Global Banks' Leverage and its Macroeconomic Effects

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Abstract: This paper develops a tractable multi-country model of the international banking system where global banks interact with local banks. In the model, consistent with the data, when the leverage of global banks goes up, countries experience both higher gross capital inflows and outflows, and global imbalances increase. I show that the net external position of a country against global banks —its assets on global banks minus its liabilities towards global banks— plays a key role in explaining its macroeconomic response to a change in global financial conditions. The main predictions of the model are borne out in the data. In particular, countries with higher net external liabilities against global banks tend to experience a larger drop in investment and a larger improvement in their current account balance following a deleveraging by global banks.

Keywords: Global Banks' Leverage, Capital Flows, Current Account Balance

JEL Codes: F32, F33, F34, E44, C23

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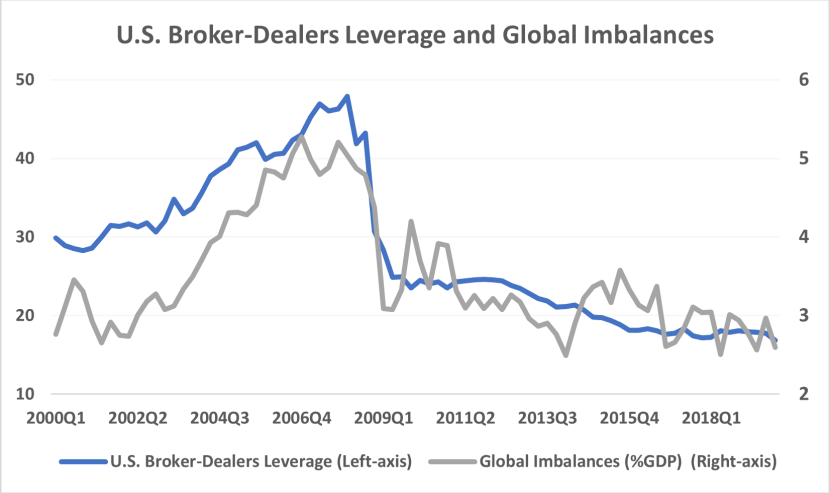
1 Introduction

Global banks are central to the international financial architecture. Over the past 20 years, they have on average intermediated approximately $25 trillion of cross-border capital flows annually (about 45% of global GDP), playing a key role in facilitating international risk sharing (Gabaix and Maggiori (2015), Miranda-Agrippino and Rey (2020)). At the same time, they propagate shocks across borders. Since the global financial crisis, there has been a renewed attention on the global factors that drive financial conditions worldwide. Rey (2013) has shown that there is a strong global co-movement in asset prices, gross capital flows, credit and risk premia, a phenomenon coined the global financial cycle (GFC). There is evidence that this global financial cycle is closely tied to a global leverage cycle, and in particular to the leverage of U.S. broker dealers (Bruno and Shin (2015), Cerutti et al. (2017), Cesa-Bianchi et al. (2018)).

While it has been extensively documented that the global financial cycle systematically drives risky asset prices and gross capital flows[1], its differentiated impact across countries, and in particular on net capital flows, i.e. the current account balance, is unexplored. Figure 1 shows that the leverage of global financial intermediaries is highly correlated with global imbalances—defined as the sum of the absolute value of current account balances across countries, normalized by world nominal GDP. This suggests that changes in the leverage of global financial intermediaries may have implications not only for gross flows, but also for net flows. In this paper, I analyze the systematic changes in net flows across countries in response to changes in the leverage of global financial intermediaries. To my knowledge, I am the first to explore the systematic changes in the current account, and its decomposition between savings and investment, across all countries, without distinguishing between advanced and emerging market economies.

[1] Cerutti et al. (2019) provide a more nuanced view on the importance of the global financial cycle in driving gross capital flows.

Figure 1 Global Banks' Leverage and Global Imbalances



Note. This chart shows the U.S. Broker-Dealer sector leverage (left axis) and global imbalances (right axis) over the period 2000Q1-2019Q4. The U.S. Broker-Dealer sector leverage is computed as assets over equity. Global imbalances are computed as the quarterly sum of the absolute value of current account balances across countries, normalized by world nominal GDP. Source: Flows of Funds, IMF BOP, author's calculations.

The objective of this paper is to shed light on the role of the international banking system and the factors explaining the different macroeconomic sensitivities across countries to a change in global financial conditions. More specifically, I intend to answer the following questions. First, why do countries differ in their macroeconomic response to a change in global financial conditions? In particular, I study the empirical response of net flows, i.e. the current account, and its decomposition between savings and investment, to a change in the leverage of global financial intermediaries. I complement this analysis by also looking at the response of risky asset prices, the real exchange rate and real GDP growth. Second, what role plays the global banking structure in explaining those differences? I show, theoretically and empirically, that heterogeneity in the exposure to global financial intermediaries, measured as a country's net external positions against global banks, both across countries and over time, is key to explaining different macroeconomic sensitivities to changes in global financial conditions.

Contribution. This paper makes two contributions. The first contribution is to develop a simple multi-country model of the international banking system where global banks, defined as internationally active banks that lend to foreign entities through cross-border loans, interact with local banks. The model features a multi-country economy comprised of global banks located heterogeneously across countries and, in each country, a continuum of local banks that have uncertain bank-specific project returns. The key ingredient of the model is that there is both cross-country and within-country heterogeneity regarding the returns on local projects. Additionally, local banks interact with global banks by borrowing and lending on the wholesale inter-bank market, but do not interact with each other. The double heterogeneity explains a few empirical facts. In particular, it generates a positive co-movement in gross inflows and outflows, and leads to differences in net external positions across countries. Moreover, it generates differences in the size of external positions across countries that are not only explained by fundamentals—namely a country's average productivity in the model— but also by the heterogeneous presence of global banks across countries. The model generates sharp testable predictions about the direction and size of gross and net capital flows. Put differently, in this model, changes in the leverage of global banks, i.e. in global financial conditions, not only have implications for gross flows, but also for net flows and global imbalances.

The second contribution of the paper is empirical. I test the predictions of the model in the data. The first prediction of the model is that an increase in the leverage of global financial intermediaries leads to relatively higher net inflows, i.e. a higher deterioration of the current account balance, in countries which have higher net external liabilities against global banks. Conversely, countries which have higher net external assets on global banks will experience relatively higher net outflows, i.e a higher improvement of the current account balance, following an increase in the leverage of global financial intermediaries. This prediction leads to a distinction between countries which differs from the traditional distinc-

tion between advanced and emerging market countries. For example, Germany, Switzerland, Bolivia, Peru and Israel are net creditors on global banks, while Spain, France, Lithuania, Turkey and Brazil are net debtor against global banks. The second prediction of the model is that this differentiated effect on the current account across countries comes from a differentiated impact on investment, not on savings. In a panel study of 52 advanced and emerging market countries, I find that the interaction of the leverage of U.S. broker dealers with the country's position against global banks—defined as its assets on global banks minus its liabilities towards global banks, and obtained from the BIS Locational Banking Statistics— is statistically and economically significant in explaining the behavior of the current account across countries and across time in the way predicted by the model.

To summarize the results, I find both theoretically and empirically that the net foreign position against global banks is a determinant of a country's vulnerability, defined as the response of its current account, to a change in global financial conditions. A country with higher net external liabilities against global banks tends to experience a larger improvement in its current account balance following a deleveraging by global banks. This differentiated impact on the current account is explained by the response of investment, not savings. To be specific, a country with higher net external liabilities against global banks tends to experience a larger drop in investment following a deleveraging by global banks. Moreover, a country with higher net external liabilities against global banks tends to experience lower real GDP growth and lower risky asset prices, and a larger depreciation of its real effective exchange rate, following a deleveraging by global banks. Although these facts on output, asset prices and exchange rates are not predictions of the model as it stands, they could be predicted by extensions of the model. Lastly, I show that the mechanism described in my model can rationalize the observed increase in global imbalances which preceded the global financial crisis, as well as the reversal in global imbalances which followed the crisis.

Literature. This paper is related to the recent literature on the global financial cycle (Akinci et al. (2022), Davis and van Wincoop (2021)), and to the literature on global financial intermediaries (Bruno and Shin (2015), Shen (2021), Cao et al. (2021), Morelli et al. (2022)). Akinci et al. (2022) find that an increase in U.S. uncertainty leads to global deleveraging pressures, a decrease in global asset prices, and an appreciation of the dollar. Their model has implications for net flows and asset prices, but not for gross flows. While their model consider two economies, advanced and emerging market economies, I build a multi-country framework which allows to distinguish different countries within each group of economies. Davis and van Wincoop (2021) develop a theory to account for changes in prices of risky and safe assets and gross and net capital flows over the global financial cycle (GFC). Their model is a portfolio model with heterogeneity in return and risk aversion, but without financial intermediaries such as global banks. Similar to their paper, and in order to keep my model analytically tractable with both within and cross-country heterogeneity, I simplify in the time dimension by using a two-period model. While they consider frictionless trade in equity and safe bonds by households across borders, I explicitly model financial institutions, in the form of local and global banks, and the constraints under which they operate. My paper relates to this recent literature by providing a theoretical framework to understand the propagation of global financial conditions through banks in an multi-country economy. In order to formalize the interaction between local and global banks, I use a financial friction a la Gertler-Kiyotaki (Gertler and Kiyotaki (2010)) which prevents local banks to lend to each other. Following their seminal work, there has been considerable progress in developing macroeconomic models which include a banking sector. Most of this literature focuses on the retail sector where banks obtain deposits from households. However, the global financial crisis that triggered the Great Recession featured a disruption of wholesale funding markets, where banks lend to one another. Accordingly, to understand the global impact of financial conditions, it is essential to capture the role of wholesale banking.

My paper also relates to the literature on global financial intermediaries. The role of banks in the global financial cycle is highlighted by Avdjiev et al. (2017) which emphasize that the positive co-movement of total capital inflows and outflows is driven by inflows and outflows vis-a-vis the domestic banking sector. They find that in response to an adverse change in global financial conditions, inflows to domestic banks decline, while domestic banks invest less abroad, decreasing their outflows. Few models are able to explain this high correlation between gross capital inflows and outflows (also documented in Forbes and Warnock (2012) and Broner et al. (2013)). Caballero and Simsek (2020) provide a model with fickle local banks and liquidity risk which can explain the positive correlation between banking inflows and outflows. Yet they do not look at the impact of sudden stops on the current account. Following Bruno and Shin (2015), I use the leverage of global banks, defined as internationally active banks that lend to foreign entities through cross-border loan, as the main indicator of global financial conditions. Coimbra and Rey (2017) show evidence that the leverage of banks is heterogeneous, and that the largest banks are the most leveraged, and became disproportionately leveraged during the boom which preceded the global financial crisis. This justifies the focus on the leverage of global banks. Similar to Bruno and Shin (2015), I develop a model where global wholesale banks interact with local retail banks. Yet, compared to their paper, my analysis provides a rationale for two-way capital flows and a differentiated macroeconomic impact across countries, and in particular on net flows, of a change in global banks' leverage. Indeed, there are still few models able to generate positive correlations in gross capital inflows and outflows such as the ones we see in the data, let alone generate different behaviors for net capital flows and asset prices[2]. Other papers point to the relevant role of global banks in the transmission of international shocks. Cao et al. (2021) study the impact of the openness to multinational banks on the depth and duration of recessions. Cetorelli and Goldberg (2012a) and Cetorelli and Goldberg (2012b)

[2]Davis and van Wincoop (2021) is a notable exception.

conjecture that global banks manage liquidity on a global scale, actively using cross-border internal funding in response to local shocks. Morelli et al. (2022) study the role of global financial intermediaries in international lending. In their model aggregate shocks transmit internationally to emerging market countries through financial intermediaries' net worth.

