) and several other countries.

We next report summary statistics for a set of variables that characterize the organizational structure and behavior of global banks along our two main dimensions of interest: the degree of control of the subsidiary's monitoring activities (including the hiring and training of local loan officers) and the degree of liquidity support provided by the parent to the subsidiary (capturing the presence and depth of internal capital markets). Consider first monitoring. About 83% of the subsidiaries declare that their parent bank sets targets for them in terms of credit growth, while in roughly 40% of the cases the parent bank sets targets for the local market shares that need to be achieved. We observe wide variation in how intensely parent banks and their subsidiaries interact on a day-to-day basis, as measured by the average number of phone calls, conference calls, and video calls the subsidiary's CEO holds with the management or board of the parent bank on a monthly basis. The average number of such calls is 13 but varies between zero and 110. In more than 85% of all cases, the subsidiaries declare that the parent bank was also involved in the selection and training of local managers.

Next, when considering heterogeneity in the use of internal capital markets, we see that 43% of all foreign bank subsidiaries are part of a global bank that operates a centralized treasury. In many cases, these internal capital markets are an important source of subsidiary funding: over a third of all interviewed CEOs even mention that parent banks are the main source of funding in case of an unexpected funding shortfall. Moreover, 69% of the subsidiary CEOs mention that their parent provides them with liquidity and/or capital "on a regular basis". We also find that 86% of global bank subsidiaries indicate that they have been supported by their parent bank via an internal credit line at least once during the past five years.

2.3 Global banks' response to shocks

2.3.1 The empirical models

Our dynamic general equilibrium model yields predictions on two fronts: (i) the response of global banks' lending, monitoring (loan officer employment and usage of other monitoring resources), and liquidity transfers following financial and real shocks; and (ii) how these responses depend on the degree of centralization of global banks (including the degree of control/intervention of global parents' headquarters into their affiliates' decisions) and on the degree of inefficiency/distance of parent headquarters relative to local affiliates.

To test these predictions, we estimate two sets of empirical models. The first model uses panel data at the bank-year level to study the lending behavior of global banks following shocks and how this behavior depends on the degree of centralization of global banks' liquidity and monitoring:

$$L_{jt} = \alpha_j + \alpha_t + \beta_1 Y_{it} + \beta_2 Y_{kt} + \gamma_1 (X_j \times Y_{it}) + \delta Z_{jt} + \eta L_{jt-1} + \epsilon_{jt}. \tag{1}$$

In equation (1), L_{jt} denotes annual credit growth of global bank subsidiary j in year t; α_j and α_t are bank and time (year) fixed effects, respectively; Y_{it} and Y_{kt} are indicators for the occurrence of a financial crisis in the host and parent country of the bank in year t, respectively;[11] X_j is a set of time-invariant, structural characteristics of the relationship of the bank affiliate with its parent bank, capturing the degree of monitoring or liquidity centralization of the global bank; Z_{jt} is a set of time-varying control variables for global bank affiliate j, including the bank's net interest margin, its leverage, and its gross loans to total customer deposits ratio; L_{jt-1} is lagged credit growth; and ϵ_{jt} is the residual.

As described in Appendix B, the key indicators in X_j include a proxy for the intensity of the contacts between the global bank parent and the affiliate (the average number of monthly calls between the parent and the affiliate offices), capturing the degree of control exerted by the parent and, hence, its monitoring centralization; and an indicator for the centralization of treasury and liquidity management in the global conglomerate.

Equation (1) is estimated by two-step difference Generalized Method of Moments (GMM). In the estimation, the lag of credit growth, the bank-level controls and the crisis dummies for the home and the host countries are treated as endogenous and instrumented with their lags. Standard errors are adjusted for Windmeijer's finite-sample correction for a two-step covariance matrix.

Next, in order to investigate the response of global banks' liquidity and monitoring to aggregate shocks (crises) in the host country during the period 2007–2017, we estimate the following cross-sectional empirical models:

$$Liq_j = \alpha' + \beta_1' Y_i + \beta_2' Y_k + \delta' Z_j' + \epsilon_{jt}' \tag{2}$$

[11] The financial crisis indicators are dummy variables equal to one if in the host (parent) country there was a systemic banking crisis, currency crisis, sovereign debt crisis or sovereign debt restructuring during the year, zero otherwise. The data are drawn from the Systemic Banking Crisis Database II by Laeven and Valencia (2020).

$$Mon_j = \alpha'' + \beta_1'' Y_i + \beta_2'' Y_k + \delta'' Z_j'' + \epsilon_{jt}'' \quad (3)$$

where Liq_j is a dummy that takes the value of one if the global bank affiliate declares that it received liquidity support from the parent bank through a credit line or transfer at least once during the period and Mon_j is a dummy that takes the value of one if the affiliate declares that the parent bank directly intervened in training and selecting managers and loan officers during the period. Y_i and Y_k are, respectively, the indicators for the occurrence of any financial crisis in the host and parent country of the bank, averaged over the 2007–2017 period (effectively capturing the average frequency of crises during the period); Z_j' and Z_j'' are sets of control variables for the bank (annual credit growth; equity to total assets; gross loans to total customer deposits; net interest margin), all computed as 2007–2017 averages; and ϵ_j are the residuals.

2.3.2 Estimates

Table 2 displays the regression estimates of Equation (1). Across specifications, we find consistent evidence that global banks expand countercyclically their lending during crisis episodes in the host country (see columns 1 to 3).[12] We also find evidence that this countercyclical lending behavior is more pronounced when parents exert a more centralized control on their affiliates (as proxied by a higher frequency of contacts between affiliate and parent offices; columns 4-6). The effect of having a higher centralization of liquidity (as proxied by the presence of a centralized treasury in the global banking conglomerate; columns 7-9) is estimated imprecisely. Interestingly, this suggests that liquidity centralization might have a distinctly lower role than monitoring centralization in global banks' countercyclical lending behavior. In line with expectations, more profitable banks (with higher net interest margin) appear to engage in stronger lending growth, while the effects of bank leverage are estimated imprecisely.

In Table 3, we show the estimates of Equations (2)-(3) for the response of global banks' liquidity support and monitoring support to macroeconomic conditions in host countries. In columns 1-3, we obtain that global banks' parent offices are more likely to provide liquidity support to affiliates when the incidence of financial crises in the host country is higher (columns 1-3). In columns 4-6, we instead investigate the response of global banks' monitoring support,

[12] As documented in Appendix Table B2, this countercyclical lending behavior of global banks is specific to host-country financial crises, while we do not detect it for other types of recessionary episodes. This is in line with the predictions of the theoretical model, as we will see.

as captured by parent offices' training of loan officers at affiliates in host countries. We find that global banks' are more likely to provide monitoring support when financial crises are more frequent in the host country.[13] As we will discuss below, these empirical patterns are consistent with the predictions of our theoretical model.

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 (final good producers and capital producers), and banks (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 their 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 monitor the loans they extend to firms, using labor (loan officers) as an input in their loan monitoring activity. The characterizing feature of our economy is the presence and organizational structure of global banks. In particular, as we describe below, global banks manage liquidity and monitoring resources (loan officers) across their offices 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 an asterisk.

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 are bankers. Each banker manages a bank and transfers dividends to the household. Each worker can work in final good production or as a loan officer 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

[13] The estimates also suggest that parent banks' liquidity support is more likely when global banks have higher liquidity centralization (a centralized treasury department) (column 3). Moreover, the probability of monitoring support is higher when there is a stronger monitoring centralization, as captured by a higher frequency of contacts between parent and affiliate offices (column 6).

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.[14] 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

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

$$\text{s.t.} \qquad C_t + D_t + D_t^g = R_{t-1}^D D_{t-1} + R_{t-1}^{D,g} D_{t-1}^g + W_t^H H_t + W_t^L L_t + W_t^{L,g} L_t^g + \Pi_t, \tag{4}$$

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 at local (global) banks, and Π_t are profits earned from owning firms and local banks. We posit a GHH utility function

$$U_t = \frac{\left(C_t - hC_{t-1} - \upsilon_H \frac{H_t^{1+\varphi}}{1+\varphi} - \upsilon_L \frac{L_t^{1+\gamma}}{1+\gamma} - \upsilon_{L,g} \frac{{L_t^g}^{1+\gamma}}{1+\gamma}\right)^{1-\sigma_c} - 1}{1-\sigma_c}, \tag{5}$$

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

Households' optimization yields equations (6) for the supply of labor to final good producers and to banks and the Euler equations (7) for consumption,

$$-\frac{U_{H_t}}{U_{C_t}} = W_t^H, \qquad -\frac{U_{L_t}}{U_{C_t}} = W_t^L, \qquad -\frac{U_{L_t^g}}{U_{C_t}} = W_t^{L,g}, \tag{6}$$

$$1 = E_t \Lambda_{t,t+1} R_t^D = E_t \Lambda_{t,t+1} R_t^{D,g}, \tag{7}$$

where $\Lambda_{t,t+1} = \beta E_t \frac{U_{C_{t+1}}}{U_{C_t}}$ is the stochastic discount factor. The equations in (7) imply equality between the deposit rate paid by local banks and global bank affiliates, $R_t^D = R_t^{D,g}$.

[14]This ensures that bankers cannot grow out of their collateral constraints. Since capital constraints bind for bankers around the steady state, they always retain earnings while in business and pay dividends when exiting.

3.2 Firms

3.2.1 Final good 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 capital purchases, 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).[15] Their constant-returns-to-scale technology reads

$$Y_t = A_t(\kappa_t K_{t-1})^{\alpha} H_t^{1-\alpha}, \tag{8}$$

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

$$A_t = \rho_A A_{t-1} + \varepsilon_t^A, \tag{9}$$

where ε_t^A is a white noise process and ρ_A measures the shock persistence. Similarly, the capital quality shock follows an $AR(1)$ process

$$\kappa_t = \rho_\kappa \kappa_{t-1} + \varepsilon_t^\kappa, \tag{10}$$

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

$$K_t = I_t + (1-\delta)\kappa_t K_{t-1}. \tag{11}$$

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

$$W_t^H = (1-\alpha)\frac{Y_t}{H_t}, \quad R_t^k = \alpha \frac{Y_t}{K_{t-1}}, \tag{12}$$

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 $F''(1) > 0$.

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

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

$$\max_{\{I_t\}_{t\geq 0}} E_0 \sum_{t=0}^{\infty} \Lambda_{0,t} \left\{ Q_t I_t - \left[1 + F\left(\frac{I_t}{I_{t-1}} \right) \right] I_t \right\}, \tag{13}$$

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

$$Q_t = 1 + F\left(\frac{I_t}{I_{t-1}}\right) + \frac{I_t}{I_{t-1}} F'\left(\frac{I_t}{I_{t-1}}\right) - E_t \Lambda_{t,t+1} \left(\frac{I_{t+1}}{I_t}\right)^2 F'\left(\frac{I_{t+1}}{I_t}\right). \tag{14}$$

3.3 Banks

Banks intermediate liquidity between households and firms. There are two types of banks. The first is a local bank that gathers 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 global. This conglomerate consists of a parent bank (variables of which are 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 to, for example, 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 liabilities cannot exceed the pledgeable value of their assets. By hiring loan officers, banks perform monitoring (due diligence) of loans, raising their recovery value in case of default and, hence, their pledgeable value to financiers.[16]

A global bank can manage liquidity and monitoring resources (loan officers) within its

[16] By monitoring loans, banks preserve the viability of their loan portfolios and certify it to retail and wholesale investors. There is extensive empirical evidence on the effects of banks' monitoring activities on banks' access to liquidity (see, e.g., King, 2008; BIS, 2015, and references therein).

conglomerate. In particular, it can transfer funds between the parent and the affiliate through internal capital markets (liquidity management). It 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. We will elaborate below on liquidity management and monitoring control within global banks.

Events in a period t unfold as follows. First, aggregate shocks are realized. Then, production takes place. Thereafter, banks learn whether they exit and new banks enter. 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 choose their deposit taking D_t from 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

$$V_t \equiv \max_{\{X_{t+j}, D_{t+j}, L_{t+j}\}_{j\geq 0}} \quad E_t \sum_{j=0}^{\infty} (1-\sigma)\sigma^j \Lambda_{t,t+j+1} N_{t+j+1}, \tag{15}$$

$$\text{s.t.} \qquad Q_t X_t = N_t + D_t - W_t^L L_t, \qquad [\lambda_t] \tag{16}$$

$$R_t^D D_t \leq \xi^L \mathcal{P}(Q_t X_t, L_t) Q_t X_t, \qquad [\mu_t] \tag{17}$$

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 of the bank. The pledgeable value of firm shares is a function of the intensity of monitoring (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 held by the local bank. λ_t and μ_t denote the Lagrange multipliers for the resource constraint and 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:

$$N_t = \left[R_t^k + (1-\delta)\kappa_t Q_t\right] X_{t-1} - R_{t-1}^D D_{t-1} + nw_t, \tag{18}$$

where nw_t is an exogenous shock to the local bank's net worth following an $AR(1)$ process.

Equation (16) is the resource constraint: net worth and deposits are used to invest in firm shares and to pay wages to loan officers. Equation (17) 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^L is a weight governed by market-based and regulatory-based capital requirements. We specify the recoverable portion of the portfolio of firm shares as:

$$\mathcal{P}(Q_tX_t, L_t)=\left(\frac{L_t}{Q_tX_t}\right)^{1-\phi}. \tag{19}$$

This is an increasing and concave function of the labor of loan officers, per unit of firm shares held by the bank. Using (19), we obtain the recovery value of firm shares:[17]

$$\mathcal{P}(Q_tX_t, L_t)Q_tX_t = (Q_tX_t)^{\phi}(L_t)^{1-\phi}. \tag{20}$$

Taking the FOCs for X_t, D_t, L_t, and combining them with the corresponding envelope conditions, we obtain:

$$\begin{aligned}
[\partial X_t]: \quad & -\lambda_t Q_t + \mu_t \xi^L \phi (L_t)^{1-\phi}(Q_t)^{\phi}(X_t)^{\phi-1} \\
& + E_t\Lambda_{t,t+1}\left[R^k_{t+1} + (1-\delta)\kappa_{t+1}Q_{t+1}\right](1-\sigma+\sigma\lambda_{t+1}) = 0, && (21)\\
[\partial D_t]: \quad & \lambda_t - \mu_t R^D_t - E_t\Lambda_{t,t+1}(1-\sigma+\sigma\lambda_{t+1})R^D_t = 0, && (22)\\
[\partial L_t]: \quad & -\lambda_t W^L_t + \mu_t\xi^L(1-\phi)(L_t)^{-\phi}(Q_tX_t)^{\phi} = 0. && (23)
\end{aligned}$$

Consider (21) 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 monitoring performed by loan officers (L_t). Consider next (23). By hiring loan officers, the local bank tightens its current resource constraint (λ_t) but raises its loan monitoring and the 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 are realized, 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 discounted sum of the

[17]The constant return to scale function in (20) allows us to abstract from the distribution of net worth across local banks.

dividends distributed to the foreign household:

$$V_t^g \equiv \max_{\{X_{t+j}^g, D_{t+j}^g, L_{t+j}^a\}_{j\geq 0}} E_t \sum_{j=0}^{\infty} (1-\sigma)\sigma^j \Lambda_{t,t+j+1}^* N_{t+j+1}^g, \tag{24}$$

$$\text{s.t.} \quad Q_t X_t^g = N_t^g + D_t^g - W_t^{L,g} L_t^g + \mathcal{Z}_t^g, \qquad [\lambda_t^g] \tag{25}$$

$$R_t^D D_t^g + \theta R_t^D \mathcal{Z}_t^g \leq \xi \left[(1-\eta)\mathcal{P}^g(.) Q_t X_t^g + \eta \mathcal{P}^{g^*}(.) Q_t^* X_t^{g^*} \right], \qquad [\mu_t^g] \tag{26}$$

$$L_t^g = L_t^a + L_t^c, \tag{27}$$

where $\mathcal{P}^g(.) = \mathcal{P}^g(Q_t X_t^g, L_t^a, L_t^c)$ and $\mathcal{P}^{g^*}(.) = \mathcal{P}^{g^*}(Q_t^* X_t^{g^*}, L_t^{a*}, L_t^{c*})$. The net worth of the affiliate bank is

$$N_t^g = \left[R_t^k + (1-\delta)\kappa_t Q_t \right] X_{t-1}^g - R_{t-1}^D D_{t-1}^g - \theta R_{t-1}^D \mathcal{Z}_{t-1}^g. \tag{28}$$

$\Lambda_{t,t+j+1}^*$ 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 monitoring (due diligence) activities 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 managed) by the global bank conglomerate.[18] The conglomerate can thus exert control over the affiliate by hiring loan officers in the host country. In (26), L_t^{a*} and L_t^{c*} denote the loan officers of the parent bank in the foreign country.