Finally, this paper also relates to the literature on the on global imbalances (Milesi-Ferretti and Tille (2014)). While fiscal and monetary policies, and other structural characteristics (e.g. demographics, productivity), are well documented determinants of the current account, I find that global financial conditions also matter. In the model, a relaxation of the constraint on global banks leads to higher gross flows, but also to higher global imbalances: countries which were initially net debtor vis-a-vis global banks experience a deterioration of their current account balance, while countries which were initially net creditors vis-a-vis global banks experience an improvement of their current account balance. Put differently, an increase in the leverage of global banks magnifies global imbalances, while a decrease in the leverage of global banks reduces global imbalances.

The rest of the paper is organized as follows. In section 2, I present some stylized facts related to capital flows and the global banking system. In section 3, I develop a multi-country model of the international banking system with both local and global banks, and derive some key predictions to be tested against the data. Section 4 presents my empirical analysis and confirms that the main predictions of the model are borne out in the data, and section 5 concludes.

2 Stylized Facts

This section presents some stylized facts related to the global banking system and that will be used to guide the assumptions made in the theoretical model.

Stylized fact 1. The leverage of financial intermediaries is very heterogeneous. As shown in Figure 2 borrowed from Coimbra and Rey (2017), the leverage of the biggest financial intermediaries by asset size is not only higher but also more volatile than the leverage of other financial intermediaries. This motivates the focus on the leverage of global banks in this paper.

Figure 2 Cross-section and Time series of banks' leverage by asset quantiles

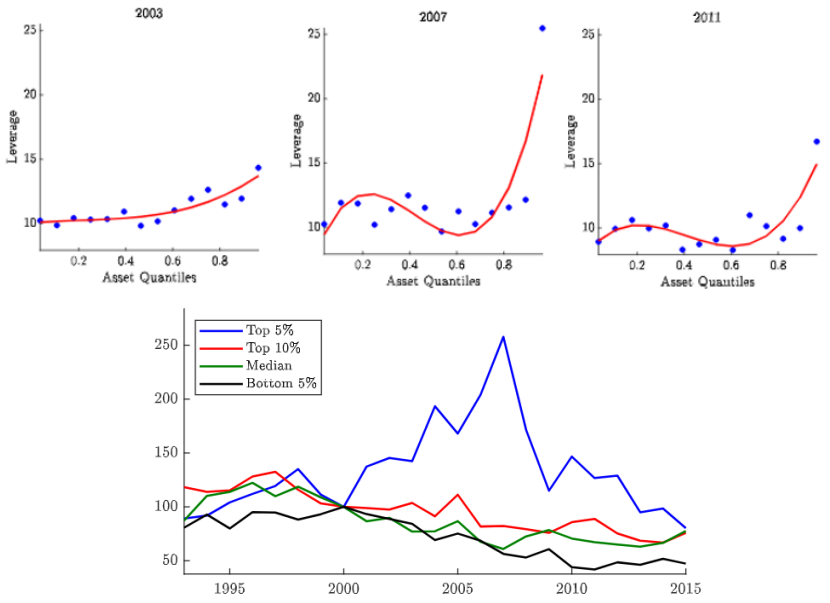


Figure 1: Evolution of leverage by quantiles (base year=2000)

Note. The upper panel shows the cross-section of leverage by asset quantile, for 3 selected years. The lower panel shows the time series of leverage by asset quantile. Source: Borrowed from Coimbra and Rey (2017).

Stylized fact 2. Global banks interact mainly with other banks, and through loans and deposits. Using the Locational Banking Statistics database from the BIS, I find that BIS reporting banks–essentially internationally active global banks according to Bruno and Shin (2015)–interact mainly with the banking sector in counter-party countries, and through loans and deposits. This evidence is reported in Table 1 and holds both for their asset and liabilities. On average during the period from 2000 to 2020, 64% of global banks liabilities were towards other banks, and 88% of global banks liabilities were in the form of loans and deposits. This motivates the focus on the interaction between global and local banks through loans and deposits in my model.

Table 1 BIS Reporting Banks Cross-border Positions

Sector	% Total	Instruments	% Total
Total claims - All sectors	100%	Total claims - All instruments	100%
Total claims - Banks, total	60%	Total claims - Loans and deposits	72%
Total claims - Non-banks, total	39%	Total claims - Debt securities	21%
Total claims - Unallocated by sector	1%	Total claims - Other instruments	7%
Total liabilities - All sectors	100%	Total liabilities - All instruments	100%
Total liabilities - Banks, total	64%	Total liabilities - Loans and deposits	88%
Total liabilities - Non-banks, total	29%	Total liabilities - Debt securities	8%
Total liabilities - Unallocated by sector	7%	Total liabilities - Other instruments	4%

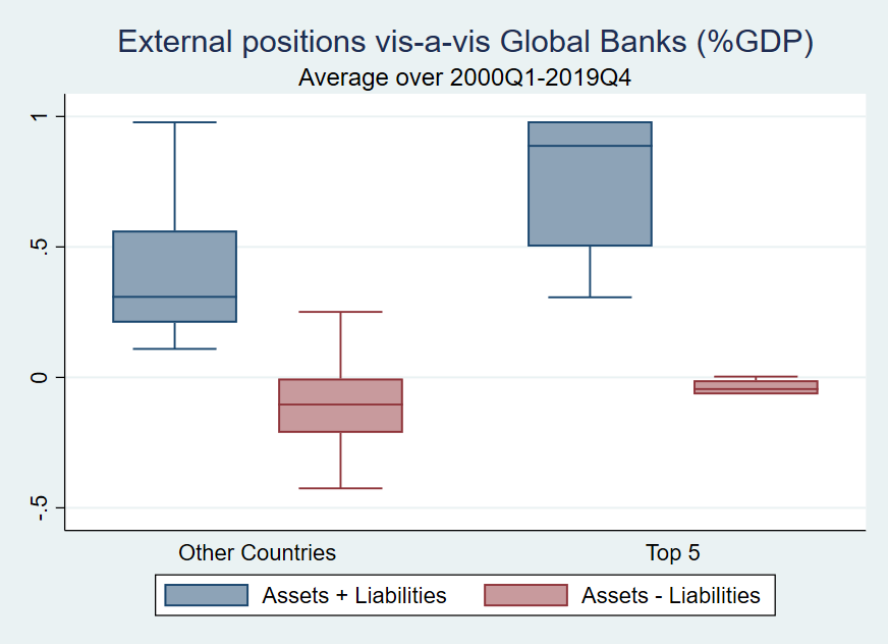
Note. The table provides the decomposition of total claims and liabilities of all BIS reporting banks by counter-party sector and by instrument. The numbers correspond to the average over the period from 2000 to 2020. Source: BIS LBS.

Stylized fact 3. Global banks are located in a small number of advanced economies, which intermediate capital to and from other countries. Using data from Aldasoro et al. (2022), I document that 42 out of 96 headquarters of global bank holdings are located in 5 countries (United States, United Kingdom, Japan, France, and Germany). A similar pattern hold when looking at global systemically important banks[3]. Those 5 countries have on average over the 2000-2020 period larger gross external positions (blue box plots), but

[3]The list of G-SIBs is provided in Appendix D.

smaller net external positions (red box plots) vis a vis global banks, than other countries. Put differently, a large share of the international borrowing in the top 5 countries is used to finance international, as opposed to local, lending. This suggests that global banks have a better ability to intermediate capital across countries by borrowing from and lending to other banks abroad. Moreover, there is a large distribution of net external positions vis-a-vis global banks (red box plot). Some countries are on average net creditors against global banks, while other countries are on average net debtor towards global banks. This distinction between countries differs from the traditional distinction between advanced and emerging market countries. For example, Switzerland, Belgium, Bolivia, Peru and Israel are net creditors on global banks, while Spain, Austria, Lithuania, Turkey and Brazil are net debtor against global banks. See Table 12 in Appendix for more details.

Figure 3 External Positions vis a vis Global Banks



Note. The charts shows the cross-sectional distribution of the average external positions over 2000-2020 for the top 5 countries (right) and the remaining countries (left). It reports the distribution for both the total positions (blue), and net assets (red). Source: BIS LBS, author's calculations.

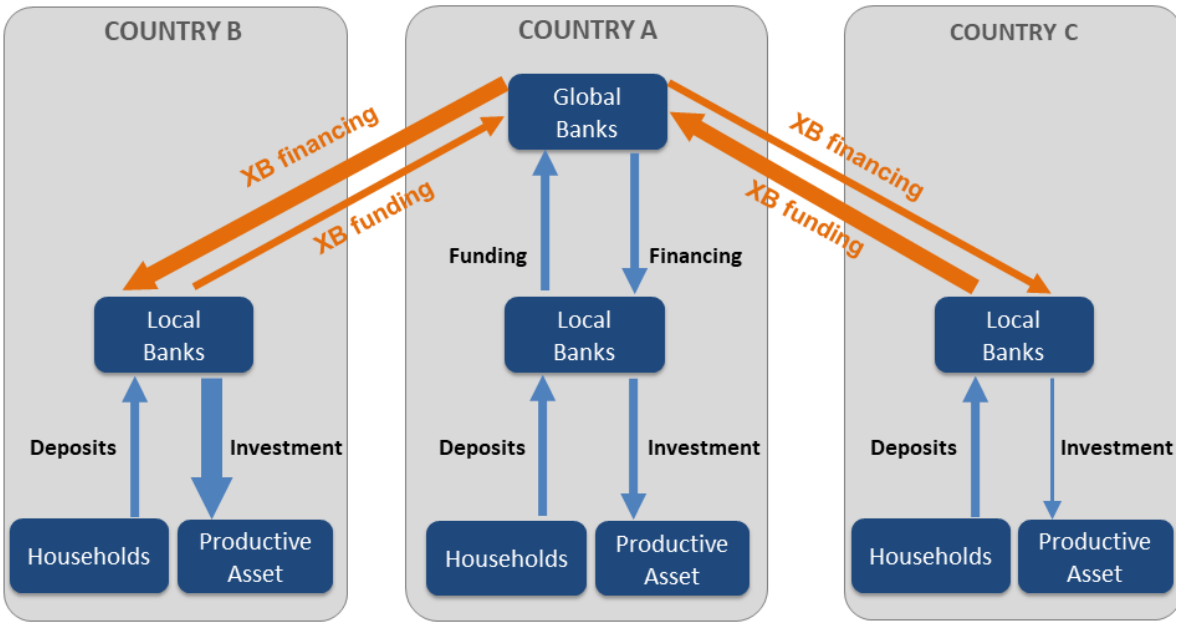
The next section builds on the above stylized facts and presents the theoretical model.

3 A Multi-Country Model with Global and Local Banks

In this section, I develop a multi-country model of the international banking system where global banks interact with local banks. The model features global banks located heterogeneously across countries, and, in each country, a continuum of local banks that have uncertain bank-specific project returns. The key ingredient of the model is that there is both cross-country and within-country heterogeneity regarding the returns on local projects. Additionally, local banks interact with global banks on the wholesale interbank market, but do not interact with each other. The double heterogeneity associated with this institutional feature of the international banking system rationalizes stylized facts of the data presented in the previous sections.