In the affiliate's resource constraint (25), $\mathcal{Z}_t^g$ is the total liquidity transfer from the conglomerate. This takes the form of a mix of an intra-group loan, possibly extended at a reduced interest rate, and an equity injection. The overall gross cost per unit of transfer is θR_t^D, where $(1-\theta) < 1$ governs the per-unit saving of the transfer relative to retail deposits gathered in the host country.[19] 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 transfer $\mathcal{Z}_t^g$ from the parent (or 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 (26) is the collateral constraint (with Lagrangian multiplier given by μ_t^g). The collateral constraint consolidates the assets of the affiliate and the parent bank. In particular, the right-hand side of (26) is the weighted sum of $\mathcal{P}^g(Q_t X_t^g, L_t^a, L_t^c) Q_t X_t^g$, the recovery value

[18] Our specification is close to a setting in which global banks directly send loan officers from headquarter offices. The main difference is the country where loan officers are hired, which matters primarily for the determination of wages in general equilibrium.

[19] This per-unit saving may partly reflect an interest rate discount, in case of intra-group loans, and partly reflect an equity injection component.

of the firm shares held by the affiliate, and $\mathcal{P}^{g^*}(Q_t^* X_t^{g^*}, L_t^{a*}, L_t^{c*}) Q_t^* X_t^{g^*}$, the recovery value of the firm shares held by the parent. The weight on the parent, η, determines the degree of consolidation of the affiliate's and parent's balance sheets. For example, a higher share of branches will entail a higher consolidation of balance sheets across the global conglomerate. A value of $\eta = 0$ implies complete separation, whereas $\eta = 0.5$ implies full consolidation.

As shown in (27), due to the partial sharing of control between affiliate and parent, the loan officers employed at the affiliate (L_t^g) are a combination 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 the assets held by the affiliate bank depends on the monitoring 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

$$\mathcal{P}^g(Q_t X_t^g, L_t^a, L_t^c) = \left(\frac{\mathcal{L}_t}{Q_t X_t^g} \right)^{1-\phi}. \tag{29}$$

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

$$\mathcal{L}_t = \left[(1-\chi) \left(L_t^a \right)^{\frac{\tau-1}{\tau}} + \chi (L_t^c)^{\frac{\tau-1}{\tau}} \right]^{\frac{\tau}{\tau-1}}. \tag{30}$$

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. Using (29), the recovery value of the affiliate's assets is

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

Recall that the term $\mathcal{P}^{g^*}(Q_t^* X_t^{g^*}, L_t^{a*}, L_t^{c*}) Q_t^* X_t^{g^*}$ in (26) indicates the recovery value of assets for the parent bank operating in the foreign country.[20]

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

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

[20] Positing a due diligence function analogous to that of local banks and global banks' affiliates, this is given by $\mathcal{P}^{g^*}(Q_t^* X_t^{g^*}, L_t^{a*}, L_t^{c*}) Q_t^* X_t^{g^*} = (Q_t^* X_t^{g^*})^{\phi} (\mathcal{L}_t^*)^{1-\phi}$, 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 aggregated loan officers of the parent bank in the foreign country.

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 hired in autonomy by the local affiliate

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

Observe (32). 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 monitoring performed by loan officers employed at the affiliate. Consider next (34). 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 $(1-\eta)$.

Global parents. The parent bank in the foreign country solves a problem similar to that of the affiliate, taking as given the transfer (intra-group loan or equity injection) $Z_t^{g^*}$ and the level of monitoring $L_t^{g^*}$, which are decided at the conglomerate level. Given the similarity with the affiliate's problem, we present the parent's optimizing conditions in Appendix A.

3.3.4 Management of liquidity and monitoring in global bank conglomerates

Global banks can operate liquidity transfers 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 banking conglomerates can also manage monitoring resources. In particular, they can exert partial control over the monitoring activities of their affiliates by being involved in the hiring of loan officers.

To better understand the comparison of our economy with alternative economies later in the analysis, it is useful to think of intra-group transfers as comprising two components. One component has "no strings attached", that is, it does not entail any control of the conglomerate over the monitoring decisions of the affiliate or the parent. The second component, instead, has "strings attached", as it serves to finance the wage bill of loan officers hired by the banking conglomerate in the host country or the foreign country. Formally,

$$\mathcal{Z}_t^g = Z_t^g + W_t^{L,g} L_t^c, \tag{35}$$

$$\mathcal{Z}_t^{g*} = Z_t^{g*} + W_t^{L,g,*} L_t^{c*}, \tag{36}$$

where $\mathcal{Z}_t^g$ denotes the total intra-group transfer, Z_t^g is the "no strings attached" component of the transfer, 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).

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

$$\max_{Z_t^g, Z_t^{g^*}, L_t^c, L_t^{c*}} \quad V_t^g + V_t^{g^*} \tag{37}$$

$$\text{s.t.} \quad \underbrace{(Z_t^g + W_t^{L,g} L_t^c)}_{\mathcal{Z}_t^g} + \underbrace{(Z_t^{g^*} + W_t^{L,g,*} L_t^{c*})}_{\mathcal{Z}_t^{g*}} + \frac{\psi_1}{2}\left(Z_t^{g^*} - \overline{Z}^{g^*}\right)^2 + \frac{\psi_2}{2}\left(W_t^{L,g} L_t^c - \overline{W}^{L,g}\overline{L}^c\right)^2 = 0. \tag{38}$$

Intra-group transfers between the parent and the affiliate incur quadratic implementation costs as in the resource constraint, where $\overline{Z}^{g^*}$ is the steady state value of the intra-group no strings attached transfers, and $\overline{W}^{L,g}\overline{L}^c$ is the steady state value of the strings attached transfers. The parameters ψ_1 and ψ_2 govern the size of the costs for making intra-group no strings attached transfers and strings attached transfers, as determined by the degree of centralization of liquidity and monitoring resources within the conglomerate, for instance.

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

$$\frac{\partial V_t^g}{\partial Z_t^g} = \lambda_t^g - \theta R_t^D \mu_t^g - \theta E_t \Lambda_{t,t+1}^* \left(1 - \sigma + \sigma \lambda_{t+1}^g\right) R_t^D. \tag{39}$$

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). For the parent,

$$\frac{\partial V_t^{g^*}}{\partial Z_t^{g^*}} = \lambda_t^{g^*} - \theta R_t^D \mu_t^{g^*} - \theta E_t \Lambda_{t,t+1}^* \left(1 - \sigma + \sigma \lambda_{t+1}^{g^*}\right) R_t^D. \tag{40}$$

Using (39) and (40), the conglomerate's optimal choice yields

$$\left[\lambda_t^g - \theta R_t^D \mu_t^g - E_t \Lambda_{t,t+1}^* \left(1 - \sigma + \sigma \lambda_{t+1}^g\right) \theta R_t^D\right] \left[1 - \psi_1 \left(Z_t^{g^*} - \overline{Z}^{g^*}\right)\right]$$
$$= \lambda_t^{g^*} - \theta R_t^D \mu_t^{g^*} - E_t \Lambda_{t,t+1}^* \left(1 - \sigma + \sigma \lambda_{t+1}^{g^*}\right) \theta R_t^D. \tag{41}$$

When choosing the no strings attached transfers, the conglomerate thus takes into account the impact of these transfers on the resource and capital constraints of parent and affiliate, as well as the implementation cost.

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 intra-group transfers) reads

$$[\partial L_t^c]: \quad \xi(1-\phi)\left[\mu_t^g(1-\eta) + \mu_t^{g^*}\eta\right]\left[(1-\chi)\left(L_t^a\right)^{\frac{\tau-1}{\tau}} + \chi (L_t^c)^{\frac{\tau-1}{\tau}}\right]^{\frac{1-\tau\phi}{\tau-1}} \chi \left(L_t^c\right)^{-\frac{1}{\tau}} \left(Q_t X_t^g\right)^{\phi}$$
$$-\theta \mu_t^g R_t^D W_t^{L,g} - E_t \Lambda_{t,t+1}^* \left(1 - \sigma + \sigma \lambda_{t+1}^g\right) \theta R_t^D W_t^{L,g}$$
$$= W_t^{L,g}\left[1 + \psi_2\left(W_t^{L,g} L_t^c - \overline{W}^{L,g}\overline{L}^c\right)\right]\left[\lambda_t^g - \theta R_t^D \mu_t^g - \theta E_t \Lambda_{t,t+1}^* \left(1 - \sigma + \sigma \lambda_{t+1}^g\right) R_t^D\right]. \tag{42}$$

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

$$[\partial L_t^{c*}]: \quad \xi(1-\phi)\left[\mu_t^g \eta + \mu_t^{g^*}(1-\eta)\right]\left[(1-\chi)\left(L_t^{a*}\right)^{\frac{\tau-1}{\tau}} + \chi (L_t^{c*})^{\frac{\tau-1}{\tau}}\right]^{\frac{1-\tau\phi}{\tau-1}} \chi \left(L_t^{c*}\right)^{-\frac{1}{\tau}} \left(Q_t^* X_t^{g*}\right)^{\phi}$$
$$-\theta \mu_t^{g*} R_t^D W_t^{L,g,*} - \theta E_t \Lambda_{t,t+1}^* \left(1 - \sigma + \sigma \lambda_{t+1}^{g*}\right) R_t^D W_t^{L,g,*}$$
$$= W_t^{L,g,*}\left[\lambda_t^g - \theta R_t^D \mu_t^g - E_t \Lambda_{t,t+1}^* \left(1 - \sigma + \sigma \lambda_{t+1}^g\right) \theta R_t^D\right]. \tag{43}$$

Consider (42). 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. Hiring more loan officers in the host economy, on the other hand, entails a resource cost as well as an implementation cost, as suggested by the right-hand-side of (42).

We will come back below to the mechanisms of interaction between liquidity management in internal capital markets and the control of monitoring resources exerted by global banks.

3.4 Market clearing

The market clearing conditions of the labor markets and deposit markets in the host economy and in the foreign economy are already embedded in the definition of the corresponding variables. In the loan market of the host economy

$$K_t \quad = \quad X_t + X_t^g. \tag{44}$$

That is, 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

$$K_t^* \quad = \quad X_t^* + X_t^{g^*}. \tag{45}$$

In equilibrium the global social resource constraint will also hold.

4 Steady State and Calibration

This section provides details on the calibration of the model and previews key mechanisms that will drive our results.

4.1 Calibration

We solve the model numerically by linearly approximating it around the non-stochastic steady state. In the baseline calibration, we posit symmetric countries and calibrate the model parameters to data moments from a broad set of economies in our sample.[21] Parameters are shown in Table 4. In total there are 19 parameters to calibrate, seven referring to the household sector, three to the firm sector, and the remaining nine to the banking sector.

Parameters regarding the representative households and representative firms are set to standard values in the literature. For example, the household discount factor β is set to 0.99, and the Frisch elasticity of labor supply for producing final goods and for monitoring at both types of banks is set to 1. This choice is in line with the recommendation of Chetty et al. (2011) and is appropriate for our model since it does not distinguish between the intensive and extensive margins of employment. Households' habit in consumption h is set to 0.5, in line with a broad class of macroeconomic models. As for the final good producing firms, the effective share and depreciation rate of capital are set to the standard values of $\alpha = 0.33$ and $\delta = 0.025$, respectively. These imply a labor share of 67% and an annual capital depreciation rate of 10%. The inverse elasticity of investment to the price of capital in steady state is set

[21] Later in the paper, in Section 5.4, we will consider the case of two asymmetric countries and calibrate the host economy specifically to Hungary.

to 1.73, in line with Gertler and Karadi (2011).

For the banking sector, we fix three parameters to values borrowed from the literature or directly calculated from external data: η, the parameter that governs the consolidation of global banks' balance sheets; θ, the weight of transfers in the bank capital constraint; and σ, the bankers' survival rate. Typically branches are consolidated and subsidiaries are not. We then set η to 0.1 in the baseline calibration, reflecting the share of foreign-bank assets accounted for by branches, as documented by Allen et al. (2013) for a large set of advanced and middle-income countries. θ is determined by market and regulatory requirements and by the composition of flows in internal capital markets. In line with other studies on the composition of such flows, Allen et al. (2013) report that in 2007–2009 for UniCredit and Citigroup, banks with large global networks of affiliates, the flows between foreign affiliates and parent banks consisted for 60% of intra-group loans and other non-equity flows.[22] We set θ to 0.6. In line with Gertler and Karadi (2011), we set bankers' survival rate σ to 0.9.

We next calibrate six banking sector parameters to fit data moments: the proportional transfer to entering bankers ς; the pledgeability of local bank loans ξ^L; the productivity weight on locally-hired loan officers χ; the pledgeability of global bank loans ξ; the parameter ϕ in banks' due diligence function; and the elasticity of substitution between locally-hired loan officers and loan officers hired by banking conglomerates τ. To this end, we match six targets, predominantly based on the data in our sample. The global bank annual loan interest rate spread is set to 3%, in the ballpark of what is documented by studies on foreign bank lending. Global banks' leverage ratio is set to 7, as implied by our sample of global bank affiliates. The ratio of global banks' wage bill for loan officers over bank assets is set to 1.45%, in line with the annual expenses on salaries and employee benefits over assets of foreign banks observed in the balance sheet data of our sample (and consistent also with banks' reports for the euro area). We target a ratio of global bank loans over total bank loans close to 25%, which is around the average global banks' loan ratio observed in our sample of countries. Accounting for this, and targeting a labor intensity (loan officers over assets) at local banks analogous to the labor intensity at global banks' affiliates, we set the monitoring (loan officers) at local banks over

[22]Our data do not provide details on the relative share of intra-group loans and equity flows. However, consistent with the calibrated value of θ, in our data the frequency with which parent banks support affiliates through loans is roughly 25% larger than the frequency with which parents decide not to repatriate dividends from affiliates (a primary form of equity injection into affiliates).

total monitoring $L/(L^g + L)$ to 0.7. Finally, our last target is the ratio of loan officers hired by banking conglomerates over loan officers hired by affiliates (L^c/L^a). In our data, approximately 85% of local affiliates declare an involvement of parent offices in the hiring and training of their loan officers. However, as noted, only the hiring of a fraction of loan officers at an affiliate will eventually be influenced directly by parent offices. Our calibration implies that slightly more than 50% of loan officers at an affiliate is ultimately selected by parent offices.

4.2 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 shocks to the macroeconomy.

Monitoring. Consider first the monitoring decision (hiring of loan officers at the affiliate level) made by global banking conglomerates (42), reported again here for convenience

$$
\begin{aligned}
[\partial L_t^c]: \quad & \xi(1-\phi)\left[\mu_t^g(1-\eta)+\mu_t^{g^*}\eta\right]\left[(1-\chi)\left(L_t^a\right)^{\frac{\tau-1}{\tau}}+\chi(L_t^c)^{\frac{\tau-1}{\tau}}\right]^{\frac{1-\tau\phi}{\tau-1}}\chi\left(L_t^c\right)^{-\frac{1}{\tau}}\left(Q_tX_t^g\right)^{\phi} \\
& -\theta\mu_t^g R_t^D W_t^{L,g} - E_t\Lambda_{t,t+1}^*\left(1-\sigma+\sigma\lambda_{t+1}^g\right)\theta R_t^D W_t^{L,g} \\
& = W_t^{L,g}\left[1+\psi_2\left(W_t^{L,g}L_t^c-\overline{W}^{L,g}\overline{L}^c\right)\right]\left[\lambda_t^g-\theta R_t^D\mu_t^g-\theta E_t\Lambda_{t,t+1}^*\left(1-\sigma+\sigma\lambda_{t+1}^g\right)R_t^D\right].
\end{aligned}
\tag{46}
$$

For illustrative purposes, we also report its simplified version when $\psi_1 = \psi_2 = 0$:

$$
\begin{aligned}
& \xi(1-\phi)\left[\mu_t^g(1-\eta)+\mu_t^{g^*}\eta\right]\left[(1-\chi)\left(L_t^a\right)^{\frac{\tau-1}{\tau}}+\chi(L_t^c)^{\frac{\tau-1}{\tau}}\right]^{\frac{1-\tau\phi}{\tau-1}}\chi\left(L_t^c\right)^{-\frac{1}{\tau}}\left(Q_tX_t^g\right)^{\phi} \\
& = W_t^{L,g}\lambda_t^g.
\end{aligned}
\tag{47}
$$

The monitoring decision of global banking conglomerates is primarily driven by the tightness of the capital constraint in the host country and, through consolidation, in the foreign country, as captured by the value of the Lagrange multipliers μ_t^g and $\mu_t^{g^*}$. Bank monitoring, in fact, enhances the pledgeability of banks' assets and allows to relax banks' capital constraint. Thus, the incentive to perform monitoring is larger, the tighter the constraint. The monitoring decision is also governed by the value (quality) of bank loan portfolios, as captured by $Q_tX_t^g$. The larger this value, the higher the marginal productivity of bank monitoring and, hence, the incentive to monitor.

The monitoring decision of global banking conglomerates is also directly affected by their structural characteristics: the degree of centralization of monitoring resources (as reflected in the cost ψ_2 of making strings attached transfers for hiring monitoring loan officers in the host country), the efficiency of affiliates relative to conglomerate headquarters (χ), and the degree of consolidation of conglomerates' balance sheets (η). Consider first the influence of the degree of centralization of monitoring resources, as captured (inversely) by the cost ψ_2 of making strings attached transfers. The higher such centralization (that is, the lower ψ_2 is), the stronger the incentive to monitor. The relative efficiency of conglomerate headquarters also shapes directly the monitoring incentives at the affiliate level: the higher the value of χ, the larger the incentive of a conglomerate to hire loan officers at affiliate offices. Finally, consider the role of balance sheet consolidation. When the conglomerate of a global bank makes decisions about loan monitoring at the affiliate level (choosing L^c_t), it takes into account the effect that loan officers have also on the pledgeability of loans for foreign lending, in the parent offices, while it takes correspondingly less into account the pledgeability of loans in the host country.

We now discuss how global banks' monitoring choice interacts with the management of liquidity in internal capital markets.

Liquidity. Internal capital markets allow global banks to make no strings attached liquidity transfers. The choice of such transfers is governed by Equation (41), reported again here for convenience:

$$\begin{aligned} &\left[\lambda^g_t - \theta R^D_t \mu^g_t - E_t \Lambda^*_{t,t+1} \left(1 - \sigma + \sigma \lambda^g_{t+1}\right) \theta R^D_t\right] \left[1 - \psi_1 \left(Z^{g^*}_t - \overline{Z}^{g^*}\right)\right] \\ &= \lambda^{g^*}_t - \theta R^D_t \mu^{g^*}_t - E_t \Lambda^*_{t,t+1} \left(1 - \sigma + \sigma \lambda^{g^*}_{t+1}\right) \theta R^D_t. \end{aligned} \tag{48}$$

The usage of internal capital markets is easier, the lower is the cost ψ_1. The provision of transfers affects the availability of liquidity for global bank affiliates. Crucially, it also has implications for monitoring activities: the provision of no strings attached liquidity (Z^g_t) can dilute the monitoring incentive of affiliates by making liquidity constraints less tight. Recall, from the FOC of loan officers L^c in (42), that the incentive to monitor is related to the tightness of the capital constraint, as captured by μ^g_t. To the extent that cheap intra-group transfers replace more costly retail deposits, the tightness of the capital constraint will be reduced too, diluting the incentive to perform loan monitoring.

5 The Response to Shocks

We investigate the response of the economy to financial and real shocks. In particular, we consider shocks to banks' net worth (nw), to capital quality (κ), and to firms' productivity (A). To gain insights into the mechanisms, we compare our economy with two alternative economies. The first comparison economy is a "decentralized monitoring" economy, in which global banks can implement no strings attached liquidity transfers, but cannot influence the hiring of loan officers by their affiliates. Formally, in this first comparison economy we posit an infinitely high value of ψ_2 for implementing strings attached transfers. The second comparison economy is a "decentralized liquidity" economy, in which global banks can influence the hiring of loan officers by their affiliates and implement strings attached transfers to finance the associated wage bill, but cannot implement no strings attached liquidity transfers. In this second comparison economy, we posit an infinitely high cost ψ_1 for implementing no strings attached transfers. In the baseline economy, both ψ_1 and ψ_2 are set at a very small number, namely, $\psi_1 = \psi_2 = 0.1$.

After studying the influence of monitoring centralization and liquidity centralization, we revisit their influence in a scenario in which loan officers hired centrally by global bank conglomerates have significantly lower productivity than those hired by affiliates ($\chi = 0.1$). We also consider a scenario in which there is no consolidation of global banks' balance sheets ($\eta = 0$). Table 5 provides an overview of the results.

5.1 Bank net worth shocks

We first study the impact of bank net worth shocks. These can especially capture drops in banks' capitalization due to crises in asset markets in which banks have significant involvement, such as real estate and sovereign debt markets. As we illustrate below, the results suggest that the stabilizing or propagating effects of global banks are heavily influenced by the functioning of their internal capital markets (liquidity centralization) and by the degree of loan monitoring control exerted by parent offices vis-à-vis their affiliates (monitoring centralization). That is, not only the mere presence of global banks but also their organizational structure matter.

Following a negative shock to the net worth of both local banks and global banks' affiliates, 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 contract their loans.

This countercyclical, and potentially stabilizing, lending behavior reflects the countercyclical behavior of global banks' loan monitoring intensity, financed by substantial liquidity support (strings attached transfers) from parent offices.

Figure 1 displays the impulse responses following a 1% negative shock to the net worth of local banks in the host country (solid black lines).[23] Observe that, in spite of the shock hitting directly only local banks, net worth drops both at local banks and global banks' affiliates, as a result of the endogenous fall of investment returns and, hence, of asset prices (Q_t) in the host economy. This erodes the loan portfolio values of both types of banks, shrinking their net worth. Following the shock, global banks' parent offices transfer liquidity to their affiliates in the host economy, both in the form of strings attached transfers ($W_t^{L,g} L_t^g$) and of no strings attached transfers (Z_t^g). As suggested by the fourth row of Figure 1, the increase in no strings attached transfers stems from the stronger tightening of liquidity constraints in the host economy, as captured by the larger increase of the Lagrangian multiplier associated with banks' resource constraint in the host country (λ_t^g), relative to the increase of the same multiplier in the foreign country (λ_t^{g*}). On the other hand, the increase of strings attached transfers reflects the rise of parent banks' hiring of monitoring loan officers (L_t^c) in the host country, which is primarily driven by the tightening of the capital constraint in the host economy (observe the increase of the Lagrangian multiplier μ_t^g).[24]

Due also to the complementarity between loan officers hired by parents and by affiliates, the loan monitoring of global bank affiliates ($\mathcal{L}_t$) rises substantially in the host country overall, facilitated by the expansion of strings attached transfers. As a result of the substantial boost to loan monitoring and of the inflow of transfers from parent offices, global bank affiliates can increase their loan supply in a countercyclical fashion. Conversely, while expanding somewhat their loan monitoring and deposit gathering, local banks shrink their credit supply.[25] That is, their lending behaves procyclically.

In the aggregate, overall credit in the host economy shrinks, indicating that the countercyclical response of global banks' loans only partially offsets the credit crunch of local banks. Investment (I_t), capital accumulation (K_t), and production (Y_t) drop, as shown in Figure 2.

[23]For all shocks, we set the persistence to 0.7.

[24]The capital constraint also tightens in the foreign country. Under partial balance sheet consolidation this also incentivizes global banks' monitoring in the host economy. We will return to this point below.

[25]Local banks also raise their loan monitoring to relax their capital constraint. Both global bank affiliates and local banks also increase their deposit taking.

However, the countercyclical lending response of global banks helps to mitigate this contraction. In what follows, we investigate how the organizational structure of global banks shapes the above effects.

5.1.1 Global banks' centralization

We consider two dimensions of global banks' centralization. The first one relates to (the lack of) frictions in global banks' internal capital markets, as reflected in the ψ_1 cost of making no strings attached liquidity transfers within banking conglomerates. We label this "liquidity centralization". The second dimension of centralization relates instead to the ability of global banks to implement strings attached transfers within their global conglomerates, and, hence, to affect the hiring of monitoring labor in their host-country affiliates. We capture this centralization of "monitoring resources" through the cost ψ_2 associated with the payment of host country loan officers' wage bill by banking conglomerates.

To examine the implications of centralization, Figure 1 compares the impulse responses following a negative bank net worth shock in our baseline economy and in the two alternative settings: an economy lacking liquidity centralization ($\psi_1 = \infty$, dashed blue lines) and an economy lacking monitoring centralization ($\psi_2 = \infty$, dashed-dotted red lines).

Monitoring centralization. The centralization of monitoring triggers a stronger intervention of banking conglomerates, in terms of larger strings attached transfers and a more pronounced countercyclical response of loan monitoring by global bank affiliates in the host country (compare the response of L^c in our baseline economy to the alternative economy with $\psi_2 = \infty$). As a result of the larger influx of strings attached liquidity, and of the sharper countercyclical boost to monitoring, the response of global bank loans is countercyclical in our baseline setting with monitoring centralization, while it is procyclical in the alternative setting with decentralized monitoring.

More specifically, as Figure 1 shows, there are almost no differences in the net worth responses of local and global banks between the two settings. But in the baseline, the overall hiring of loan officers by global bank affiliates ($\mathcal{L}_t$) rises significantly more than in the alternative setting (where, nonetheless, loan monitoring slightly rises, driven by the autonomous hiring decisions of local affiliates). Interestingly, the overall liquidity transfers ($\mathcal{Z}_t^g$) behave similarly in the two settings: indeed, in the alternative economy, the global bank conglomerate reshuffles liquidity transfers from the strings attached type to the (much less costly) no strings attached type. As shown in the figure, global bank loans in the host economy increase countercyclically in our baseline setting, while, when $\psi_2 = \infty$, they instead drop. The much stronger loan monitoring response appears to be a key driver of the countercyclicality of global bank loans under monitoring centralization.

Liquidity centralization. The centralization of liquid resources has quite different consequences for the transmission mechanisms of bank net worth shocks. This can be seen by comparing the baseline economy with the $\psi_1 = \infty$ alternative setting in Figure 1. Under liquidity centralization, we observe a larger inflow of no strings attached transfers (Z_t^g) than in the alternative setting but, remarkably, a less countercylical response of the hiring of loan monitoring officers by parent banks (L_t^c). Intuitively, the inflow of liquid funds from the conglomerates mitigates the tightening of the resource and capital constraints of global banks' affiliates in the host country, as revealed by the smaller increase of the associated Lagrangian multipliers (λ_t^g and μ_t^g). This, in turn, dilutes global banks' incentive to boost their monitoring in the host economy. The overall influence of liquidity centralization on the behavior of global bank loans (X_t^g) is thus ambiguous a priori: there is a smaller increase in loan monitoring and hence in the pledgeability of affiliates' loan portfolio assets, but also more liquidity support. As shown in Figure 1, on balance, liquidity centralization contributes to the countercylicality of global bank loans. Indeed, while increasing in our baseline economy, global bank loans decline in the alternative setting with $\psi_1 = \infty$.

On the other hand, as revealed by the figure, the gap in global banks' loan response between the baseline economy and the economy with decentralized liquidity is smaller relative to the gap between the baseline and the decentralized monitoring economy. This points to a more pronounced influence of monitoring centralization on global bank loans' countercyclicality following bank net worth shocks relative to the influence of liquidity centralization (see Table 5, Panel A, for a summary).

Macroeconomic implications. The countercyclical lending of global banks can help supplant the drop in local bank lending.[26] Figure 2 shows that both in the case of centralization in terms of liquidity and in terms of monitoring, the overall macroeconomic effects are beneficial to the host economy, in terms of stabilization of capital accumulation and output. In fact, as shown in the figure, under both types of global banks' centralization the host economy suffers a smaller drop in investment, capital, and production.

5.1.2 Centralization and other characteristics of global banks

Global banks' skills and centralization: A case of complementarity. The impact of global banks' centralization of monitoring and liquidity may differ depending on the distribution of monitoring skills between the parent bank and the affiliate offices. Figure 3a reassesses centralization under different values of the parameter χ.[27] In particular, the figure displays differences in the impulse responses between the baseline economy and the above two comparison economies ($\psi_1 = \infty$ and $\psi_2 = \infty$) following a bank net worth shock separately for the baseline scenario ($\chi = 0.5$; dashed red line) and for a scenario in which loan officers hired by conglomerates are significantly less skilled in monitoring than those hired by affiliates ($\chi = 0.1$; solid blue line). When managing loan officers in the host country, conglomerates may in fact have worse local knowledge than affiliates, and hence the monitoring of the loan officers they control could be less effective than that of the loan officers hired by affiliates.[28]

When comparing the baseline and the $\psi_2 = \infty$ economy, Figure 3a clearly shows that the countercyclical lending behavior of global banks under monitoring centralization is especially pronounced when, as in the baseline calibration, global banks' conglomerates have relative large efficiency in hiring loan officers. In particular, in the baseline global banks make more transfers to their affiliates (especially strings attached transfers), and their monitoring (L_t^c) and loans (X_t^g) increase by more. One intuition for the stronger response of global banks' monitoring and loans under monitoring centralization is that the intervention of parent offices is expected to have a larger beneficial impact on the pledgeability of loans when χ is higher. This, in turn,

[26]Due to the competition from global banks in the deposit and loan markets, local banks can suffer from some crowding out by global banks, besides suffering from the direct effect of the net worth shock. More specifically, rising deposit rates and lower loan returns can depress their credit supply.