Set-up. Consider a single-good, two-period ($t = 1, 2$) economy. The world economy consists of a large number $N \geq 3$ of countries indexed by superscript i. There are three type of agents: households, local banks, and global banks. In each country, there is a representative household who faces an inter-temporal consumption-savings decision, and a unit continuum of local banks indexed by superscript j. Each local bank raises deposits from their domestic household on the local retail market, has access to a stochastic bank-specific project, and can participate to the global wholesale market. There is also a unit continuum of global banks indexed by superscript g, and located across countries, which perform wholesale banking operations allowing them to reallocate assets among local banks, subject to a leverage constraint. We denote by s^i the share of global banks which is headquartered in country i, with $\sum_{i=1}^{N} s^i = 1$. The distribution of global banks across countries is exogenous. A simplified schematic of the model economy is sketched in Figure 4. The following sections provide more details regarding the timelime and each agent.

Figure 4 Model - Simplified Overview



Note. This chart provides a simplified schematic representation of the model for the case where $N = 3$, $s^A = 1$, and $R^C < R^A < R^B$. The red arrows denote cross-border (XB) transactions and the blue arrows denote local transactions.

Timeline. In this two-period economy, the sequence of events is the following:

1. Period 1:

   (a) At the beginning of period 1, local banks compete to raise deposits from their domestic household in the retail market.

   (b) At the end of period 1, after the retail market closes, the stochastic bank-specific returns are revealed and global banks reallocate capital across local banks worldwide, by borrowing and lending on the wholesale funding market, subject to a leverage constraint.

2. Period 2: The projects are financed and output is consumed by banks and households.

The economic interpretation of this sequence of events in period 1 is that deposits are considered as long-term, and more sticky, while investment opportunities are more volatile.

This characterization of global and local banks follows Gertler et al. (2016) who distinguish between the subset of financial intermediaries, usually investment banks, that is highly leveraged, often with short-term debt and relies heavily on borrowing from other financial institutions in wholesale markets, and banks borrowing from households in retail markets. In my model, global banks are defined as highly leveraged internationally active banks that lend to foreign entities through cross-border loans. The local banks, i.e. the retail banking sector, in turn, includes financial institutions that rely mainly on household saving for external funding and provide a significant amount of short-term financing to the wholesale banks. This corresponds to commercial banks and money market funds that raise funds mainly from households and on net provide financing to wholesale banks[4].

3.1 Households

In each country i, there is a representative household. Households are born with a wealth endowment W^i in period 1, optimally consume and save through local bank deposits d^i at the gross competitive deposit rate R_H^i. Households in country i maximize:

$$\max_{d^i} U^i = u(c_1^i) + \beta^i \, \mathbb{E}[c_2^i] \tag{1}$$

Their budget constraints in period 1 and 2 are given by:

$$c_1^i + d^i = W^i \tag{2}$$

$$c_2^j = R_H^i d^i \tag{3}$$

[4]In my model, I assume that projects are bank-specific and financed by local banks. Thus, global banks lend to local banks in order to finance projects. Shen (2021) finds that local (resp. global) banks have a comparative advantage in extracting information on local (resp. global) risk, and this double information asymmetry creates a segmented credit market. The model has a similar interpretation where global banks raise funding from local banks on the wholesale market, and provide direct funding to the local projects.

3.2 Productive Assets

Local banks have access to a bank-specific project[5] with gross return $R^{i,j}$, which can be decomposed between a stochastic country-specific component R^i and a stochastic bank-specific component ϵ^j. The project of local bank j located in country i produces output according to the following technology:

$$y^{i,j} = \left(\underbrace{R^i + \epsilon^j}_{\equiv R^{i,j}} \right) k^{i,j} \tag{4}$$

where $R^i \sim \mathcal{U}_{[\underline{R};\overline{R}]}$ is a stochastic country-specific productivity parameter uniformly distributed on the interval $[\underline{R};\overline{R}]$, $\epsilon^j \sim \mathcal{U}_{[-\sigma;\sigma]}$ is a bank-specific stochastic productivity shock uniformly distributed on the interval $[-\sigma,\sigma]$, and $k^{i,j}$ is the amount of capital invested by bank j located in country i in its project. R^i and ϵ^j are independent random variables, and we denote $R = \mathbb{E}[R^i]$. These assumptions regarding the distribution of country-specific and bank-specific shocks are made to obtain closed-form solutions both at the country and global levels but they do not affect the essence of the results. We denote by $G(x)$ the global cumulative distribution function of projects' returns at the end of period 1, and by $F_i(x)$ the cumulative distribution function of projects' returns at the end of period 1 in country i.

3.3 Local Banks

Within each country i, there is a unit continuum of local banks indexed by superscript j. Local banks are endowed with an initial equity endowment $E^{i,j}$, and have access to a bank-specific project with gross return $R^{i,j}$. At the beginning of period 1, local banks are active on the retail market, through which they can raise deposits $d^{i,j}$ at the competitive rate R^i_H

[5] An alternative interpretation of the model is that local banks are located on a continuum of islands and, given their supply of available funds, can only make friction-less (equity-like) loans to non-financial firms located on the same island (Gertler and Kiyotaki (2010)).

from households. At the end of period 1, local banks are active on the interbank wholesale market, through which they can borrow $d_M^{i,j}$ at the competitive rate R_M^d or lend $l_M^{i,j}$ at the competitive rate R_M^l. Local banks borrow from or lend to global banks, but not directly to each other[6].

Retail operations. At the beginning of period 1, before uncertainty is resolved, local banks compete to raise deposits $d^{i,j}$ from their home representative household. Local banks set their demand for deposits $d^{i,j}$ in order to maximize their expected profits $\pi^{i,j}$ in period 2:

$$\max_{d^{i,j}} \quad \mathbb{E}[\pi^{i,j}] \tag{5}$$

Interbank operations. At the end of period 1, after the stochastic returns are revealed, local banks can lend an amount $l_M^{i,j}$ to or borrow an amount $d_M^{i,j}$ from global banks on the global wholesale market. Local banks can invest up to $\bar{k}$ units of capital in their project, which pays off in period 2. Local banks maximize their period-2 profits:

$$\max_{d_M^{i,j}\geq 0, l_M^{i,j}\geq 0} \pi^{i,j} = \left(\underbrace{R^i + \epsilon^j}_{\equiv R^{i,j}} \right) k^{i,j} + R_M^l l_M^{i,j} - R_H^i d^{i,j} - R_M^d d_M^{i,j} \tag{6}$$

[6]This assumption can be micro-founded by introducing an agency problem between borrowers and lenders. More specifically, we can assume that after global and local banks obtains funds on the wholesale market, they can respectively divert a fraction θ^G and θ^L of the borrowed funds and default on their debt. The creditors may re-claim the remaining fraction of funds. Because creditors recognize banks' incentive to divert funds, they will restrict the amount they lend. In this way a borrowing constraint may arise. I implicitly consider the corner case where $\theta^G = 0$ and $\theta^L = 1$, but the main results would hold as long as $\theta^G < \theta^L$, i.e. as long as global banks have a lower incentive to divert funds than local banks (e.g. due to higher reputation, or tighter regulatory constraints). See for example Gertler et al. (2016). This institutional feature of the international banking system is also consistent with Cetorelli and Goldberg (2012a) and Cetorelli and Goldberg (2012b) who conjecture that global banks manage liquidity on a global scale, actively using cross-border internal funding in response to local shocks.

subject to a balance sheet identity:

$$k^{i,j} + l_M^{i,j} = E^{i,j} + d^{i,j} + d_M^{i,j} \tag{7}$$

and to a limit on the availability of projects:

$$k^{i,j} \leq \bar{k} \tag{8}$$

This constraint on the availability of projects for local banks is made to prevent a corner solution where, given the linear technology specification in (4), only the bank with the highest realization of the shocks receives market funding from all other banks. Figure 5 represents the balance sheet of a local bank.

Figure 5 Balance sheet of local bank j located in country i

Assets	Liabilities
$k^{i,j}$	$E^{i,j}$
$l_M^{i,j}$	$d^{i,j}$
	$d_M^{i,j}$

3.4 Global Banks

Global banks are endowed with initial equity E^g and have the ability to lend an amount l_M^g to or borrow an amount d_M^g from local banks, located either at home or abroad, on the global wholesale market through their broker-dealer entities. At the end of period 1, after returns' uncertainty is resolved, global banks can reallocate capital across local banks, subject to a leverage constraint. To summarize, global banks perform wholesale banking operations,

through which they reallocate assets globally among local banks, from the least efficient to the most efficient banks. Global banks maximize their period-2 profits:

$$\max_{l_M^g \geq 0, d_M^g \geq 0} \pi^g = R_M^d l_M^g - R_M^l d_M^g \tag{9}$$

subject to a balance sheet identity:

$$l_M^g = E^g + d_M^g \tag{10}$$

and a leverage constraint:

$$d_M^g \leq \bar{\lambda} \tag{11}$$

The leverage constraint, which sets a limit on the size of global banks' balance sheet will play a key role in the model. In particular, a tight leverage constraint (i.e. a lower $\bar{\lambda}$) limits the ability of global banks to borrow funds on the wholesale market, and thus prevents them from reallocating capital from local banks associated with a low return project to the ones associated with a high return project. Figure 6 represents the balance sheet of a global bank.

Figure 6 Balance sheet of global bank g

Assets	Liabilities
l_M^g	E^g
	d_M^g

3.5 Equilibrium

We turn to the description of the competitive equilibrium in which: (i) Global banks set their levels of l_M^g and d_M^g so as to maximize their profits subject to their balance sheet and

leverage constraints, taking the interbank rates as given; (ii) Local banks raise deposits $d^{i,j}$ so as to maximize their expected profits, and set their levels of $l_M^{i,j}$ and $d_M^{i,j}$ contingent on the realization of their productivity parameter, taking the interbank rates and the bank deposit rate as given; (iii) Households set their level of d^i so as to maximize their utility, taking the bank deposit rate as given; and (iv) the lending and borrowing interbank rates, R_M^l and R_M^d, and the bank deposit interest rates, R_H^i, clear the global wholesale market and the local retail markets for household deposits in all countries. We derive the equilibrium by proceeding backwards, starting with the equilibrium on the wholesale market at the end of period 1, and then the equilibrium on the retail markets at the beginning of period 1. It will be useful to make the following assumption.

Assumption 1 *Households and all local banks receive the same initial endowment across and within countries, i.e.* $W^i = \bar{W}\ \forall i$ *and* $E^{i,j} = \bar{E}_L\ \forall i, j$. *Moreover, we assume that all global banks receive the same initial endowment, i.e.* $E^g = \bar{E}_G\ \forall g$.

Remark 1 *Given Assumption 1, the deposits collected from households by local banks are equalized across all local banks, i.e.* $d^{i,j} = d^i = \bar{d}\ \forall i, j$.

Proof. In Appendix B.1. ■

The reason for introducing such assumption is that it reduces the heterogeneity of local banks to their asset side, while their liabilities, both their internal equity and the deposits collected from households, are similar across all local banks. This assumption simplifies the model and it does not affect the essence of the results.