[27]In the figures presented in this section, we focus on the impulse responses of selected variables. The full sets of impulse responses are displayed in Appendix Figures B1-B4.

[28]For instance, a conglomerate could have a limited understanding of the local market for bank managers and officers, and hence end up hiring less suitable loan officers.

incentivizes the intervention of global conglomerates.

Figure 3b shows how the effects of liquidity centralization (difference between the baseline and the $\psi_1 = \infty$ economy) depend on χ. For a higher χ (indicating a relatively high efficiency of global conglomerates in hiring loan officers), the difference in the overall liquidity transfers Z_t^g between the baseline and the $\psi_1 = \infty$ comparison setting is larger. This is especially driven by more inflows of no strings attached transfers. These liquidity inflows lead to even greater "laziness" of conglomerate banks in performing loan monitoring relative to the case with heterogeneous monitoring skills (lower χ). On the other hand, due to the boost to liquidity inflows, the greater countercyclicality of global bank lending X_t^g becomes more pronounced.

In conclusion, though for different reasons, the stabilizing role of both monitoring and liquidity centralization is more accentuated when global banks feature a more homogeneous distribution of skills between parent and affiliate offices. Broadly speaking, we can refer to this as a form of complementarity between global banks' centralization and the sophistication of their monitoring skills.

Global banks' consolidation and centralization: A case of substitutability. We next study how the degree of balance sheet consolidation of global banks influences the effects of their monitoring or liquidity centralization. This amounts to studying how the effects of ψ_1 and ψ_2 on the responses of the host economy depend on the value of η, with a lower η implying less balance sheet consolidation. To grasp the forces at work, it is useful to compare the loan monitoring decisions (loan officer hiring) of a global bank headquarter (L_t^c) and of its affiliate (L_t^a):

$$\left(\frac{L_t^c}{L_t^a}\right)^{-\frac{1}{\tau}} = \underbrace{\frac{\lambda_t^g + \psi_2\left(W_t^{L,g}L_t^c - \overline{W}^{L,g}\overline{L}^c\right)\left[\lambda_t^g - \theta R_t^D\mu_t^g - \theta E_t\Lambda_{t,t+1}^*\left(1-\sigma+\sigma\lambda_{t+1}^g\right)R_t^D\right]}{\lambda_t^g}}_{Cost\ of\ Liquidity} \times \underbrace{\frac{1-\chi}{\chi}}_{Efficiency}\underbrace{\frac{\mu_t^g(1-\eta)}{\mu_t^g(1-\eta)+\mu_t^{g^*}\eta}}_{Externality} \quad (49)$$

When the implementation cost $\psi_2 = 0$, this ratio reduces to

$$\left(\frac{L_t^c}{L_t^a}\right)^{-\frac{1}{\tau}} = \frac{1-\chi}{\chi}\underbrace{\frac{\mu_t^g(1-\eta)}{\mu_t^g(1-\eta)+\mu_t^{g^*}\eta}}_{Externality}. \quad (50)$$

As Equation (50) 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, headquarter offices internalize a large effect of their monitoring on the conglomerate. This is especially true when the capital constraint on parent banks is tighter ($\mu_t^{g^*}$ is higher).

Figures 4a-4b show that the effects of global bank centralization (low ψ_1 or ψ_2) are more pronounced when global banks' balance sheets are not consolidated ($\eta = 0$). This is for two reasons. First, under consolidation, global banks consider conditions in the foreign country when hiring loan officers for the host country affiliates. To the extent that conditions in the foreign country worsen less than in the host country after the bank net worth shock, this dilutes global banks' incentive to step up monitoring in the host economy. Second, when balance sheets are consolidated more, the response of loans in the host economy tends to be weaker. This, in turn, weakens the monitoring and liquidity transfer response of global conglomerates.

In a nutshell, when η is high (more consolidation), parent banks put a smaller weight on the contracting host economy and a larger weight on the foreign economy (which is contracting less, as revealed also by the multiplier μ_t^{g*} in the foreign country shooting up significantly less than μ_t^g in the host country). Broadly speaking, our results therefore point to a form of substitutability between global banks' centralization and balance sheet consolidation in driving their countercyclical lending in the host country.

5.2 Capital quality shocks

The above analysis points to an overall stabilizing influence of global banks following shocks to banks' net worth. Such a stabilizing influence is more pronounced when global banks centralize monitoring resources and, to a lesser extent, liquid resources. This is especially the case when monitoring skills are more homogeneous within banking conglomerates and when balance sheet consolidation is lower (for example, when global banks operate relatively more subsidiaries than branches in host countries).

The influence of global banks and of their organizational structure is more nuanced following negative capital quality shocks in the host country. Such shocks can capture deteriorations in the quality of banks' loan portfolios in the form of spikes in non-performing loans and loan defaults. Portfolio returns and portfolio quality effects play a large role in shaping the transmission of such shocks. In the aftermath of negative capital quality shocks, the centralization of global banks' monitoring is less relevant, and possibly less beneficial, relative to the centralization of liquidity. In fact, in some circumstances the centralization of monitoring resources can even become destabilizing. Intuitively, a negative capital quality shock directly hurts the quality of loan portfolios and this can depress global banks' incentive to monitor loans (recall the discussion in Section 3). This can be seen in Figure 5, which displays the impulse responses to a 1% negative capital quality shock in the host country. In our baseline economy, while increasing in the immediate aftermath of the shock, global banks' monitoring drops below the initial steady state level after a few periods. Accordingly, strings attached liquidity transfers also become negative, driving down total transfers from parents to affiliates. Global bank loans fall too in the host country, thus exhibiting a procyclical behavior, and they only recover once the effects of the shock fade away.

In this scenario global banks can take on a destabilizing role. Interestingly, this occurs especially when these banks deploy a centralized monitoring structure (in Figure 5, compare the impulse responses in the baseline economy with those in the alternative economy with $\psi_2 = \infty$). In fact, we obtain that in the first few periods after the capital quality shock, the temporary increase in monitoring is stronger under monitoring centralization. Yet, in later periods, decentralization (i.e. the alternative economy) is associated with a lesser decline in monitoring. Intuitively, under monitoring centralization, global banks are more sensitive to the drop in loan portfolio quality triggered by the capital quality shock. Their monitoring incentives therefore weaken more. This also implies that, while under a centralized monitoring structure the decline in global bank lending is initially milder, the subsequent recovery of lending is slower than in the alternative economy with decentralized monitoring.

While monitoring centralization now exacerbates the destabilizing influence of global banks, liquidity centralization retains some stabilizing influence (in Figure 5, compare the baseline economy with the alternative economy with $\psi_1 = \infty$). In fact, a lack of liquidity centralization of global banks ($\psi_1 = \infty$) is uniformly associated with a weaker response of their loan monitoring, a lower inflow of transfers and—except in the immediate aftermath of the shock—a procyclical (rather than countercyclical) response of global bank lending. Intuitively, as shown in the figure, when no strings attached liquidity transfers are muted, there is a smaller repatriation of liquidity from global bank affiliates to parent offices. Thus, the bank resource and capital constraints in the host country become looser, diluting global banks' incentive to monitor. As a result, the alternative economy without liquidity centralization exhibits a more procyclical response of global bank lending.

Overall, centralization has an ambiguous impact on the stability of global bank lending after capital quality shocks: it boosts stability in the case of liquidity centralization but undermines it in the case of monitoring centralization (see Table 5, Panel B, for a summary). Interestingly, these differential effects of liquidity and monitoring centralization contrast with those seen after bank net worth shocks, where monitoring centralization acted as a better stabilizer than liquidity centralization. Nonetheless, as revealed by Figure 6, due to the contrasting forces at work, even in the case of liquidity centralization, the overall benefits for macroeconomic stabilization are clearly more modest than what we observed after shocks to banks' net worth.

5.3 TFP shocks

In Figure 7, we study the effects of a 1% negative shock to firms' total factor productivity. A reduction in TFP directly erodes global banks' incentives to extend loans in the host country. This is captured by a drop in the return to investments R_k. The shock also causes a tightening of affiliates' resource and capital constraints, as indicated by the increase in the Lagrangian multipliers associated with those constraints (though this tightening is less pronounced than following bank net worth shocks). The tightening of affiliates' capital constraint, in turn, incentivizes global banks to increase their loan monitoring, and to finance the additional hiring of loan officers in the host country via strings attached transfers. This tends to boost global banks' lending in the host country. The cyclical behavior of global banks' loans depends on whether the former or the latter effect dominates. In our simulations, as revealed by Figure 7, the rise in bank monitoring moderates, but does not outweigh, the reduced incentive to grant loans. Global banks' lending in the host country consequently falls after a negative TFP shock.

The organizational structure of global banks influences the balance between the above opposite forces (in Figure 7, compare the baseline economy with the alternative economies with $\psi_1 = \infty$ and $\psi_2 = \infty$). We obtain that when global banks exert centralized control over affiliates' monitoring decisions (baseline economy with ψ_2 finite and low), their countercyclical monitoring gains strength relative to the direct impact of lower productivity and loan returns. This leads to a smaller drop in the loans of global bank affiliates following the TFP shock.

In contrast, the influence of liquidity centralization is less clear here. Since the tightening of resource constraints is much less pronounced, the difference between the baseline economy and the economy with decentralized liquidity is modest. In a sense, while following capital quality shocks, liquidity centralization was more beneficial than monitoring centralization, here, similar to the case of bank net worth shocks, it is monitoring centralization that stabilizes global bank lending most (see Table 5, Panel C, for a summary). In the real sector, as shown in Figure 8, the host economy suffers from a bigger drop in investment, capital, and production in the absence of monitoring or liquidity centralization.

5.4 Global banks' business models and business cycles in Hungary

We quantitatively assess the implications of global banks' business models for the business cycle dynamics of Hungary. This is a country in our empirical sample that has been characterized by a significant presence of multinational banks' affiliates since its major banking reforms of the mid-1990s. These have included affiliates of Austrian, French, and Italian global banking conglomerates, among others. To conduct a quantitative assessment, we adapt our calibration to a scenario with two asymmetric countries. We treat Hungary as the host economy and continue to let the foreign country represent the rest of the world.

We re-calibrate the following parameters for each of the two countries: the proportional transfer to entering bankers ς; the pledgeability of local bank loans ξ^L; the productivity weight on locally-hired loan officers χ; the pledgeability of global bank loans ξ; the parameter ϕ in banks' due diligence function; and the elasticity of substitution between locally-hired loan officers and loan officers hired by banking conglomerates τ. The bottom panel of Table 4 reports the parameter values. To perform the recalibration, we adjust four targets of the host economy to match data moments for Hungary drawn from our database.[29] We target a ratio of global bank loans over total bank loans of 40%, and a leverage of global banks of 9.65. We target a ratio of loan officers hired by conglomerates over loan officers hired by affiliates such that about 60% of loan officers at an affiliate is ultimately selected by parent offices. Finally, we set the monitoring (loan officers) at local banks over total monitoring to 0.6.

Using Hungarian data, we then estimate $AR(1)$ processes for the three shocks of the model: bank net worth, capital quality, and total factor productivity. For the estimation, we rely on

[29] For the host country, the other two targets remain as in the baseline calibration. Moreover, for the foreign country we retain the targets used in the baseline calibration.

time series data on banks' TIER 1 capital to asset ratio for the bank net worth shock (National Bank of Hungary data); time series data on banks' non-performing loans for the capital quality shock (National Bank of Hungary data); and time-series data on gross domestic product, capital and labor for the TFP shock, as in Fernald (2014) (Hungarian Central Statistical Office data). We feed the estimated shocks into the model and conduct 3,000 stochastic time-series simulations spanning 11,000 quarters, discarding the first 1,000 quarters of data to counteract initial condition biases.

Using the simulated data, we identify recessionary episodes following the criterion proposed by Abiad et al. (2011), where recessions are defined as episodes in which the output series falls more than one standard deviation below zero. The onset of a recession is defined as the quarter immediately following an output peak. For each recessionary episode, we analyze the simulated data over 40 quarters following the recession's onset. We next categorize recessions based on the relative influence of the three shocks in driving the output contraction. As a metric of each shock's impact, we consider the standardized mean of the shock, computed as the average of the shock over the 40-quarter span, divided by its standard deviation. We next define "bank net worth-driven recessions" as the recessionary episodes in which the standardized mean of the bank net worth shock exceeds (in absolute value) the standardized mean of the capital quality and TFP shocks (and analogously for "capital quality-driven recessions" and "TFP-driven recessions"). Aggregating across simulations within each category of recessions, we then compute the average path of the recessions and a 90% confidence interval.

Figure 9 displays the results of this quantitative exercise. The results point to a stabilizing influence of global banks' centralization in bank net worth-driven recessions. This is somewhat more pronounced in the case of monitoring centralization than in the case of liquidity centralization. In the average bank net worth-driven recession, aggregate investment drops by 13.1% on average during the following 40 quarters in the baseline model, but by 15% (respectively, 14.8%) in the comparison model without monitoring (liquidity) centralization. Global bank loans exhibit a more pronounced decline in the comparison model without monitoring centralization (average drop of 34%) than in the baseline model (13.3%), while their pattern is more mixed in the absence of liquidity centralization.[30]

[30] The average response of global bank loans in the absence of liquidity centralization falls within the 90% confidence internal of their response in the baseline economy.

As a result of the contrasting forces uncovered in the impulse response analysis, the influence of global banks is much more nuanced following capital quality shocks. In the average capital quality-driven recession, the economy without liquidity centralization exhibits a slightly larger investment drop than the baseline setting, but the difference is very modest (1.67% versus 1.44% on average over the 40-quarter span). And the economy without monitoring centralization actually exhibits a slightly smaller investment reduction than the baseline (1.34% versus 1.44%). This is due to the decline in global banks' monitoring in the baseline economy, which tends to be muted when monitoring is decentralized. Finally, the patterns and comparisons in the average TFP-driven recession are closer to those in the average bank net worth-driven recession, though the effects of global banks' business models are generally less pronounced.

6 Conclusion

Global banks constitute complex financial institutions with articulated internal decision processes and organizational structures. We have studied the effects of global banking and global banks' organizational structure on macroeconomic stability. Motivated by micro-level evidence from a large set of multinational banks, we highlight two key dimensions of global banks' structure: their control of monitoring decisions across their affiliates and their management of internal capital markets. The results reveal that more centralized global banks can mitigate the credit market effects of negative financial (bank net worth) shocks by facilitating loan monitoring interventions by global parents and a larger infusion of liquidity across banking conglomerates. This loan stabilizing effect of global banks is especially pronounced when these banks feature a higher degree of sophistication of due diligence skills in host countries. In contrast, we obtain that global banks can be destabilizing following capital quality shocks that directly impair loan portfolio quality. Such a destabilizing effect is more pronounced when global banks adopt a centralized business model of tight monitoring control. Liquidity centralization, on the other hand, contributes to mitigating this destabilizing effect. The analysis shows, nonetheless, that following capital quality shocks the influence of liquidity and monitoring centralization on the (de)stabilizing behavior of global banks tends to be significantly smaller than their stabilizing influence following bank net worth shocks.