3.5.1 Equilibrium in the inter-bank wholesale market

At the end of period 1, after uncertainty is resolved, local banks set $d_M^{i,j}$ and $l_M^{i,j}$ in order to maximize their profits in period 2. As shown in the Appendix, the optimization problem of

local banks leads to corner solutions. We can distinguish 3 cases regarding the decisions of local banks, depending on the realization of $R^{i,j}$:

$$\begin{cases} d_M^{i,j} = k - E^{i,j} - d^{i,j} \text{ and } l_M^{i,j} = 0 & \text{if } R^{i,j} > R_M^d \\ d_M^{i,j} = 0 \text{ and } l_M^{i,j} = 0 & \text{if } R_M^d > R^{i,j} > R_M^l \\ d_M^{i,j} = 0 \text{ and } l_M^{i,j} = E^{i,j} + d^{i,j} & \text{if } R^{i,j} < R_M^l \end{cases} \tag{12}$$

Note that there is a wedge between the lending R_M^l and borrowing R_M^d rates on the inter-bank market if the leverage constraint of global banks is binding (i.e. if $d_m^g = \bar{\lambda}\ \forall g$). Thus, global banks realize a profit from intermediating funds on the inter-bank market. If the constraint of global banks is not binding then there is no wedge between the lending and borrowing rates, and the economy efficiently allocates funds worldwide.

Equilibrium. At the end of period 1, the supply of funds on the inter-bank market comes both from the internal liabilities of global banks–their equity–and their external liabilities–the funds borrowed by their broker-dealer entities on the inter-bank wholesale market from local banks. In particular, local banks will supply funds on the inter-bank market if the inter-bank lending rate is higher than the return on their project. The supply of funds by local bank j in country i is given by:

$$l_M^{i,j} = \begin{cases} E^{i,j} + d^{i,j} & \text{if } R^{i,j} < R_M^l \\ 0 & \text{otherwise} \end{cases} \tag{13}$$

The demand of funds on the inter-bank market comes from the local banks which borrow funds from global banks to finance local projects. In particular, local banks will demand funds on the inter-bank wholesale market if the inter-bank borrowing rate is lower than the

return on their project. The demand of funds by local bank j in country i is given by:

$$d_M^{i,j} = \begin{cases} \bar{k} - E^{i,j} - d^{i,j} & \text{if } R^{i,j} > R_M^d \\ 0 & \text{otherwise} \end{cases} \tag{14}$$

In equilibrium, the global supply of funds should be equal to the global demand for funds on the inter-bank market. The equilibrium condition is:

$$\underbrace{\underbrace{\int_g E^g}_{\text{Global banks' internal equity}} + \underbrace{\sum_{i=1}^{N} \int_j \left(E^{i,j} + d^{i,j}\right) \mathbb{I}(R^{i,j} < R_M^l)}_{\text{Local banks' lending}}}_{\text{Global banks' lending}} = \underbrace{\sum_{i=1}^{N} \int_j \left(\bar{k} - E^{i,j} - d^{i,j}\right) \mathbb{I}(R^{i,j} > R_M^d)}_{\text{Local banks' borrowing}} \tag{15}$$

where $\mathbb{I}(R^{i,j} < R_M^l)$ is an indicator function equal to 1 if $R^{i,j} < R_M^l$ and 0 otherwise. Similarly, $\mathbb{I}(R^{i,j} > R_M^d)$ is an indicator function equal to 1 if $R^{i,j} > R_M^d$ and 0 otherwise. The two terms on the left-hand side represent the liabilities of global banks, both their internal liabilities–their equity–and their external liabilities–the funds borrowed from local banks. A change in their leverage constraint changes their ability to take on external liabilities. In equilibrium, the sum of those liabilities is equal to global banks' lending, which is itself equal to local banks' borrowing.

Lemma 3.1 *If $\bar{\lambda} < \lambda^*$, then the inter-bank lending rate R_M^l is given by:*

$$R_M^l = G^{-1}\left(\frac{\bar{\lambda}}{N\left(\bar{E}_L + \bar{d}\right)}\right) \tag{16}$$

and is increasing in $\bar{\lambda}$. Moreover, the inter-bank borrowing rate R_M^d is given by:

$$R_M^d = G^{-1}\left(1 - \frac{\bar{\lambda} + \bar{E}_G}{N\left(\bar{k} - \bar{E}_L - \bar{d}\right)}\right) \tag{17}$$

and is decreasing in $\bar{\lambda}$.

If $\bar{\lambda} \geq \lambda^*$*, then the inter-bank lending rate* R_M^l *and borrowing rate* R_M^d *are equalized:*

$$R_M^l = R_M^d \tag{18}$$

where $\lambda^* = \frac{1+\frac{\bar{E}_G}{N(\bar{k}-\bar{E}_L-\bar{d})}}{\frac{1}{N(\bar{E}_L+\bar{d})}+\frac{1}{N(\bar{k}-\bar{E}_L-\bar{d})}}$.

Proof. In Appendix B.1. ■

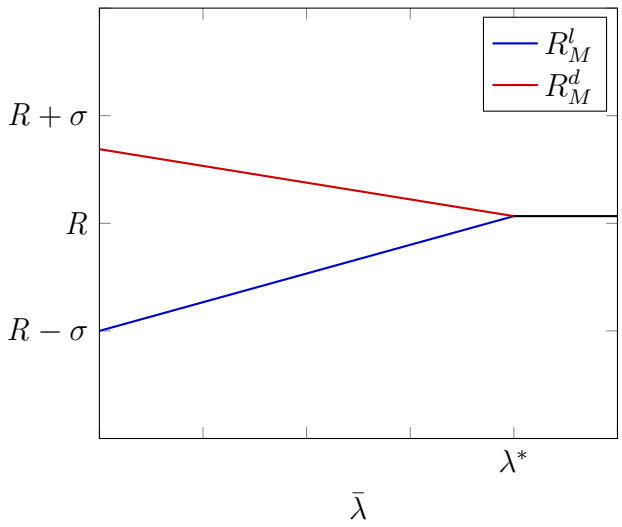
The inter-bank lending rate R_M^l at which local banks can lend their funds on the wholesale market is increasing in the leverage of global banks $\bar{\lambda}$, and is decreasing in the quantity of funds supplied. Intuitively, as global banks can increase their leverage, their demand for funds increases, which drives the lending rate up. Conversely, the interbank borrowing rate R_M^d at which local banks can borrow funds on the wholesale market (or, the borrowing rate at which local project can get funding from global banks) is decreasing in the leverage of global banks $\bar{\lambda}$, and is increasing in the quantity of funds demanded. Intuitively, as global banks can increase their leverage, their supply of funds increases, which drives the borrowing rate down. The two rates are equalized, i.e. there is no spread on the interbank market (or between the rate at which global banks can raise funding on the wholesale market and the rate at which they lend to local project), when the leverage constraint of global banks does not bind anymore, i.e. when $\bar{\lambda} \geq \lambda^*$.

Figure 7 represents the inter-bank interest rates as a function of global banks' leverage, in the special case where there is no country-specific productivity shock, i.e. $R^i = R \; \forall i$.

3.5.2 Equilibrium in the retail markets for local deposits

At the beginning of period 1, before uncertainty is resolved, local banks compete to raise deposits $d^{i,j}$ from their home representative household. Local banks set their deposits $d^{i,j}$ in

Figure 7 Inter-bank Borrowing and Lending Rates



Note This figure shows the inter-bank borrowing (red line) and lending (blue line) rates as a function of global banks' leverage, in the special case where $R^i = R\ \forall i$. The value λ^* denotes the leverage level such that the constraint of global banks does not bind.

order to maximize their expected profits in period 2. Their demand for deposits is given by:

$$G(R_M^l)R_M^l + \left(1 - G(R_M^l)\right)\mathbb{E}\left[R^{i,j}|R^{i,j} > R_M^l\right] = R_H^i \tag{19}$$

The first term on the left represents the option value for the local bank of lending those deposits to global banks if the return on its project is too low, while the second term on the left represents the marginal value of the deposits to the local bank, conditional on using them to invest in its project (i.e. conditional on the project having a relatively high return). Note that both $\frac{dR_M^l}{d\bar{d}} < 0$ and $\frac{d\,\mathbb{E}\left[R^{i,j}|R^{i,j}>R_M^l\right]}{d\bar{d}} < 0$, thus the demand for deposits is decreasing in R_H^i. Moreover, as can be seen by combining Lemma 3.1 and equation (19), an increase in global banks' leverage $\bar{\lambda}$ leads to an outward shift of the demand schedule for deposits.

The supply of deposits d^i is given by households' first-order condition:

$$u'(W^i - d^i) = \beta^i R_H^i \tag{20}$$

The supply of deposits is increasing in R_H^i.

Equilibrium. In a symmetric equilibrium, the deposits raised by every local bank, both within and across countries, are equalized. As noted in remark 1, we have: $d^{i,j} = d^i = \bar{d}\ \forall i, j$. Using this equality, the demand for deposits (19), and the supply of deposits (20), the equilibrium domestic bank deposits $\bar{d}$ solves:

$$u'(\bar{W} - \bar{d}) = \beta^i \left(\frac{\bar{\lambda}}{N\left(\bar{E}_L + \bar{d}\right)} G^{-1}\left(\frac{\bar{\lambda}}{N\left(\bar{E}_L + \bar{d}\right)} \right) + \left(1 - \frac{\bar{\lambda}}{N\left(\bar{E}_L + \bar{d}\right)} \right) \mathbb{E}\left[R^{i,j} | R^{i,j} > G^{-1}\left(\frac{\bar{\lambda}}{N\left(\bar{E}_L + \bar{d}\right)} \right) \right] \right) \tag{21}$$

The equilibrium gross competitive deposit rate R_H^i in country i is obtained using (20). As seen from equation (19) the deposit rate for households R_H^i is higher than the lending rate on the inter-bank market R_M^l. Thus, local banks might default. For simplicity, I assume that local banks are well capitalized and do not raise sufficient deposits to be in the default region. The introduction of costly default in this model is left for future research.

3.6 Country Aggregates

External positions. We turn to the analysis of countries' external positions. The main derivations are reported to Appendix B.4. In order to obtain a unique closed-form solution for countries' external positions we will make the following assumption.

Assumption 2 *The lending by any local bank to global banks is equally distributed across all global banks, whether those global banks are headquartered in the same country as the local bank or not. Similarly, the borrowing by any local bank from global banks is equally distributed across all global banks, whether those global banks are headquartered in the same country as the local bank or not.*

At the margin global banks are indifferent between borrowing from a local bank located

in the same country or abroad. The former does not generate a cross-border capital flow while the latter does. Thus, I need to make this assumption to uniquely pin-down cross-border flows.

Special case. In a first step, and in order to clarify the exposition, I first present a special case where there is no country-specific heterogeneity in the productivity parameter, i.e. $R^i = R \ \forall i$. Note that in this specific case, the global and local cumulative distribution function of projects' returns at the end of period 1 in country i are the same. The external assets of country i are given by:

$$A^i = \left(1 - s^i\right) \frac{\bar{\lambda}}{N} + s^i \left(\frac{N-1}{N}\right) \left(\bar{E}_G + \bar{\lambda}\right) \tag{22}$$

The first term corresponds to the money lent by local banks of country i to global banks headquartered outside of country i. Note that if all global banks are headquartered in country i, i.e. if $s^i = 1$, then this first term is equal to zero as local banks do not lend funds to banks located outside of the country. The second term corresponds to the money lent by global banks headquartered in country i to local banks located outside of country i. Similarly, the external liabilities of country i are given by:

$$L^i = \left(1 - s^i\right) \frac{\bar{E}_G + \bar{\lambda}}{N} + s^i \left(\frac{N-1}{N}\right) \bar{\lambda} \tag{23}$$

The first term corresponds to the money borrowed by local banks of country i from global banks located outside of country i. The second term corresponds to the money borrowed by global banks headquartered in country i from local banks not located in country i.

As can be seen from equation (22) and (23), a country's external assets and liabilities are

both increasing in global banks' leverage $\bar{\lambda}$. Moreover, they are both increasing in the share of global banks headquartered in the country s^i as long as the number of countries is large enough[7]. The net external assets of country i, are given by:

$$N^i \equiv A^i - L^i = \bar{E}_G \left[s^i - \frac{1}{N} \right] \tag{24}$$

Note that countries which host more global banks tend to have higher net external assets because they can use their own internal equity to lend to local banks located in other countries. In this special case without country-specific heterogeneity in the productivity parameter across countries, the net assets of all countries are equal to zero if either $\bar{E}_G = 0$ or $s^i = \frac{1}{N}\ \forall i$. Put differently, there are no global imbalances if either global banks have no internal capital or are equally distributed across countries. Moreover, in this special case, the leverage of global banks has no effect on net external assets.

General case. Building on the above analysis, we turn to the general case, where there is country-specific heterogeneity in the productivity parameter R^i. As shown in Appendix, the external assets of country i are given by:

$$A^i = \left(1 - s^i\right) \frac{\bar{\lambda}}{N} \frac{F_i(R_M^l)}{G(R_M^l)} + s^i \left(\bar{E}_G + \bar{\lambda}\right) \left[\frac{N\left(1 - G(R_M^d)\right) - \left(1 - F_i(R_M^d)\right)}{N\left(1 - G(R_M^d)\right)} \right] \tag{25}$$

As before, the first term corresponds to the money lent by local banks of country i to global banks headquartered outside of country i, and the second term corresponds to the money lent by global banks headquartered in country i to local banks located outside of country i. Note that if $F_i(R_M^d) = G(R_M^d)$ and $F_i(R_M^l) = G(R_M^l)$ then we are back to the special case. Moreover, both $F_i(R_M^d)$ and $F_i(R_M^l)$ are decreasing in R^i. Thus, external

[7] More formally, $\frac{dL^i}{ds^i} >$ if and only if $N > 2 + \frac{\bar{E}_G}{\bar{\lambda}}$. Because global banks are highly leveraged, I assume that their debt liabilities are larger than their equity, $\bar{\lambda} > \bar{E}_G$. Thus, the condition simplifies to $N \geq 3$.

assets are decreasing with R^i, i.e. with the realization of the country-specific productivity shock. Intuitively, if a country has a higher country-specific productivity shock then it will invest less abroad. In particular, local banks will provide less funding to the global wholesale market, and domestic global banks will lend less to foreign local banks. Similarly, the external liabilities of country i are given by:

$$L^i = \left(1 - s^i\right) \frac{\bar{E}_G + \bar{\lambda}}{N} \frac{1 - F_i(R_M^d)}{1 - G(R_M^d)} + s^i \bar{\lambda} \left[\frac{NG(R_M^l) - F_i(R_M^l)}{NG(R_M^l)} \right] \tag{26}$$

As before, the first term corresponds to the money borrowed by local banks of country i from global banks headquartered outside of country i. The second term corresponds to the money borrowed by global banks headquartered in country i from local banks located abroad. External liabilities are increasing with R^i, i.e. with the realization of the country-specific productivity shock. Intuitively, if a country has a higher country-specific productivity shock then it will attract more investment. In particular, local banks will borrow more funding from the wholesale market, and domestic global banks borrow more funds from foreign local banks.

As derived in the Appendix, a country's external assets and liabilities are both increasing in global banks' leverage $\bar{\lambda}$ and in the share of global banks headquartered in the country s^i.

Proposition 1 *The net external assets of country i, are given by:*

$$N^i \equiv A^i - L^i = \frac{\bar{\lambda}}{N} \left[\underbrace{\frac{F_i(R_M^l)}{G(R_M^l)} - \frac{1 - F_i(R_M^d)}{1 - G(R_M^d)}}_{\equiv \xi^i} \right] + \frac{\bar{E}_G}{N} \left[s^i N - \frac{1 - F_i(R_M^d)}{1 - G(R_M^d)} \right] \tag{27}$$

The change in net external assets in response to a change in $\bar{\lambda}$ depends on ξ^i.

The proposition states that the sign and the magnitude of a change in net external assets N^i in response to a change in $\bar{\lambda}$ depends on the sign of ξ^i. This variable can be interpreted

as the net assets of the country vis-a-vis global banks. Indeed, the variable ξ^i depends on the relative distribution of projects' returns in a given country (both the lower and upper tail) compared to projects' returns worldwide. Net external assets vis-a-vis global banks are decreasing with R^i, i.e. with the realization of the country-specific productivity shock. Intuitively, if a country has a higher country-specific productivity shock then it will invest less abroad and it will attract more investment. In particular, local banks will provide less net funding to (or obtain more net borrowing from) the global wholesale market and domestic global banks provide less net funding to (or obtain more net borrowing from) foreign local banks. Countries with a positive value of ξ^i are thus net creditor vis-a-vis global banks, and can be thought as as capital abundant countries, while countries with a negative value of ξ^i are net debtor vis-a-vis global banks, and can be thought as capital scarce countries.

A natural extension of this result is to decompose the current account between saving and investment. It is a well-know identity in international macroeconomics that the current account of a country is equal to the difference between its savings and investment. Thus, any change in the current account should be reflected by a change in savings and/or investment. In the model, following an increase in global banks' leverage, investment is increasing in aggregate, and more in countries which are net debtor against global banks, while savings are increasing in aggregate without distinction across countries. Put differently, the heterogeneous impact on the current account across countries is entirely driven by heterogeneous responses of investment across countries.

Proposition 2 *Following an increase in global banks' leverage $\bar{\lambda}$, savings $\bar{d}$ are increasing in aggregate without distinction across countries, while investment is increasing in aggregate, and more in countries which are net debtor against global banks.*

Proof. In Appendix. ■

Intuitively, this proposition follows from two facts. First, the fact that all local banks have a similar structure on their liabilities side after raising deposits in the beginning of period 1, because they face the same constraints and the same expected return on their project. Second, the fact that they have heterogeneous realized returns, and thus that they will have different optimal composition on the asset side of their balance sheet.

3.7 Comments

In the model, both within and across country heterogeneity are needed to explain the pattern of gross and net capital flows. Indeed, within-country heterogeneity in local projects' returns will lead to both gross banking inflows and outflows as global banks channel funds across countries from banks associated with the least productive projects to the ones associated with the most productive projects. Additionally, cross-country heterogeneity in the country-specific return R^i will lead to net external banking positions at the country level, where the high-return, capital-scarce, countries will have net external banking liabilities, and the low-return, capital-abundant, countries will have net external banking assets. Moreover, the distribution of global banks across countries helps explain why some countries have higher external gross assets and liabilities, In the model, countries which host more global banks' headquarters have both higher external banking assets and liabilities.

In order to make the model tractable with both within and cross-country heterogeneity, I assume that uncertainty about returns is resolved at the end of period 1. Thus, the model allows me to analyze changes in the leverage of global banks, but not to study cycles where the leverage goes up and down over time. Moreover, the leverage of global banks, which is a measure their risk-capacity (Gabaix and Maggiori (2015)), is considered as exogenous in the model and I do not explicitly analyze their its underlying determinants such as monetary policy or risk-aversion shocks (Akinci et al. (2022), Coimbra and Rey (2017)).

4 Empirical Analysis

The closed-form solutions given by the model provide some testable predictions. In particular, the two main predictions to be tested in the data are the following:

1. The response of the current account to global banks' leverage depends on the country's net external position against global banks.

2. This differentiated response of the current account is driven by investment, not savings.

To test those predictions, I compile a database of cross-border borrowing and lending by internationally active banks using the Locational Banking Statistics (LBS) from the Bank for International Settlements (BIS). I supplement the database with data on GDP, current account balances, equity prices, and real exchange rates from multiple sources. The main results in this empirical section are obtained using dynamic panel regressions. I also complement those results with some cross-sectional evidence during the global financial crisis.

4.1 Sample and Variables

My sample consists of a quarterly panel of 52 advanced and emerging market economies, for the period from 2000Q1 to 2019Q4. The list of countries is provided in Appendix C.1. All countries have a large foreign bank penetration, as measured by the number of foreign banks and by the share of domestic banking assets held by foreign-owned local institutions documented by Claessens et al. (2008). Following the literature (e.g. Bruno and Shin (2015), Cesa-Bianchi et al. (2018), Cerutti et al. (2017)), I use the U.S. Broker-Dealers' leverage as a proxy for global banks' leverage[8]. Leverage is defined as the ratio of assets to equity of

[8]Bank leverage has been used in the literature to proxy for financial intermediaries' funding conditions (higher leverage indicating greater ease of funding) and risk attitudes (higher leverage indicating risk-on attitudes). As such, the literature interprets US broker–dealer leverage as a proxy for wider financial conditions, and papers (e.g. Bruno and Shin (2015) and Cerutti et al. (2017)) have found a relationship between broker–dealers' leverage and cross-border bank flows. As for the leverage of the global banks, the empir-

the U.S. broker dealer sector and is obtained from the Federal Reserve's Flow of Funds[9]. I also include the VIX and the world real GDP growth rate, which are factors that also affect capital flows according to the global financial cycle literature, as control variables in my baseline regressions. I use BIS Locational Banking Statistics (LBS) to measure the net cross-border positions vis-a-vis global banks. The LBS collects data from internationally active banks which report both their claims on and liabilities towards different countries. As argued by Bruno and Shin (2015), global banks account for most of these international exposures reported by internationally active banks. The key organisational criteria of the BIS locational statistics data are the country of residence of the reporting banks and their counter-parties as well as the recording of all positions on a gross basis, including those vis-a-vis own affiliates. This makes the LBS appropriate for measuring the role of global banks in the intermediation of international capital flows and lending flows. In my empirical analysis, I define a country's net position vis-a-vis global banks as the difference between the liabilities of BIS reporting banks against all counter-party sectors located in this country minus the assets of BIS reporting banks on all counter-party sectors located in this country. To be clear, a negative value means that a given counter-party country has net liabilities towards global banks, while a positive value means that a given counter-party country has net assets on global banks. As a robustness check I use the net position of the local bank counter-party sector vis-a-vis global banks. The results are robust to using the position of

ical counterpart should ideally be measured as the leverage of the broker dealer subsidiaries of the global banks that facilitate cross-border lending. However, the reported balance sheet data for European banks are consolidated numbers at the holding company level that includes the much larger commercial banking unit, rather than the wholesale investment banking subsidiary alone. For the reasons discussed in Adrian and Shin (2010), broker dealers and commercial banks differ in important ways in their balance sheet management. The broker dealer sector much more closely mirrors the wholesale funding operations of the global banks. For this reason, I use instead the leverage of the US broker dealer sector from the Flow of Funds series published by the Federal Reserve as our empirical proxy for global bank leverage. I may expect to capture the main forces at work to the extent that US broker dealers are influenced by the same forces as the broker dealer subsidiaries of the European global banks.

[9]As the leverage of US Broker-Dealers is endogenous to the US business cycle, I conduct robustness checks excluding the U.S. from the sample. The results (available upon request) are robust to removing the U.S. from the sample.

the local bank counter-party sector vis-a-vis global banks. All variables are normalized by the counter-party country's GDP.