Our paper leaves questions open for future research. In the analysis, we have taken the structure of global banks as given. However, the structure of internal capital markets and the control of monitoring decisions within global banking conglomerates are likely to interact with global banks' network formation decisions. Exploring this interplay can then yield important insights into the macroeconomic implications of global banking. We leave these and other issues to future research.

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Table 1: Summary Statistics

	N	Mean	Median	SD
Bank location and financial characteristics				
Region: Central Asia	248	0.04	0	0.19
Region: Central Europe and Baltic States	248	0.29	0	0.46
Region: Eastern Europe and the Caucasus	248	0.19	0	0.39
Region: Russia	248	0.06	0	0.25
Region: South-eastern Europe	248	0.31	0	0.47
Region: Southern and Eastern Mediterranean	248	0.06	0	0.24
Region: Turkey	248	0.04	0	0.20
Annual credit growth (%)	1,721	13.04	5.13	51.86
Equity/Total assets (%)	1,721	13.80	12.37	7.00
Gross loans/Total customer deposits (%)	1,721	583.76	110.27	7,913.52
Net interest margin (%)	1,721	4.70	4.05	3.05
Subsidiary lending behaviour				
SME lending	224	0.91	1	0.29
Relationship is important (SME)	224	0.86	1	0.35
Global bank monitoring				
Parent targets credit growth	217	0.83	1	0.37
Parent targets market share	218	0.40	0	0.49
No. calls of subsidiary with parent	121	12.61	7	16.60
Parent provided monitoring support	121	0.91	1	0.29
Parent selected managers	121	0.87	1	0.34
Global bank liquidity				
Parent operates centralized treasury	121	0.43	0	0.50
Parent most important to cover funding shortfall	215	0.37	0	0.48
Liquidity centralization	121	0.25	0	0.43
Parent regularly provides capital and/or liquidity	215	0.69	1	0.46
Parent provided liquidity support	219	0.86	1	0.35

Note: This table presents summary statistics for the sample of banks interviewed as part of the BEPS survey. All observations are at the bank level, except *Annual credit growth*, *Equity/Total assets*, *Gross loans/Total customer deposits*, and *Net Interest Margin* which are at the bank-year level. Section 2.3 provides more details on measurement. Appendix Table B1 contains all variable definitions.

Table 2: Global Banks' Lending, Banks' Organization, and Crises

	Annual Credit Growth								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Any crisis host	21.669*	18.958*	15.581*	-1.079	0.586	-2.756	35.973**	33.494*	28.490*
	(8.570)	(8.473)	(7.705)	(15.292)	(18.989)	(19.664)	(12.945)	(13.588)	(13.623)
Any crisis host × # Calls with parent				2.588**	2.156*	2.158*			
				(0.841)	(1.045)	(0.927)			
Liquidity centralization × Any crisis host							-29.075	-27.159	-22.824
							(15.573)	(16.012)	(16.410)
Any crisis home	8.216	4.877	12.332	-1.124	-4.585	-7.548	-0.212	-2.407	-5.114
	(5.218)	(6.084)	(7.190)	(5.043)	(4.596)	(15.712)	(5.427)	(5.008)	(15.157)
L.Annual credit growth	0.283***	0.218***	0.146**	0.311***	0.280***	0.192**	0.295***	0.272***	0.182**
	(0.050)	(0.053)	(0.046)	(0.074)	(0.066)	(0.068)	(0.067)	(0.066)	(0.068)
Equity/Total assets		-0.709	-1.371		0.363	0.932		0.376	1.049
		(1.484)	(1.250)		(1.338)	(1.468)		(1.380)	(1.497)
Gross loans/Total customer deposits		-0.000	0.000		0.000	0.000		0.000	0.000
		(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)
Net interest margin		9.284**	7.584*		3.629	-0.222		3.851	-0.108
		(3.124)	(3.204)		(2.102)	(2.144)		(2.111)	(2.265)
Subsidiary FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	No	No	Yes	No	No	Yes	No	No	Yes
Observations	1740	1721	1721	911	908	908	911	908	908
Number of banks	245	241	241	120	120	120	120	120	120

Note: This table presents estimates for the effects of crises on global banks' lending in host countries. The estimator is a two-step difference GMM. The panel refers to the 2007-2017 period. For details on measurement see Section 2.3. For the definitions of all variables, see Appendix Table B1. Standard errors are adjusted for the Windmeijer's finite-sample correction for the two-step covariance matrix. ***, ** , and * denote significance at the 1 percent, 5 percent, and 10 percent level, respectively.

Table 3: Parent Banks' Liquidity and Monitoring Support during Crises

	Liquidity Support			Monitoring Support		
	(1)	(2)	(3)	(4)	(5)	(6)
Any crisis host	0.655***	0.722***	0.506***	0.642*	0.858*	0.182
	(0.152)	(0.167)	(0.132)	(0.305)	(0.337)	(0.196)
SME lending	0.082			0.124		
	(0.094)			(0.164)		
Relationship is important (SME)		0.126			0.377	
		(0.079)			(0.202)	
Liquidity centralization			0.120**			
			(0.040)			
# Calls with parent above 75th percentile						0.120**
						(0.038)
Any crisis home	-0.146	-0.127	-0.394	-1.676*	-1.452*	-1.393*
	(0.494)	(0.494)	(0.446)	(0.803)	(0.714)	(0.582)
Annual credit growth (winsorized; 0.01)	0.000	0.000	0.000	0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)
Equity/Total assets	-0.001	-0.001	-0.001	0.004	0.005	-0.001
	(0.004)	(0.004)	(0.004)	(0.005)	(0.005)	(0.004)
Gross loans/Total customer deposits	-0.000	-0.000	-0.000	-0.001	-0.001	0.000*
	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.000)
Net interest margin	-0.003	-0.004	0.005	-0.031	-0.033	-0.001
	(0.011)	(0.011)	(0.006)	(0.021)	(0.021)	(0.008)
Constant	0.784***	0.752***	0.839***	1.128***	0.863***	1.028***
	(0.107)	(0.096)	(0.067)	(0.188)	(0.245)	(0.063)
R-squared	0.049	0.059	0.069	0.136	0.210	0.091
Observations	219	219	208	97	97	121

Note: This table presents estimates for the effects of crises on global banks' liquidity and monitoring support of affiliates in host countries in columns (1) – (3) and (4) – (6), respectively. Estimates are from cross-sectional OLS regressions. The data is the collapsed panel which constitute averages of all variables between 2007 and 2017. For details on measurement see Section 2.3. For the definitions of all variables, see Appendix Table B1. Robust standard errors are in parenthesis. ***, ** , and * denote significance at the 1 percent, 5 percent, and 10 percent level, respectively.

Table 4: Parameters

Parameter	Description	Baseline (symmetric)	Quantitative Exercise Hungary	Quantitative Exercise Foreign
	Fixed Parameters			
Households				
β	Discount factor	0.99		
h	Habits on consumption	0.50		
φ	Inverse of Frisch elasticity in goods production	1.00		
γ	Inverse of Frisch elasticity in due diligence	1.00		
ν_H	Disutility of labor in goods production	1.00		
ν_L	Disutility of labor in due diligence at local banks	0.50		
$\nu_{L,g}$	Disutility of labor in due diligence at global banks	0.50		
Firms				
α	Capital share	0.33		
δ	Capital depreciation rate	0.025		
$I(F''/F')$	Inverse elasticity of investment to capital price in SS	1.73		
Banks				
σ	Survival rate of bankers	0.90		
θ	Fraction of deposit interest rate paid on intra-group loans	0.60		
η	Degree of balance sheet consolidation	0.10		
	Fitted Parameters			
Banks				
ς	Proportional transfer to entering bankers	0.01	0.008	0.008
ξ^L	Pledgeability of bank loans (local)	2.85	2.85	2.92
ξ	Pledgeability of bank loans (global)	3.00	3.35	3.00
ϕ	Weight of loans in the recovery value of firm shares	0.70	0.71	0.70
χ	Productivity weight on locally-hired loan officers	0.50	0.65	0.50
τ	Elasticity of substitution between loan officers	0.50	0.60	0.50

Note: All fixed parameters in the quantitative exercise take the same values as those in the baseline case.

Table 5: Effects of Shocks on Global Banks' Behavior (Overview)

	Loan monitoring	Transfers: Strings attached	Transfers: No strings attached	Transfers: Total	Lending
Panel A: Bank net worth crunch					
Overall effect	↑	↑	↑	↑	↑
Monitoring centralization	↑	↑	=	↑	↑
Liquidity centralization	↓	↓	↑	↑	↑
Panel B: Capital quality drop					
Overall effect	↑↓	↑↓	↑↓	↑↓	↓
Monitoring centralization	↓	↓	=	↓	↓
Liquidity centralization	↑	↑	↑	↑	↑
Panel C: TFP drop					
Overall effect	↑	↑	↑↓	↑↓	↑↓
Monitoring centralization	↑	↑	=	↑	↑
Liquidity centralization	↓	↓	↑	↑	↑

Note: This table provides an overview of the effects of negative shocks on global banks' behavior and of the influence of global banks' structure on such response. In the "overall effect" rows, "↑" indicates that the variable increases, "↓" indicates that the variable decreases, and "↑↓" indicates an ambiguous response (e.g., an increase on impact but then a decline below the steady state level). In the "monitoring centralization" and "liquidity centralization" rows, "↑" indicates that the variable increases more (or decreases less), "↓" indicates that the variable decreases more (or increases less), and "↑↓" indicates an ambiguous or negligible influence of centralization.

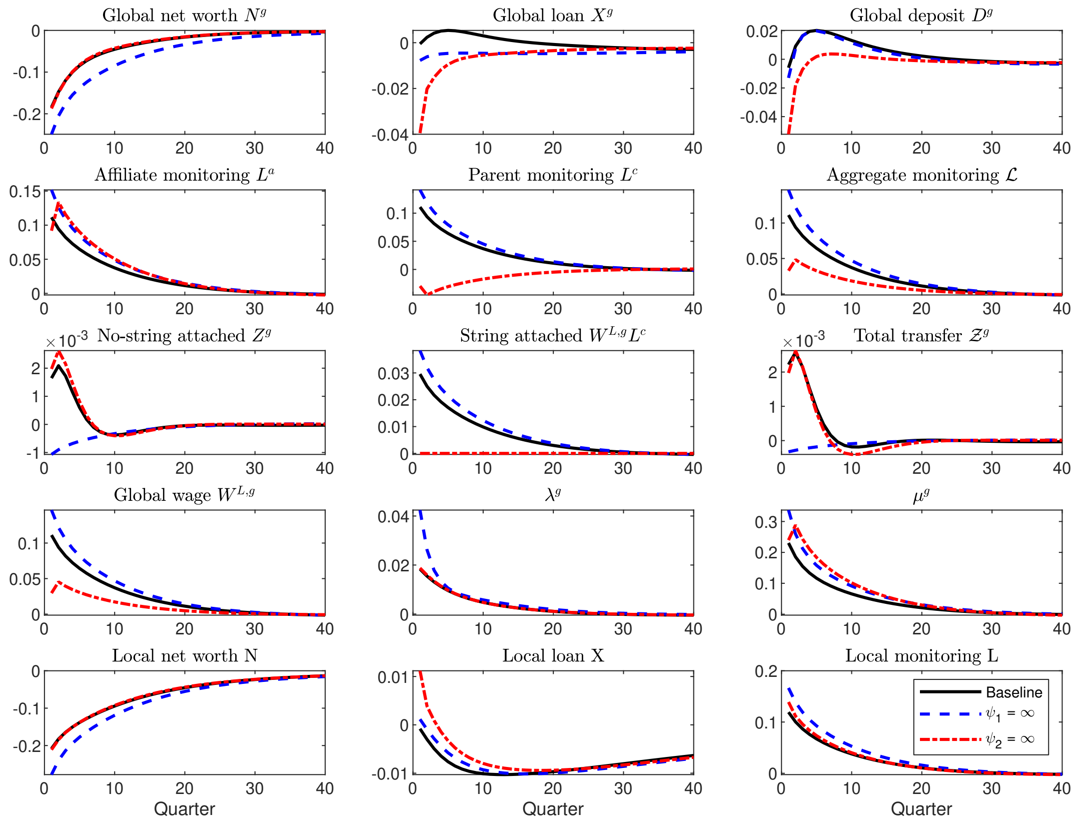


Figure 1: Responses to negative net worth shock in host country: banking variables

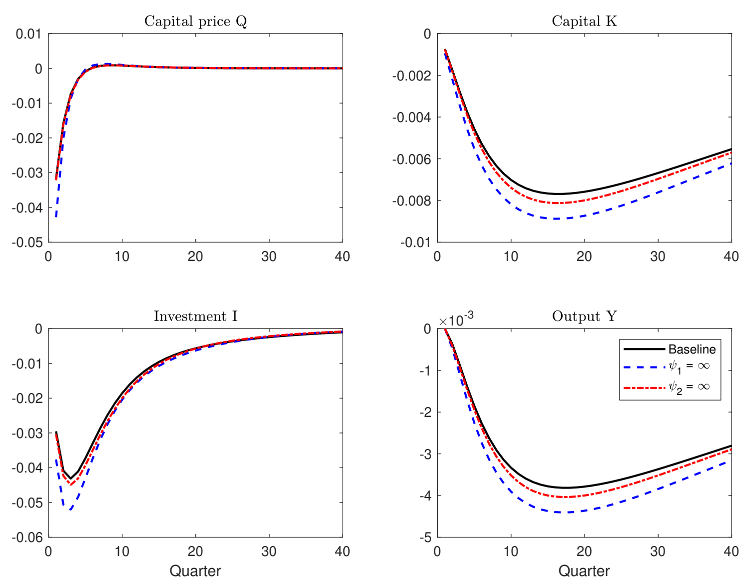
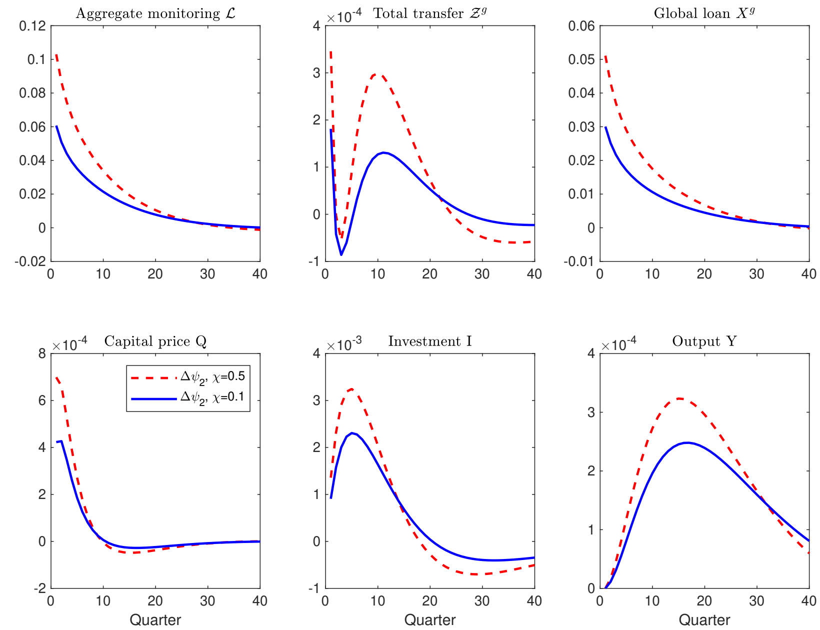
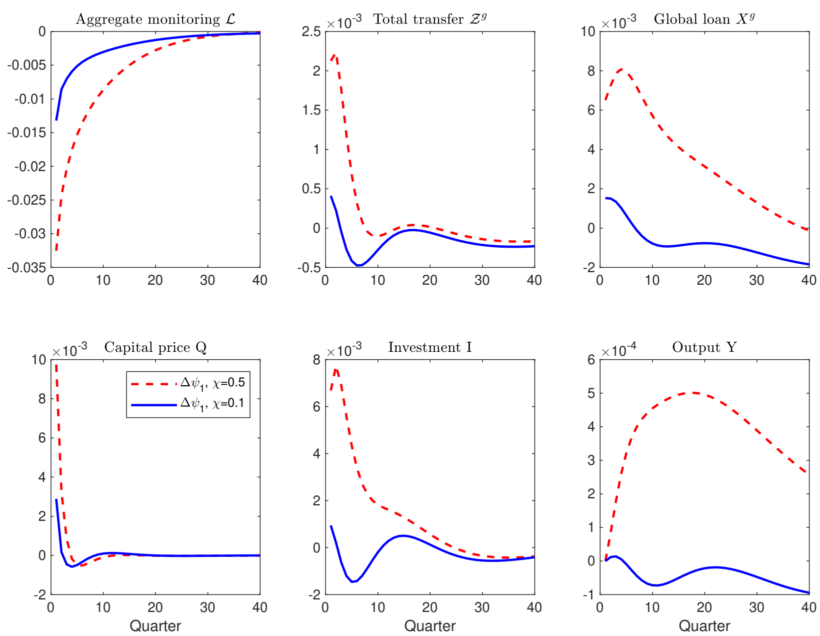