I use data on the current account to GDP ratio from the IMF. I also construct an alternative measure of net flows by taking the difference between total gross outflows and total gross inflows in a given quarter[10], normalized by the country's GDP. Investment, defined as gross fixed capital formation, is obtained from the IMF IFS database. Savings are computed as the sum of the current account and investment, using the equality that the current account is equal to the difference between savings and investment ($CA = S - I$). I supplement those data with real effective exchange rate, real GDP growth, and real equity prices from different sources (IMF, BIS, Global Financial Database). More details on the sources and variables construction are provided in Appendix C.2. Table 11 in Appendix provides some summary statistics of the variables used in the empirical analysis.

4.2 Panel Regressions

In this section, I analyze the impact of the global banks' leverage on the current account, and focus on the role of a country's net position vis-a-vis global banks in driving the result. The specification follows the closed-form solutions obtained in the previous section. More specifically, I estimate the following regressions:

$$Y_{i,t} = c_i + \beta_0^i t + \beta_1 L_t + \beta_2 L_t * P_{i,t-1} + \beta_3 P_{i,t-1} + \alpha_1 \mathbb{X}_t + \beta_4 Y_{i,t-1} + \epsilon_{i,t} \tag{28}$$

where $Y_{i,t}$ is either the current account to GDP, net outflows to GDP, the gross fixed capital formation to GDP, or savings to GDP, in country i and quarter t. L_t is the leverage

[10] I construct total gross inflows as the sum of FDI gross inflows, portfolio gross inflows, and other investment gross inflows. I construct total gross outflows as the sum of FDI gross outflows, portfolio gross outflows, other investment gross outflows, and reserves outflows. All variables are obtained from the IMF BOP database.

of U.S. Broker-Dealers. $P_{i,t-1}$ is the net external asset positions of all counter-party resident sectors of country i on global banks at $t-1$. I also use the variable $P^b_{i,t-1}$, the net external asset positions of banks counter-party resident sectors of country i on global banks at $t-1$ in my robustness checks. $\mathbb{X}_t$ is a vector including the world real GDP growth rate and the VIX. I include one lag of the dependant variable as an explanatory variable to control for country-time specific conditions.

All regressions are estimated via OLS, include country fixed effects and country-specific linear time trends, and double-clustered standard errors by country and time. By doing so, I allow for correlated shocks across countries for a given quarter, as well as correlated shocks over time for a given country. I also report R^2 values from within-country variation. A difficulty arises with the fixed effects model in the context of a dynamic panel data model because the demeaning process creates a correlation between the regressor and the error. Yet, Nickell (1981) demonstrates that the inconsistency is of order $1/T$, which should be limited in my estimations given that in my panel $T = 80$. I show that my baseline results are robust to removing the lagged dependent variable from the regressors. I also provide a multitude of robustness checks where I remove financial centers (see list of countries in Appendix C.1) and the global financial crisis years (2007-2009) from the regressions, or change the specification to include time fixed effects in addition to country fixed effects.

Results. The main results are presented in Table 2. Following the closed-form solutions given by the model, my focus is on the coefficient on the interaction between the leverage of global banks and the net assets on global banks, reported on the first line. The coefficient on column 1 is positive and significant for the current account, meaning that when the leverage of global banks increases, the current account balance improves in countries which are net creditor against global banks, while it deteriorates in countries which are net debtor against global banks. Unsurprisingly, global factors such as world real GDP growth and the VIX

Table 2 Impact on the Current Account, Investment, and Savings
Baseline Results

$$Y_{i,t} = c_i + \beta_0^i t + \beta_1 L_t + \beta_2 L_t * P_{i,t-1} + \beta_3 P_{i,t-1} + \alpha_1 \mathbb{X}_t + \beta_4 Y_{i,t-1} + \epsilon_{i,t}$$

	Dependent Variable			
	Current Account	Net Outflows	Investment	Savings
	(1)	(2)	(3)	(4)
Global Banks Leverage	0.178***	0.328***	-0.169***	-0.043
# Net Assets on Global Banks	[0.055]	[0.065]	[0.035]	[0.058]
Global Banks Leverage	-0.050	-0.062	0.112***	0.060**
	[0.032]	[0.043]	[0.030]	[0.029]
Net Assets on Global Banks	-2.174	-7.389***	5.800***	3.869**
	[1.586]	[1.836]	[1.973]	[1.865]
World Real GDP Growth	0.099	-0.335	0.293	0.367
	[0.235]	[0.294]	[0.410]	[0.314]
VIX	-0.020	-0.075***	0.028	0.005
	[0.019]	[0.025]	[0.024]	[0.021]
Lagged Dependent Variable	0.218*	0.124	0.213***	0.143***
	[0.115]	[0.087]	[0.059]	[0.050]
Constant	1.696	3.217**	14.370***	17.868***
	[1.119]	[1.472]	[1.692]	[1.574]
Country FE	Yes	Yes	Yes	Yes
Country-specific Time Trend	Yes	Yes	Yes	Yes
Observations	4,040	4,037	3,493	3,445
R-squared	0.591	0.425	0.544	0.729
R-squared (within)	0.097	0.061	0.133	0.052

Robust standard errors in brackets
*** p<0.01, ** p<0.05, * p<0.1

Note. All regressions are estimated via OLS, include country fixed effects and country-specific linear time trends, and double-clustured standard errors by country and time.

have no predictive power for systematic changes in the current account. The main result is confirmed by the positive and significant coefficient in the regression in column 2 for net outflows, which is used as a proxy for the current account. Countries which are more net debtor vis a vis global banks tend to receive more inflows when the leverage of global banks goes up. As shown in columns 3 and 4, this differentiated effect on the current account is driven by the response of investment, and not by savings. As predicted by the model, a higher leverage of global banks is associated with both higher global investment and savings. Yet, when the leverage of global banks increases, investment increases more in countries which are net debtor against global banks, while there is no significant difference in the response of savings across countries related to different positions against global banks.

In Appendix, I provide robustness checks excluding financial centers in Table 13, and excluding financial centers and the financial crisis years in Table 14, to show that my results are not driven by a few financial center countries, or by a specific period around the global financial crisis. Also, I complement the results by using the banking counter-party sector net external assets on global banks instead of all country-party sectors net external assets on global banks in Tables 15, 16, and 17, and find similar results.

4.3 Robustness

To confirm that the estimates are not driven by the inclusion of a lag of the dependent variable as a control variable, I replicate the analysis without the lagged dependent variable in control variables. I also provide results for a specification with both country fixed effects and time fixed to control for broader financial conditions not captured by the VIX or world real GDP growth. The results are reported in Tables 3 and 4, and confirm the results from the baseline analysis. Also, I repeat this robustness analysis using banks external positions vis a vis global banks in the Appendix (Tables 18 and 19). Finally, all results[11] are also robust to

[11] Tables available upon request.

including real GDP growth, a driver of the current account according to the open-economy RBC literature, as a control variable.

Table 3 Impact on the Current Account, Investment, and Savings Robustness - Without Lagged Dependent Variable

$$Y_{i,t} = c_i + \beta_0^i t + \beta_1 L_t + \beta_2 L_t * P_{i,t-1} + \beta_3 P_{i,t-1} + \alpha_1 \mathbb{X}_t + \epsilon_{i,t}$$

	Dependent Variable			
	Current Account	Net Outflows	Investment	Savings
	(1)	(2)	(3)	(4)
Global Banks Leverage	0.228***	0.376***	-0.215***	-0.049
# Net Assets on Global Banks	[0.069]	[0.083]	[0.040]	[0.069]
Global Banks Leverage	-0.062	-0.069	0.141***	0.070**
	[0.038]	[0.048]	[0.036]	[0.033]
Net Assets on Global Banks	-2.694	-8.076***	7.168***	4.521**
	[1.899]	[2.087]	[2.271]	[2.184]
World Real GDP Growth	0.230	-0.256	0.145	0.352
	[0.219]	[0.291]	[0.418]	[0.318]
VIX	-0.024	-0.080***	0.034	0.006
	[0.019]	[0.025]	[0.027]	[0.022]
Constant	2.007	3.474**	18.460***	20.914***
	[1.246]	[1.615]	[1.442]	[1.272]
Country FE	Yes	Yes	Yes	Yes
Country-specific Time Trend	Yes	Yes	Yes	Yes
Observations	4,044	4,043	3,497	3,452
R-squared	0.571	0.416	0.524	0.724
R-squared (within)	0.053	0.047	0.093	0.032

Robust standard errors in brackets
*** p<0.01, ** p<0.05, * p<0.1

Note. All regressions are estimated via OLS, include country fixed effects and country-specific linear time trends, and double-clustured standard errors by country and time.

Table 4 Impact on the Current Account, Investment, and Savings Robustness - Using Time Fixed Effects

$$Y_{i,t} = c_i + a_t + \beta_2 L_t * P_{i,t-1} + \beta_3 P_{i,t-1} + \epsilon_{i,t}$$

	Dependent Variable			
	Current Account	Net Outflows	Investment	Savings
	(1)	(2)	(3)	(4)
Global Banks Leverage	0.237***	0.365***	-0.172***	0.040
# Net Assets on Global Banks	[0.078]	[0.089]	[0.051]	[0.080]
Net Assets on Global Banks	-4.626*	-10.227***	6.221**	2.316
	[2.519]	[2.793]	[2.787]	[2.906]
Constant	-0.171	-0.406**	23.202***	23.250***
	[0.103]	[0.176]	[0.180]	[0.081]
Country FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
Observations	4,044	4,043	3,497	3,452
R-squared	0.493	0.343	0.458	0.697
R-squared (within)	0.037	0.030	0.016	0.032

Robust standard errors in brackets
*** p<0.01, ** p<0.05, * p<0.1

Note. All regressions are estimated via OLS, include country fixed effects and time fixed effects, and double-clustured standard errors by country and time.

4.4 Additional Results

In this section, I present some additional results by extending the analysis to other macroeconomic variables. As the leverage of global banks has a differentiated impact across countries, depending on their net position vis a vis global banks, I test whether this differentiated impact is also significant for other domestic macroeconomic variables such as the real exchange rate, real equity prices and real GDP. To obtain meaningful estimates, I take the log difference of those variables, and correspondingly use the change in global banks leverage as a regressor. I use the following specification:

$$\Delta Y_{i,t} = c_i + a_t + \beta_2 \Delta L_t * P^b_{i,t-1} + \beta_3 P^b_{i,t-1} + \sum_{h=1}^{4} \delta_h \Delta Y_{i,t-h} + \epsilon_{i,t} \tag{29}$$

where Δ represents the first-difference operator, $Y_{i,t}$ is the log of either the real effective exchange rate (an increase represents an appreciation), the real equity index, or real GDP, in country i and time t. L_t is the leverage of U.S. Broker-Dealers, and $P^b_{i,t-1}$ is the net external asset positions of banks counter-party resident sectors of country i on global banks at $t-1$. In some regressions, I include four lags of the dependant variable as explanatory variables to control for country-time specific conditions. All regressions are estimated via OLS, include country fixed effects and time fixed effects, and double-clustured standard errors by country and time.

Results. As in the baseline analysis, my focus is on the coefficient on the interaction between the leverage of global banks and the net assets of banks counter-party residents on global banks, reported on the first line. The coefficient on column is negative and significant for all variables, meaning that when the leverage of global banks increases, the real exchange rate appreciates more, and real equity prices and GDP increase more in countries which are net debtor against global banks. The results are significant in all regressions except for real

GDP growth when including 4 lags as controls. Results are robust to using the net external assets of all counter-party sectors on global banks $P_{i,t-1}$. As another robustness check for my baseline results, I also reproduce my results for the current account, net outflows, investment and savings in first-difference and using time fixed effects in Tables 21 and 22 in Appendix. This confirms the baseline results obtained in the previous section.