Figure 2: Responses to negative net worth shock in host country: aggregate variables

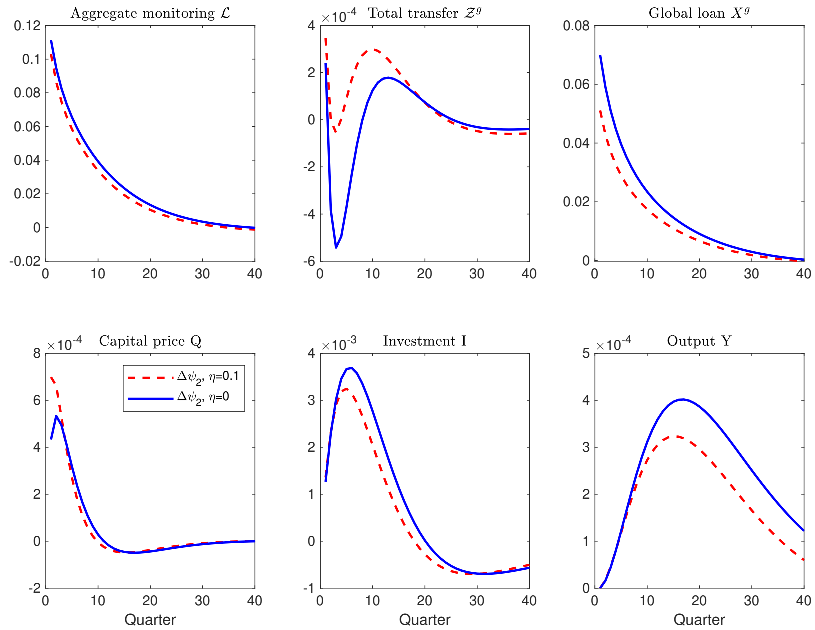


(a) Global banks' monitoring skills and monitoring centralization

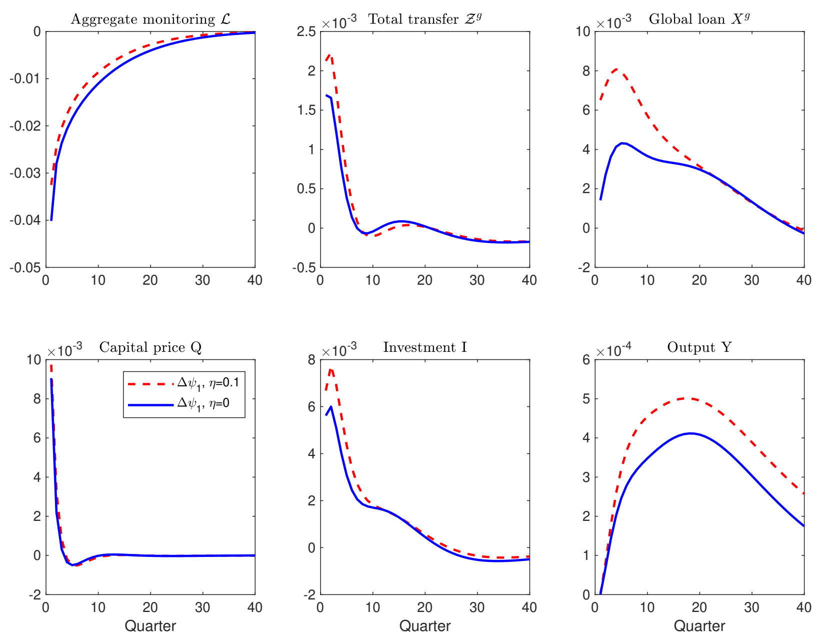


(b) Global banks' monitoring skills and liquidity centralization

Figure 3: Global banks' monitoring skills and centralization. The IRFs are in difference between the baseline economy and the comparison economy with $\psi_2 = \infty$ (Panel a) or the comparison economy with $\psi_1 = \infty$ (Panel b).



(a) Global banks' consolidation and monitoring centralization



(b) Global banks' consolidation and liquidity centralization

Figure 4: Global banks' consolidation and centralization. The IRFs are in difference between the baseline economy and the comparison economy with $\psi_2 = \infty$ (Panel a) or the comparison economy with $\psi_1 = \infty$ (Panel b).

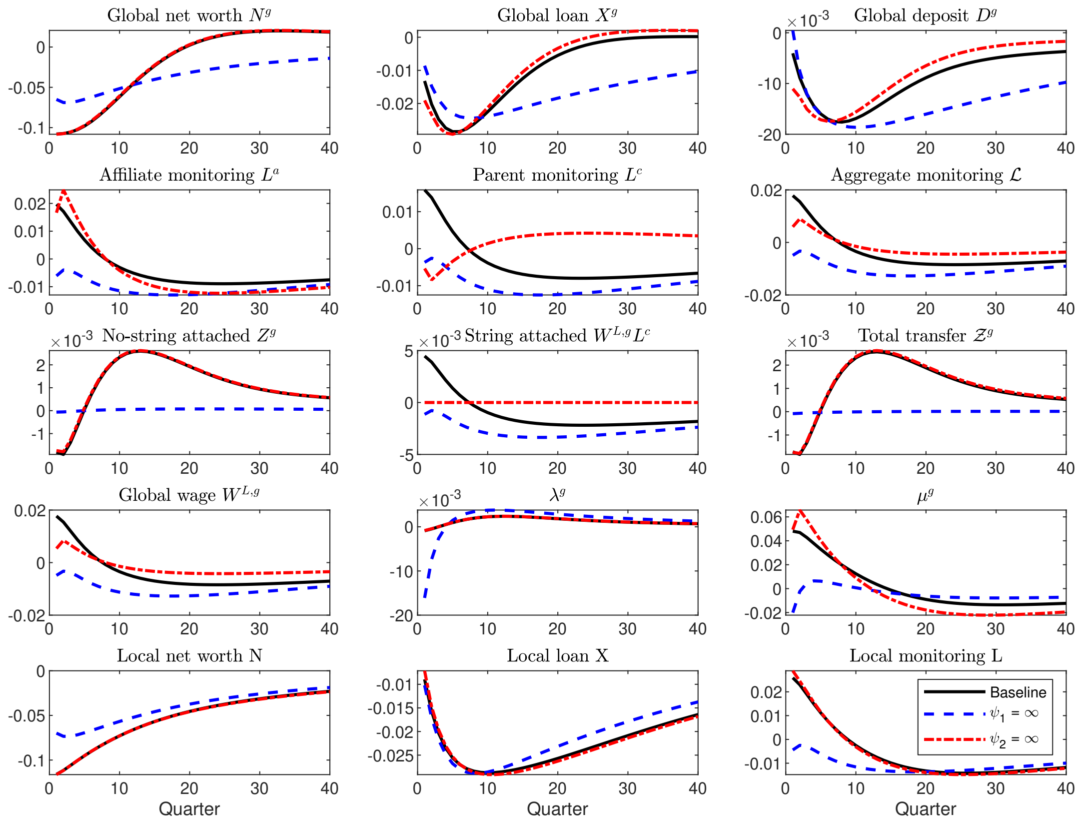


Figure 5: Responses to negative capital quality shock in host country: banking variables

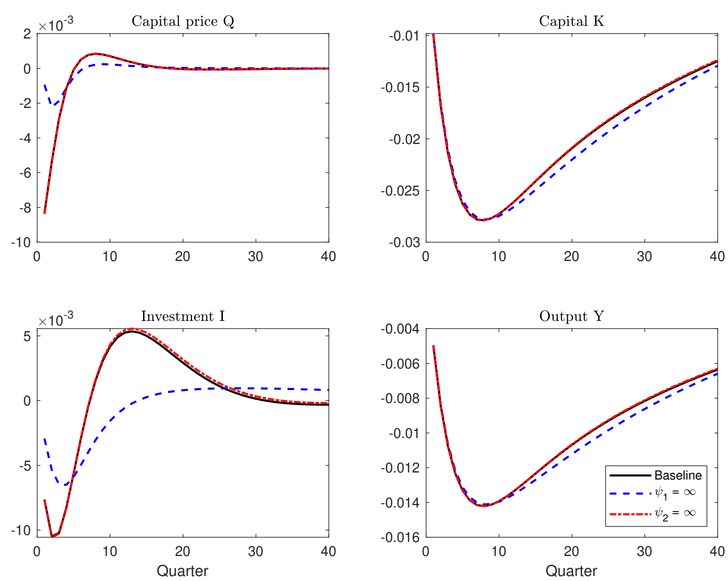


Figure 6: Responses to negative capital quality shock in host country: aggregate variables

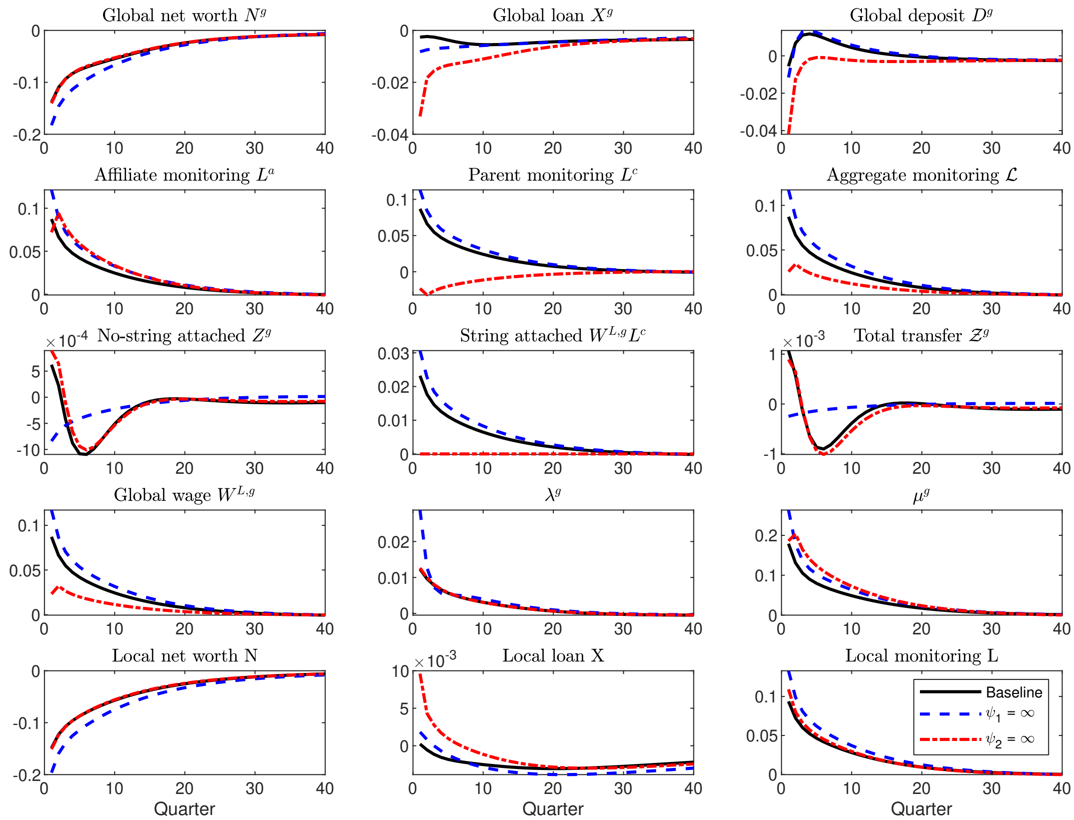


Figure 7: Responses to negative TFP shock in host country: banking variables

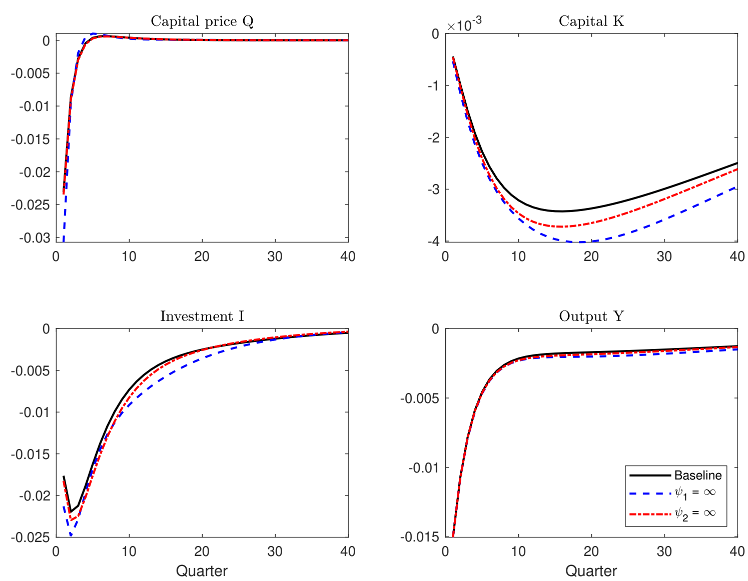


Figure 8: Responses to negative TFP shock in host country: aggregate variables

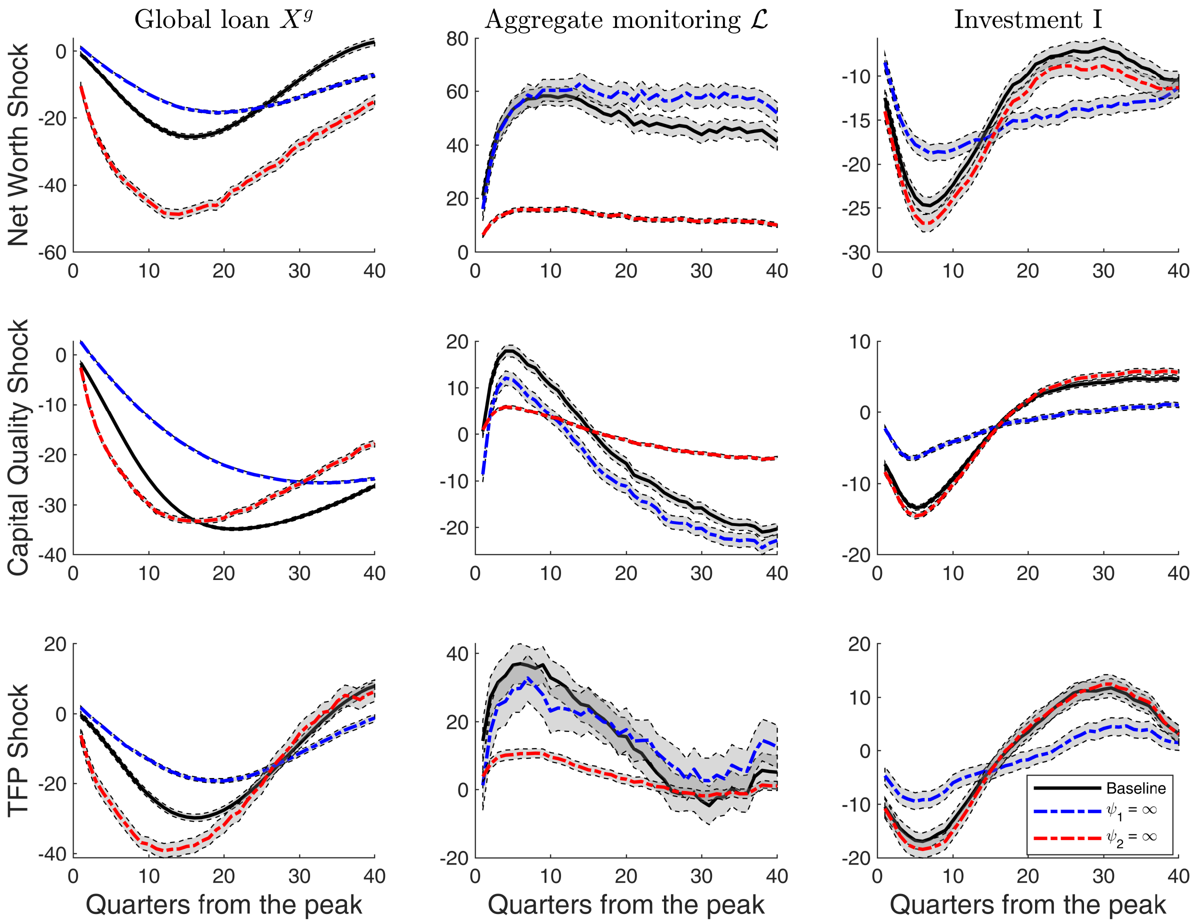


Figure 9: Dynamics during recessions. The figure reports the average response of selected variables across 3,000 simulations, and associated 90% confidence intervals. See Section 5.4 for details.

Online Appendices

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

These Online Appendices present details on the derivations of the model (Appendix A), details on the data used for the empirical analysis and for the calibration (Appendix B) and appendix tables and figures.

Appendix A: Details on Derivations of the Model

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:

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

The envelope conditions are:

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

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

$$\begin{aligned}
[\partial X_t]: &\quad -\lambda_t Q_t + \mu_t\xi^L\phi(L_t)^{1-\phi}(Q_t)^{\phi}(X_t)^{\phi-1} +\\
&\quad + E_t\Lambda_{t,t+1}\left[R_{t+1}^k + (1-\delta)\kappa_{t+1}Q_{t+1}\right](1-\sigma+\sigma\lambda_{t+1}) = 0, \qquad (51)\\
[\partial D_t]: &\quad \lambda_t - \mu_t R_t^D - E_t\Lambda_{t,t+1}(1-\sigma+\sigma\lambda_{t+1})R_t^D = 0, \qquad (52)\\
[\partial L_t]: &\quad -\lambda_t W_t^L + \mu_t\xi^L(1-\phi)(L_t)^{-\phi}(Q_t X_t)^{\phi} = 0. \qquad (53)
\end{aligned}$$

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:

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

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:

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

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

$$N_t = (\sigma + \varsigma)[R_t^k + (1-\delta)\kappa_t Q_t] X_{t-1} - \sigma R_{t-1}^D D_{t-1}. \tag{54}$$

Global Bank 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:

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

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

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

The envelope conditions are:

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

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

$$[\partial X_t^g]: \quad -\lambda_t^g Q_t + \mu_t^g \xi(1-\eta)\phi \left[(1-\chi)(L_t^a)^{\frac{\tau-1}{\tau}} + \chi(L_t^c)^{\frac{\tau-1}{\tau}}\right]^{\frac{\tau(1-\phi)}{\tau-1}} (Q_t)^\phi (X_t^g)^{\phi-1}$$
$$+ E_t\Lambda_{t,t+1}^* \left[R_{t+1}^k + (1-\delta)\kappa_{t+1}Q_{t+1}\right] \left(1-\sigma+\sigma\lambda_{t+1}^g\right) = 0, \tag{55}$$

$$[\partial D_t^g]: \quad \lambda_t^g - \mu_t^g R_t^D - E_t\Lambda_{t,t+1}^* \left(1-\sigma+\sigma\lambda_{t+1}^g\right) R_t^D = 0, \tag{56}$$

$$[\partial L_t^a]: \quad -\lambda_t^g W_t^L + \mu_t^g \xi(1-\eta)(1-\phi) \left[(1-\chi)(L_t^a)^{\frac{\tau-1}{\tau}} + \chi(L_t^c)^{\frac{\tau-1}{\tau}}\right]^{\frac{1-\tau\phi}{\tau-1}}$$
$$\times (1-\chi)(L_t^a)^{-\frac{1}{\tau}} (Q_t X_t^g)^\phi = 0. \tag{57}$$

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 $N_{y,t}^g$:

$$N_t^g = (\sigma+\varsigma)\left[R_t^k + (1-\delta)\kappa_t Q_t\right] X_{t-1}^g - \sigma R_{t-1}^D (D_{t-1}^g + \theta \mathcal{Z}_{t-1}^g). \tag{58}$$

Global Bank Parent

The parent's problem reads:

$$V_t^{g^*} \equiv \max_{\left\{X_{t+j}^{g^*}, D_{t+j}^{g^*}\right\}_{j\geq 0}} E_t \sum_{j=0}^{\infty} (1-\sigma)\sigma^j \Lambda_{t,t+j+1}^* N_{t+j+1}^{g^*}, \tag{59}$$

$$\text{s.t.} \quad Q_t^* X_t^{g^*} = N_t^{g^*} + D_t^{g^*} - W_t^{L,g,*} L_t^{g^*} + \mathcal{Z}_t^{g^*}, \qquad [\lambda_t^{g^*}] \tag{60}$$

$$R_t^{D^*} D_t^{g^*} + \theta R_t^D \mathcal{Z}_t^{g^*} \leq \xi\left[(1-\eta)\mathcal{P}^{g^*}(.) Q_t^* X_t^{g^*} + \eta \mathcal{P}^g(.) Q_t X_t^g\right], \quad [\mu_t^{g^*}] \tag{61}$$

$$L_t^{g*} = L_t^{a*} + L_t^{c*}, \tag{62}$$

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. Similar to the affiliate, the capital constraint (61) of the parent consolidates the balance sheets of the parent and the affiliate. The net worth $N_t^{g^*}$ of the parent bank is

$$N_t^{g^*} = \left[R_t^{k^*} + (1-\delta)\kappa_t^* Q_t^*\right] X_{t-1}^{g^*} - R_{t-1}^{D^*} D_{t-1}^{g^*} - \theta R_{t-1}^D \mathcal{Z}_{t-1}^{g^*}. \tag{63}$$

The problem 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

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

and

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

The envelope conditions are:

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

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

$$\begin{aligned}
[\partial X_t^{g^*}]:\quad &-\lambda_t^{g^*}Q_t^*+\mu_t^{g^*}\xi\phi(1-\eta)\left[(1-\chi)\left(L_t^{a*}\right)^{\frac{\tau-1}{\tau}}+\chi(L_t^{c*})^{\frac{\tau-1}{\tau}}\right]^{\frac{\tau(1-\phi)}{\tau-1}}(Q_t^*)^{\phi}(X_t^{g^*})^{\phi-1}\\
&+E_t\Lambda^*_{t,t+1}\left[R_{t+1}^{k^*}+(1-\delta)\kappa_{t+1}^*Q_{t+1}^*\right]\left(1-\sigma+\sigma\lambda_{t+1}^{g^*}\right)=0,
\end{aligned}\tag{64}$$

for its deposit gathering

$$[\partial D_t^{g^*}]:\quad \lambda_t^{g^*}-\mu_t^{g^*}R_t^{D^*}-E_t\Lambda^*_{t,t+1}\left(1-\sigma+\sigma\lambda_{t+1}^{g^*}\right)R_t^{D^*}=0,\tag{65}$$

and for the loan officers hired by the parent

$$\begin{aligned}
[\partial L_t^{a*}]:\quad &-\lambda_t^{g*}W_t^{L,g,*}+\mu_t^{g*}\xi(1-\eta)(1-\phi)\left[(1-\chi)\left(L_t^{a*}\right)^{\frac{\tau-1}{\tau}}+\chi(L_t^{c*})^{\frac{\tau-1}{\tau}}\right]^{\frac{1-\tau\phi}{\tau-1}}\\
&\times(1-\chi)\left(L_t^{a*}\right)^{-\frac{1}{\tau}}\left(Q_t^*X_t^{g*}\right)^{\phi}=0.
\end{aligned}\tag{66}$$

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 $N_{y,t}^{g^*}$:

$$N_t^{g^*} = (\sigma + \varsigma) \left[R_t^{k^*} + (1 - \delta)\kappa_t^* Q_t^* \right] X_{t-1}^{g^*} - \sigma (R_{t-1}^{D^*} D_{t-1}^{g^*} + \theta R_{t-1}^D Z_{t-1}^{g^*}). \tag{67}$$

The decisions of the conglomerate

When $\psi_1 = \psi_2 = 0$, the conglomerate's choice of the monitoring at the affiliate (42) becomes

$$[\partial L_t^c]: \quad \xi(1-\phi) \left[\mu_t^g (1-\eta) + \mu_t^{g^*} \eta \right] \left[(1-\chi) \left(L_t^a\right)^{\frac{\tau-1}{\tau}} + \chi (L_t^c)^{\frac{\tau-1}{\tau}} \right]^{\frac{1-\tau\phi}{\tau-1}} \chi \left(L_t^c\right)^{-\frac{1}{\tau}} \left(Q_t X_t^g\right)^{\phi}$$
$$= W_t^{L,g} \lambda_t^g. \tag{68}$$

The first-order condition for the conglomerate's hiring of officers at the parent bank (43) is

$$[\partial L_t^{c*}]: \quad \xi(1-\phi) \left[\mu_t^g \eta + \mu_t^{g^*} (1-\eta) \right] \left[(1-\chi) \left(L_t^{a*}\right)^{\frac{\tau-1}{\tau}} + \chi (L_t^{c*})^{\frac{\tau-1}{\tau}} \right]^{\frac{1-\tau\phi}{\tau-1}} \chi \left(L_t^{c*}\right)^{-\frac{1}{\tau}} \left(Q_t^* X_t^{g*}\right)^{\phi}$$
$$= W_t^{L,g,*} \lambda_t^{g*}. \tag{69}$$

The choice of no strings attached transfers (41) simplifies to

$$\lambda_t^g - \theta R_t^D \mu_t^g - E_t \Lambda_{t,t+1}^* \left(1 - \sigma + \sigma \lambda_{t+1}^g\right) \theta R_t^D$$
$$= \lambda_t^{g^*} - \theta R_t^D \mu_t^{g^*} - E_t \Lambda_{t,t+1}^* \left(1 - \sigma + \sigma \lambda_{t+1}^{g^*}\right) \theta R_t^D. \tag{70}$$

Appendix B: Data

The BEPS survey

For data on cross-bank heterogeneity in the financial and organizational integration of foreign subsidiaries into their respective multinational banking groups, we turn to the Banking Environment and Performance Surveys (BEPS) undertaken by the EBRD and Tilburg University.[31] As part of this unique survey, senior financial consultants—each with considerable first-hand banking experience—conducted in-depth interviews with bank CEOs. As part of BEPS III, each bank's Head of Credit was (separately) interviewed as well. The BEPS II survey was implemented face-to-face in 2012 while the BEPS III survey was conducted on-line in 2020-21, using either the Zooms or Microsoft Teams platform.

[31] https://www.ebrd.com/what-we-do/economics/data/banking-environment-and-performance-survey.html.

Sampling frame and sample construction

The BEPS research design covers both large and small banks and is nationally representative. For both BEPS II and III, the sample was drawn from all commercial, cooperative and savings banks active at the time of sampling. The aim was to survey banks that jointly represent at least 95 percent of all bank assets in each country. To arrive at this sample, a list was obtained from each country's central bank with all savings, commercial, and cooperative banks. By country, these banks were then ordered by total assets and, moving down the list, banks were added until an aggregate market share of at least 95 percent was reached.[32]

As part of BEPS, bank CEOs and Heads of Credit were asked about their bank's lending activities, the competitive environment and various other topics. A dedicated module for subsidiaries of multinational banks was also fielded and this is module we use in this paper. Importantly, in case of multinational banks, each subsidiary was treated as an independent (foreign-owned) bank. The resulting sampling frame for the countries used in this paper consists of 872 banks in 30 countries for BEPS II. Out of this sampling frame, 591 CEOs were successfully interviewed, a relatively high success rate of 68 percent. These banks represent 76 percent of all bank assets (and 80 percent of all foreign bank assets) in our sample countries. For BEPS III, the sampling frame comprised 408 banks in 28 countries. Out of this frame, 301 CEOs were successfully interviewed, a success rate of 74 percent. These banks represent 75 percent of all bank assets (and 81 percent of all foreign bank assets) in these countries.

Survey implementation

All interviews followed a standardized survey instrument, which was first piloted in several countries. Based on the pilot results, the questionnaire was adapted and modified to the final version. Interview teams were extensively trained so that all interviewers understood the full scope of the project and were able to confidently respond to questions by the bank CEOs and Heads of Credit. Interviews were conducted in either Arabic, English, French, Romanian, Russian, Serbo-Croatian, Turkish, or Ukrainian. These languages proved to cover the needs of all the countries. In advance of the interview, a list of topics to be covered in the interview was

[32] In each country, the goal was therefore to interview all banks except for the very smallest ones: those banks that (jointly) make up no more than five percent of all bank lending. Leaving out these banks does not affect our results as these banks are typically domestic banks that only operate one or very few branches.

submitted to the bank by e-mail following the meeting confirmation or, upon request of the bank, in anticipation of the confirmation. In a small number of cases, and upon request of the bank, the full survey instrument was submitted to the bank by e-mail ahead of the meeting.