Table 5 Impact on the REER, Real Equity Returns, and Real GDP Growth

$$\Delta Y_{i,t} = c_i + a_t + \beta_2 L_t * P^b_{i,t-1} + \beta_3 P^b_{i,t-1} + \sum_{h=1}^{4} \delta_h Y_{i,t-h} + \epsilon_{i,t}$$

	Dependent Variable					
	Δ REER		Δ Equity Index		Δ Real GDP	
	(1)	(2)	(3)	(4)	(4)	(4)
Δ Global Banks Leverage	-0.249**	-0.283**	-0.384***	-0.416***	-0.031	-0.037**
# Banks Net Assets on Global Banks	[0.115]	[0.118]	[0.087]	[0.089]	[0.022]	[0.014]
Banks Net Assets on Global Banks	-0.257	-0.250	1.907	2.932*	0.829**	1.006***
	[0.567]	[0.589]	[1.247]	[1.609]	[0.328]	[0.356]
Constant	0.070***	0.064***	0.968***	1.040***	0.538***	0.709***
	[0.023]	[0.018]	[0.066]	[0.056]	[0.065]	[0.012]
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Lags Dependent Variable	Yes	No	Yes	No	Yes	No
Observations	3,900	4,108	2,908	3,068	3,415	3,557
R-squared	0.110	0.053	0.606	0.557	0.339	0.311
R-squared (within)	0.061	0.003	0.082	0.007	0.047	0.016

Robust standard errors in brackets
*** p<0.01, ** p<0.05, * p<0.1

Note. All regressions are estimated via OLS, include country fixed effects and time fixed effects, and double-clustured standard errors by country and time.

4.5 Cross-sectional Evidence

In this section, I provide some cross-sectional evidence during the global financial crisis. As a result of the global financial crisis, the leverage of U.S. broker dealers tightened markedly in 2008Q4. As shown in Figure 9 in Appendix, the change in the leverage of U.S. broker-dealers was equal to -12.5, which corresponds to a change greater than 6 standard deviations. This sudden and major financial event which originated in the U.S. financial sector is arguably exogenous to other countries' external positions, and the risk of reverse causality is limited because of the unexpected nature of the financial crisis. Thus, I use this for my identification and to obtain a causal interpretation of my results. More specifically, I test whether the net exposure of counter-party banks located in given country towards global banks is a significant determinant of the response of the current account, investment, and savings in this country during the global financial crisis. I use the following specification:

$$Y_{i,2008Q4} - Y_{i,T} = \beta_1 P^b_{i,T} + \beta_2 C_{i,T} + \beta_3 A_{i,T} + \epsilon_i \tag{30}$$

where $Y_{i,t}$ is either the current account to GDP, net outflows to GDP, the gross fixed capital formation to GDP, or savings to GDP, in country i and quarter t. $P^b_{i,t}$ is the net external asset positions of banks counter-party resident sectors of country i on global banks at t, $C_{i,t}$ is the current account to GDP, and $A_{i,t}$ is the total net external asset position of the country i at time t. I consider two different dates T for the pre-crisis values: 2008Q3 (1-quarter) or 2007Q4 (4-quarter). Because I am interested in whether the pre-shock net external positions vis-a-vis global banks has predictive power for the macroeconomic adjustment during the crisis I focus on the β_1 coefficient, reported on the first line.

Results. As shown in Table 6 the effect on the 1-quarter change in the current account balance and on net outflows is negative and significant: the higher the net external liabilities

positions of banks counter-party resident sectors of a country on global banks, the higher the increase in the current account in this country between 2007Q4 and 2008Q4. Quantitatively, a 50% GDP difference in the net liabilities towards global banks (a number equal to one cross-sectional standard deviation excluding financial centers for 2008Q3) is associated with a 5 percentage point difference change in the current account to GDP ratio between and with a 3 percentage point difference change in the investment to GDP ratio between 2008Q3 and 2008Q4. The results complement the findings of Milesi-Ferretti and Tille (2014) about the heterogeneity of the impact of the crisis on capital flows across assets and country groups.

Table 6 Impact on the Current Account, Investment, and Savings
Event-Specific Results (1-Quarter Change)

$$Y_{i,2008Q4} - Y_{i,2008Q3} = \beta_1 P^b_{i,2008Q3} + \beta_2 C_{i,2008Q3} + \beta_3 A_{i,2008Q3} + \epsilon_i$$

	Dependent Variable (2008Q3 - 2008Q4)			
2008Q3	Current Account (1)	Net Outflows (2)	Investment (3)	Savings (4)
Banks Net Assets on Global Banks	-10.002***	-20.615***	6.038**	-3.147
	[2.801]	[4.989]	[2.680]	[3.198]
Current Account	-0.579***	-0.319	0.279**	-0.329**
	[0.110]	[0.197]	[0.113]	[0.134]
Total Net External Assets	0.105***	0.078**	-0.046**	0.053**
	[0.019]	[0.034]	[0.019]	[0.022]
Constant	-0.844	-2.593**	-0.335	-1.407*
	[0.640]	[1.141]	[0.650]	[0.776]
Observations	52	52	44	44
R-squared	0.421	0.291	0.178	0.161

Robust standard errors in brackets
*** p<0.01, ** p<0.05, * p<0.1

Note. Change between 2008Q3 and 2008Q4 against variables in 2008Q3.

Additonal Results. As shown in Table 7, the effects on the 4-quarter change in net outflows and investment are still significant, but the net asset position of banks on global banks is not significant anymore in the current account regression.

Table 7 Impact on the Current Account, Investment, and Savings Event-Specific Results (4-Quarter Change)

$$Y_{i,2008Q4} - Y_{i,2007Q4} = \beta_1 P^b_{i,2007Q4} + \beta_2 C_{i,2007Q4} + \beta_3 A_{i,2007Q4} + \epsilon_i$$

	Dependent Variable (2007Q4 - 2008Q4)			
2007Q4	Current Account (1)	Net Outflows (2)	Investment (3)	Savings (4)
Banks Net Assets on Global Banks	-3.174	-21.199***	3.702**	0.803
	[2.043]	[5.050]	[1.701]	[2.098]
Current Account	-0.437***	-0.364**	0.098	-0.382***
	[0.067]	[0.166]	[0.059]	[0.073]
Total Net External Assets	0.049***	0.118***	-0.022	0.029*
	[0.016]	[0.039]	[0.013]	[0.016]
Constant	-0.187	1.210	-1.207**	-1.504**
	[0.540]	[1.334]	[0.460]	[0.567]
Observations	52	52	44	44
R-squared	0.487	0.286	0.137	0.447

Robust standard errors in brackets
*** p<0.01, ** p<0.05, * p<0.1

Note. Change between 2007Q4 and 2008Q4 against variables in 2007Q4.

Finally, as shown in Table 8, the annualized drop in real GDP was more pronounced in countries which were more net debtors vis a vis global banks. Quantitatively, a 50% GDP difference in the net liabilities towards global banks (a number equal to one cross-sectional standard deviation excluding financial centers for 2008Q3) is associated with a 4 percentage point difference in the real GDP growth between 2007Q4 and 2008Q4.

Table 8 Impact on Real GDP Growth
Event-Specific Results (4-Quarter Change)

$$Y_{i,2008Q4} - Y_{i,2007Q4} = \beta_1 P^b_{i,2007Q4} + \beta_2 C_{i,2007Q4} + \beta_3 A_{i,2007Q4} + \epsilon_i$$

	Dependent Variable (2007Q4 - 2008Q4)			
	Δ Real GDP			
2007Q4	(1)	(2)	(3)	(4)
Banks Net Assets on Global Banks	2.842**	6.098***	8.013***	8.755***
	[1.232]	[1.569]	[2.882]	[2.970]
Current Account		-0.002		-0.097
		[0.055]		[0.064]
Total Net External Assets		-0.030**		0.005
		[0.012]		[0.018]
Constant	-0.937**	-1.454***	-0.157	-0.355
	[0.426]	[0.422]	[0.470]	[0.581]
Observations	49	49	43	43
R-squared	0.102	0.278	0.159	0.243

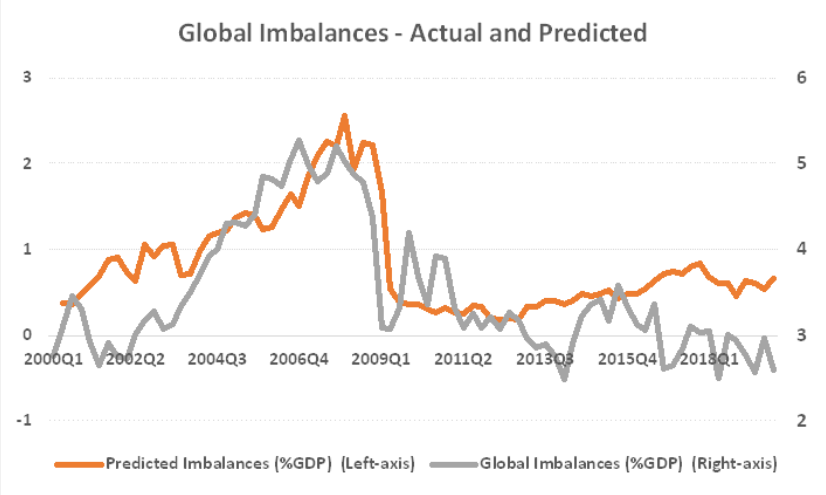
Robust standard errors in brackets
*** p<0.01, ** p<0.05, * p<0.1

Note. Change between 2007Q4 and 2008Q4 against variables in 2007Q4. Columns (3)-(4) exclude financial centers.

4.6 The Global Financial Cycle meets Global Imbalances

In this last section, I test the predictions of my model regarding global imbalances. In order to do so, I obtain the predicted values for current account balances from the regression estimated in Table 3. Then, predicted global imbalances are computed as the quarterly sum of the absolute value of predicted current account balances across countries, normalized by world nominal GDP. As shown in Figure 8, the mechanism described in my model can rationalize the increase in global imbalances which preceded the global financial crisis, as well as the reversal in global imbalances which followed the crisis.

Figure 8 Global Imbalances - Actual versus Predicted



Note. This chart shows the actual and predicted values of global imbalances. Actual global imbalances are computed as the quarterly sum of the absolute value of current account balances across countries, normalized by world nominal GDP. Predicted global imbalances are computed as the quarterly sum of the absolute value of predicted current account balances obtained from the regression estimated in Table 3 across countries, normalized by world nominal GDP. Source: IMF BOP, author's calculations.

To summarize, changes in the leverage of global financial intermediaries not only have implications for gross flows, as highlighted by the global financial cycle literature, but also for net flows and global imbalances.