In the case of BEPS II, each interviewer was provided with a portable scanner. Following the interviews, the completed questionnaires were scanned by the interviewer and submitted to the central support team using an encrypted Dropbox. The completed original questionnaire was then submitted for archiving. The scanned questionnaires were received by the central support team and printed. These were then separately entered into two instances of Snap 10 Survey Software by two different people. The resulting datasets were compared for discrepancies and those found corrected. Any missing or inconsistent answers were noted and the interviewer was asked to provide clarification by e-mail.

In the case of BEPS III, a CAPI (computer-assisted personal interviewing) form was programmed to allow data to be entered instantaneously as the questionnaires were administered. In addition to allowing appropriate skip patterns to be programmed, the CAPI form also limited responses to pre-defined ranges and provided warning notifications to interviewers if responses were internally inconsistent. The CAPI form was programmed using Open Data Kit (ODK). The CAPI program allowed all responses to be directly entered into the BEPS III database. Data verification, to the greatest extent possible, occurred during data entry itself as the survey instrument was programmed with pre-defined ranges and provided warning notifications for inconsistent data. Each questionnaire was checked by a logical check code that was developed during the pilot. Any issues that emerged from data cleaning and validation codes were immediately followed up on with the respondent.

Merge with other banking data

We hand-match the BEPS survey data with two other datasets. First, we draw on Bureau Van Dijk's BankScope and Orbis databases for bank-level financials for the years 2007–2017. Specially, for each subsidiary we calculate annual credit growth, the solvency ratio (equity divided by total assets, %), wholesale funding (gross loans divided by total customer deposits, %), and net interest margin. Second, we use the Systemic Banking Crises Database II by Laeven and Valencia (2020) to identify any crises in subsidiaries' host and home country. Specifically, we create *Any Crisis host (home)*, a dummy variable equal to 1 if there was a banking crisis, currency crisis, sovereign debt crisis or sovereign debt restructuring in a country-year in the subsidiary's host (home) country. In the end, our data contains a panel of 248 foreign banks from 30 countries interviewed as part of BEPS II and/or BEPS III matched to banking financials and systemic crisis data between the years 2007–2017.

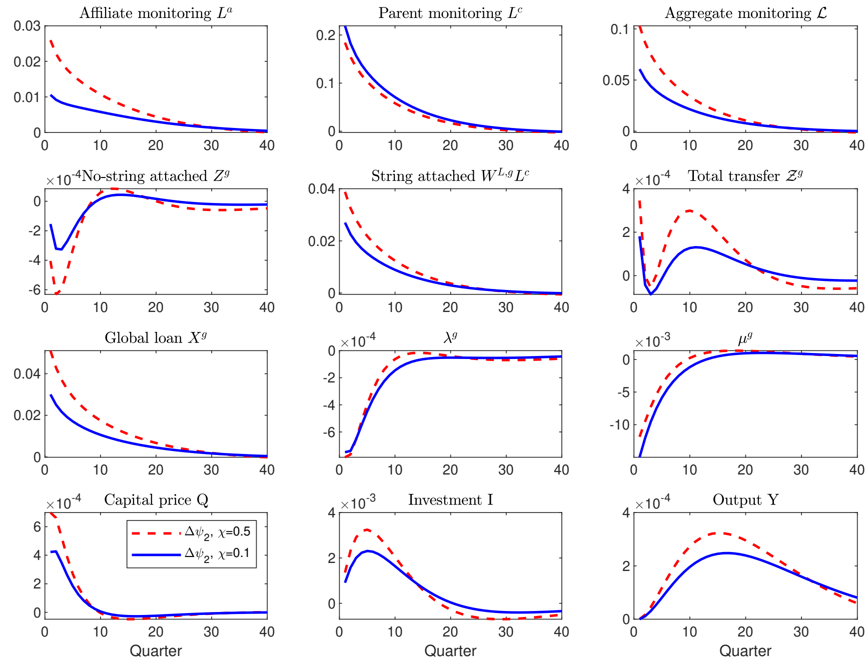
Appendix Table B1: Variable Definitions

	Definition	Source
Credit growth and other bank characteristics		
Region: Central Asia	Dummy variable equal to 1 if the subsidiary is located in Central Asia and 0 otherwise.	BEPS
Region: Central Europe and Baltic States	Dummy variable equal to 1 if the subsidiary is located in Central Europe and Baltic States and 0 otherwise.	BEPS
Region: Eastern Europe and the Caucasus	Dummy variable equal to 1 if the subsidiary is located in Eastern Europe and the Caucasus and 0 otherwise.	BEPS
Region: Russia	Dummy variable equal to 1 if the subsidiary is located in Russia and 0 otherwise.	BEPS
Region: South-eastern Europe	Dummy variable equal to 1 if the subsidiary is located in South-eastern Europe and 0 otherwise.	BEPS
Region: Southern and Eastern Mediterranean	Dummy variable equal to 1 if the subsidiary is located in Southern and Eastern Mediterranean and 0 otherwise.	BEPS
Region: Turkey	Dummy variable equal to 1 if the subsidiary is located in Turkey and 0 otherwise.	BEPS
Annual credit growth	Annual credit growth (%), winsorized at the 1% level.	Bankscope and Orbis
Equity/Total assets (%)	Equity as a percentage of total assets.	Bankscope and Orbis
Gross loans/Total customer deposits (%)	Wholesale funding defined as gross loans as a percentage of total customer deposits.	Bankscope and Orbis
Net Interest Margin	The ratio of the net interest income expressed as a percentage of earning assets	Bankscope and Orbis
Subsidiary lending behaviour		
SME lending	Dummy variable equal to 1 if the subsidiary provides credit to Small and Medium Enterprises (SME) with between 10 and 250 employees and 0 otherwise.	BEPS
Relationship is important (SME)	Dummy variable equal to 1 if knowledge of the client is important or very important when lending to SME customers and 0 otherwise.	BEPS
Global bank monitoring		
Parent targets credit growth	Dummy variable equal to 1 if the parent bank sets annual targets for the subsidiary in terms of credit growth and 0 otherwise.	BEPS
Parent targets market share	Dummy variable equal to 1 if the parent bank sets annual targets for the subsidiary in terms of market share and 0 otherwise.	BEPS
# Calls of subsidiary with parent	Number of phone calls, conference calls, and video conference calls the subsidiary holds per month, on average, with the management or board of their parent bank.	BEPS
Parent provided monitoring support	Dummy variable equal to 1 if parent bank provided managers of the subsidiary with training and 0 otherwise.	BEPS
Parent selected managers	Dummy variable equal to 1 if the parent bank was involved in the selection of at least one manager at the subsidiary and 0 otherwise.	BEPS
Global bank liquidity		
Parent operates centralized treasury	Parent bank operates a centralized treasury department or desk (i.e. a desk that centrally raises funding for subsidiaries in several countries)	BEPS
Parent is most important to cover funding shortfall	Dummy variable equal to 1 if the CEO considers parent bank funding to be the most important funding source to plug a gap created by an unexpected shortfall in funding and 0 otherwise.	BEPS
Liquidity centralization	Dummy variable equal to 1 if the parent operates a centralized treasury and the parent is most important to cover unexpected funding shortfall and 0 otherwise.	BEPS
Parent regularly provides capital and/or liquidity	Dummy variable equal if the CEO agrees that the parent bank provides capital and/or liquidity to its various subsidiaries on a regular basis and 0 otherwise.	BEPS
Parent provided liquidity support	Dummy variable equal to 1 if parent bank provided subsidiary, at least once, with internal credit lines/loans/liquidity during the period and 0 otherwise.	BEPS

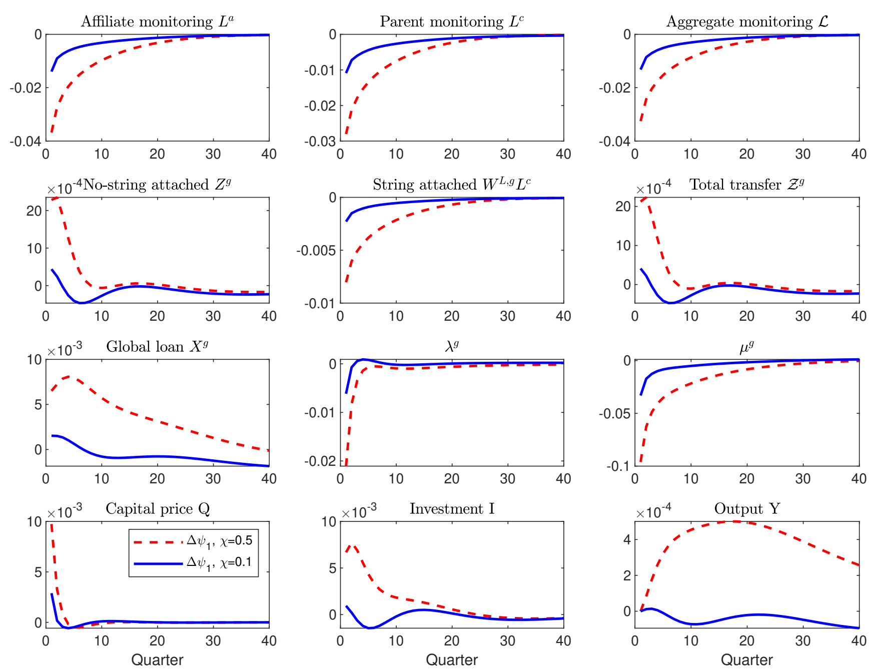
Appendix Table B2: Global Banks' Lending, Banks' Organization, and Crises. Further Tests

	Annual Credit Growth					
	(1)	(2)	(3)	(4)	(5)	(6)
Any crisis host	21.669*	18.958*	15.581*			
	(8.570)	(8.473)	(7.705)			
Recession year host				6.782	6.095	7.394
				(4.543)	(4.604)	(4.114)
Any crisis home	8.216	4.877	12.332			
	(5.218)	(6.084)	(7.190)			
Recession year home				12.532**	10.931*	3.095
				(3.971)	(4.288)	(5.244)
L.Annual credit growth	0.283***	0.218***	0.146**	0.277***	0.243***	0.154**
	(0.050)	(0.053)	(0.046)	(0.056)	(0.060)	(0.048)
Equity/Total assets		-0.709	-1.371		-1.529	-2.290
		(1.484)	(1.250)		(1.538)	(1.483)
Gross loans/Total customer deposits		-0.000	0.000		0.000	0.000
		(0.000)	(0.000)		(0.000)	(0.000)
Net interest margin		9.284**	7.584*		8.102**	8.264*
		(3.124)	(3.204)		(2.936)	(3.733)
Subsidiary FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	No	No	Yes	No	No	Yes
Observations	1740	1721	1721	1663	1647	1647
Number of banks	245	241	241	238	234	234

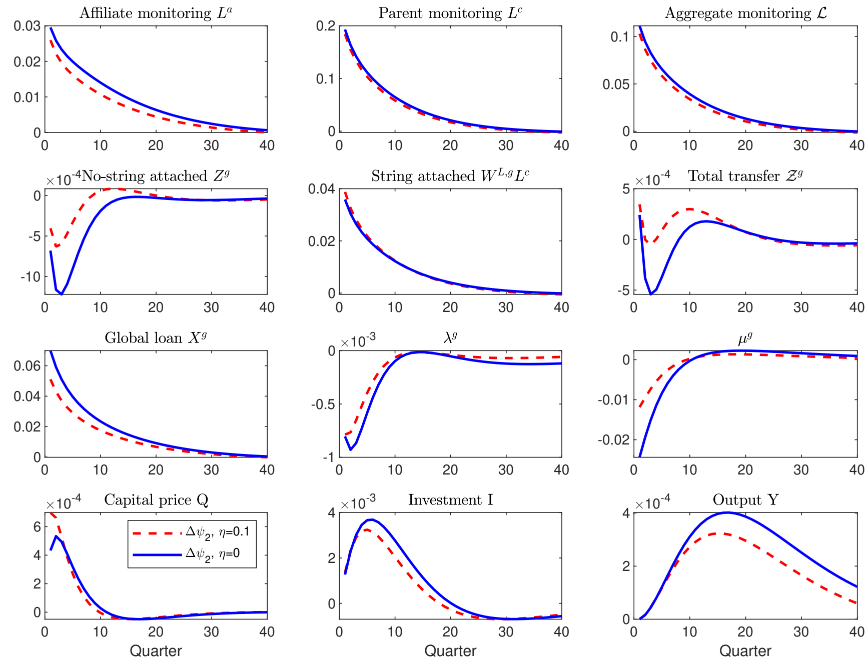
Note: This table presents estimates for the effects of financial crises and recessions on global banks' lending in host countries. The estimator is a two-step difference GMM. The panel refers to the 2007-2017 period. Standard errors are adjusted for the Windmeijer's finite-sample correction for the two-step covariance matrix. ***, ** , and * denote significance at the 1 percent, 5 percent, and 10 percent level, respectively.



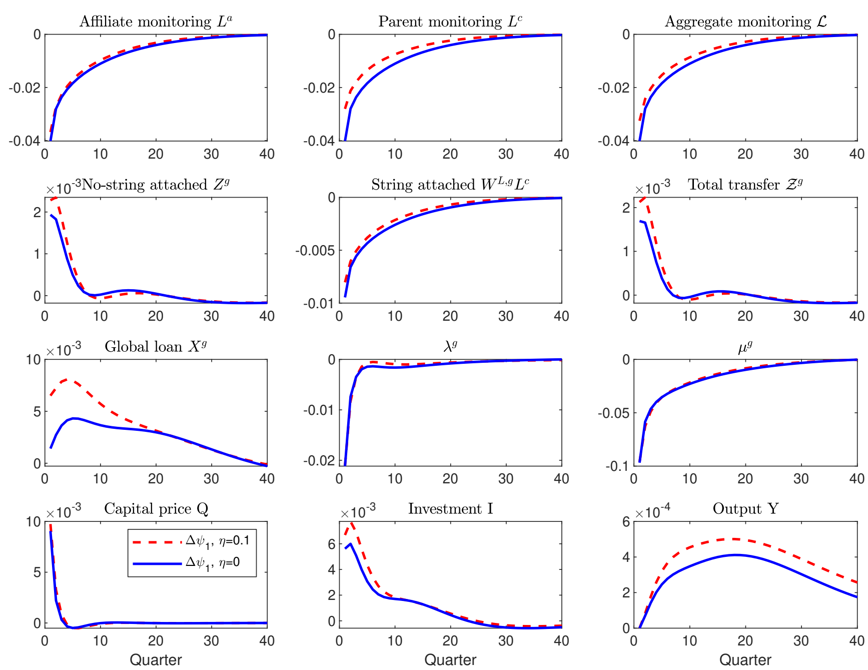
Appendix Figure B1: Global banks' monitoring skills and monitoring centralization. The IRFs are in difference between the baseline economy and the comparison economy with $\psi_2 = \infty$.



Appendix Figure B2: Global banks' monitoring skills and liquidity centralization. The IRFs are in difference between the baseline economy and the comparison economy with $\psi_1 = \infty$.



Appendix Figure B3: Global banks' consolidation and monitoring centralization. The IRFs are in difference between the baseline economy and the comparison economy with $\psi_2 = \infty$.



Appendix Figure B4: Global banks' consolidation and liquidity centralization. The IRFs are in difference between the baseline economy and the comparison economy with $\psi_1 = \infty$.