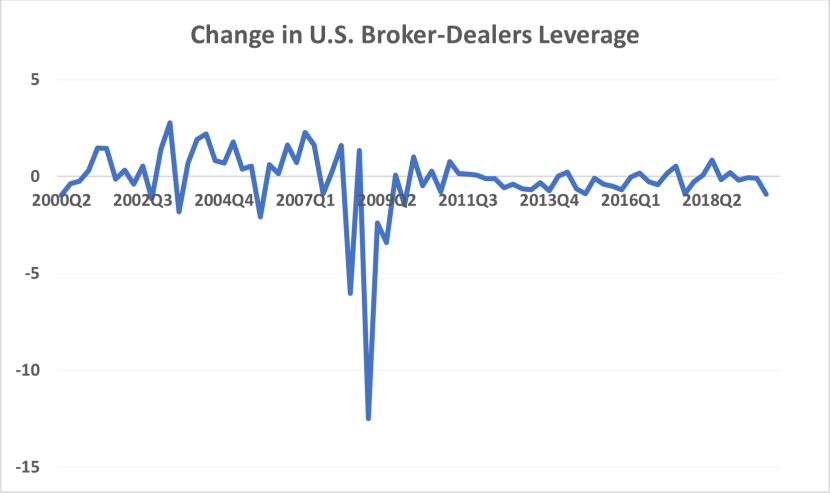
5 Conclusion

This paper develops a tractable multi-country model of the international banking system where global banks interact with local banks. In the model, consistent with the data, when the leverage of global banks goes up, countries experience higher gross capital inflows and outflows, and global imbalances increase. Thus, changes in global banks' leverage not only has impact on gross flows, but also on net flows. The main prediction of the model is that a country's net external position against global banks —its assets on global banks minus its liabilities towards global banks— plays a key role in explaining its macroeconomic response to a change in global financial conditions. In particular, countries with higher net external liabilities against global banks tend to experience a larger drop in their current account balance following a deleveraging by global banks. The main predictions of the model are borne out in a panel study of 52 advanced and emerging market countries. I also provide additional empirical evidence that this differentiated impact across countries of a change in global financial conditions is also reflected in risky asset prices and real GDP growth, in line with what is observed for the current account balance.

The model presented in this paper could be extended to include a tradable sector and a non-tradable sector in order to introduce the exchange rate. Another potential extension is to introduce a distinction between global banks' affiliates and non-related banks among local banks as in Cao et al. (2021). Finally, it would be interesting to study the normative implications of the model, and in particular the need for macro-prudential policies. This is left for future research.

A Appendix - Charts

Figure 9 Change in Global Banks' Leverage



Note. This charts shows the first-difference of the U.S. Broker-Dealer sector leverage. Source: Flows of Funds.

B Appendix - Derivations

B.1 Proofs

Proof. (Remark 1) Under Assumption 1, all representative households face the same optimization problem. Thus, their supply schedule of deposits is the same across countries. Moreover, all local banks face the same problem, and in particular the same expected rate of return R on their project, at the beginning of period 1, before uncertainty is revealed. Thus, their demand schedule for deposits is the same, both across and within countries. As a result, every local bank offers the same deposit rate and collects the same quantity of deposit. ■

Proof. (Lemma 3.1) Using Assumption 1 and Remark 1, the equilibrium condition given by equation (15) in the main text simplifies to:

$$\bar{E}_G + N\left(\bar{E}_L + \bar{d}\right) G(R_M^l) = N\left(\bar{k} - \bar{E}_L - \bar{d}\right)\left(1 - G(R_M^d)\right) \tag{B.1}$$

If the leverage constraint of global banks is binding, then we have:

$$N\left(\bar{E}_L + \bar{d}\right) G(R_M^l) = \bar{\lambda} \tag{B.2}$$

Solving for R_M^l yields:

$$R_M^l = G^{-1}\left(\frac{\bar{\lambda}}{N\left(\bar{E}_L + \bar{d}\right)}\right) \tag{B.3}$$

Using equations (B.1) and (B.2), we obtain:

$$\bar{E}_G + \bar{\lambda} = N\left(\bar{k} - \bar{E}_L - \bar{d}\right)\left(1 - G(R_M^d)\right) \tag{B.4}$$

Solving for R_M^d yields:

$$R_M^d = G^{-1}\left(1 - \frac{\bar{\lambda} + \bar{E}_G}{N\left(\bar{k} - \bar{E}_L - \bar{d}\right)}\right) \tag{B.5}$$

Using equations (B.3) and (B.5) we can solve for the leverage threshold λ^* above which the leverage constraint does not bind:

$$\lambda^* = \frac{1 + \frac{\bar{E}_G}{N\left(\bar{k} - \bar{E}_L - \bar{d}\right)}}{\frac{1}{N\left(\bar{E}_L + \bar{d}\right)} + \frac{1}{N\left(\bar{k} - \bar{E}_L - \bar{d}\right)}} \tag{B.6}$$

■

Proof. (Proposition 1) See section B.4.2. ■

Proof. (Proposition 2) As shown in Proposition 1 the impact on net flows is heterogeneous across countries. As shown in Lemma 3.1, an increase in global banks' leverage $\bar{\lambda}$ leads to higher lending rate R_M^l. This increases the option value for the local bank of lending its deposits to global banks, and it also increases the marginal value of the deposits to the local bank, conditional on using them to invest in its project. Thus, using the demand for deposits in equation (19) in the main text, this leads to an increase in the deposit rate to households R_H^i. This increase in the deposit rate leads to an increase in the equilibrium deposits for all local banks, and in all countries, using Remark 1. Thus, the impact on savings is the same across countries. As a result, the heterogeneity across countries comes from investment. ■

B.2 Equilibrium in the inter-bank wholesale market

We solve the model backwards. At the end of period 1, after uncertainty is resolved, local banks set $d_M^{i,j}$ and $l_M^{i,j}$ in order to maximize their profits in period 2:

$$\max_{d_M^{i,j}\geq 0, l_M^{i,j}\geq 0} \pi^{i,j} = \left(\underbrace{R^i + \epsilon^j}_{\equiv R^{i,j}} \right) k^{i,j} + R_M^l l_M^{i,j} - R_H^i d^{i,j} - R_M^d d_M^{i,j} \tag{B.7}$$

subject to a balance sheet identity:

$$k^{i,j} + l_M^{i,j} = E^{i,j} + d^{i,j} + d_M^{i,j} \tag{B.8}$$

and a leverage (or total assets under management) constraint:

$$k^{i,j} \leq \bar{k} \tag{B.9}$$

The Lagrangian is given by:

$$\mathcal{L}^{i,j} = R^{i,j}\left(E^{i,j} + d^{i,j} + d_M^{i,j} - l_M^{i,j}\right) + R_M^l l_M^{i,j} - R_H^i d^{i,j} - R_M^d d_M^{i,j} - \mu_1\left(\bar{k} - (E^{i,j} + d^{i,j} + d_M^{i,j} - l_M^{i,j})\right) - \mu_2(d_M^{i,j}) - \mu_3(l_M^{i,j}) \tag{B.10}$$

The FOCs are:

$$\frac{d\mathcal{L}^{i,j}}{dd_M^{i,j}} = 0 \ : \ R^{i,j} - R_M^d = \mu_1 + \mu_2 \tag{B.11}$$

$$\frac{d\mathcal{L}^{i,j}}{dl_M^{i,j}} = 0 \ : R^{i,j} - R_M^l = \mu_1 - \mu_3 \tag{B.12}$$

As will be seen below, the leverage constraint of local banks never binds (i.e. the sum of their initial capital endowment and deposits raised from households is never greater than the maximum amount they can invest in their project) so that local banks have the ability

to borrow on the inter-bank market if their project has a high return.

Global banks maximize their period 2 profits:

$$\max_{d_M^g} \pi^g = R_M^d l_M^g - R_M^l d_M^g \tag{B.13}$$

subject to a balance sheet identity:

$$l_M^g = E^g + d_M^g \tag{B.14}$$

and a leverage constraint:

$$d_M^g \leq \bar{\lambda} \tag{B.15}$$

The Lagrangian is given by:

$$\mathcal{L}^g = R_M^d \left(E^g + d_M^g\right) - R_M^l d_M^g + \mu^g \left[\bar{\lambda} - d_M^g\right] \tag{B.16}$$

The FOC is:

$$\frac{d\mathcal{L}^g}{dd_M^g} = 0 \ : \ R_M^d = R_M^l + \mu^g \tag{B.17}$$

There is a wedge between the lending and borrowing rates on the inter-bank market if and only if the leverage constraint is binding.

B.3 Equilibrium in the retail markets for local deposits

At the beginning of period 1, before uncertainty is resolved, local banks compete to raise deposits $d^{i,j}$ from their home representative household. As derived above, the profits of local

bank j located in country i in period 2 are:

$$\pi^{i,j} = \begin{cases} R_M^l \left(E^{i,j} + d^{i,j}\right) - R_H^i d^{i,j} & \text{with probability } G(R_M^l) \\ R^{i,j} \left(E^{i,j} + d^{i,j}\right) - R_H^i d^{i,j} & \text{with probability } G(R_M^d) - G(R_M^l) \\ R^{i,j} \left(E^{i,j} + d^{i,j}\right) - R_H^i d^{i,j} + \left(R^{i,j} - R_M^d\right) d_M^{i,j} & \text{with probability } 1 - G(R_M^d) \end{cases} \tag{B.18}$$

In order to derive local banks' demand for deposits, it will be useful to introduce the following lemma.

Lemma B.1 *The deposit rate for households in any country i is strictly higher than the lending rate on the inter-bank market: $R_H^i > R_M^l$.*

Proof. Assume $R_H^i < R_M^l$. Then, a local bank in country i can set $R_H^i + \epsilon < R_M^l - \epsilon$, where ϵ is arbitrarily small, raise more deposits from households at the beginning of period 1, lend them on the inter-bank market at the end of period 1 and make a profit. Thus, this is not an equilibrium. Assume $R_H^i = R_M^l$. Then, a local bank in country i can set $R_H^i + \epsilon < R_M^l - \epsilon$, where ϵ is arbitrarily small, raise more deposits from households at the beginning of period 1, and either lend them on the inter-bank market or use them to invest in its project at the end of period 1, and increase its expected profits. Thus, this is not an equilibrium. ■

Corollary 1 *No local bank will raise deposits $d^{i,j}$ such that $d^{i,j} > \bar{k} - E^{i,j}$.*

Proof. Assume one local bank raises $d^{i,j} > \bar{k} - E^{i,j}$. Then, using the balance sheet identity, we must have $l_M^{i,j} > 0$ independently of the realization of the stochastic return $R^{i,j}$. Yet, because $R_H^i > R_M^l$, the local bank incurs a loss with certainty, independently of the realization of its stochastic return, equal to a least $(R_H^i - R_M^l) * (d^{i,j} - \bar{k} + E^{i,j})$. The local bank can unambiguously increase its profits by instead setting $d^{i,j} = \bar{k} - E^{i,j}$. Thus, this is not an equilibrium. ■

Local banks set their deposits $d^{i,j}$ in order to maximize their period-2 expected profits:

$$\max_{d^{i,j}} \ \mathbb{E}[\pi^{i,j}] = \left[G(R_M^l)R_M^l + \left(1 - G(R_M^l)\right)\mathbb{E}\left[R^{i,j}|R^{i,j} > R_M^l\right]\right]\left(E^{i,j} + d^{i,j}\right) + \left(1 - G(R_M^d)\right)\left(\mathbb{E}\left[R^{i,j}|R^{i,j} > R_M^d\right] - R_M^d\right)d_M^{i,j} - R_H^i d^{i,j}$$

Their demand for deposits is given by their first-order condition:

$$\frac{d\,\mathbb{E}[\pi^{i,j}]}{dd^{i,j}} = 0 \ : \ G(R_M^l)R_M^l + \left(1 - G(R_M^l)\right)\mathbb{E}\left[R^{i,j}|R^{i,j} > R_M^l\right] = R_H^i \tag{B.19}$$

Given Corollary 1, local banks' demand for deposits is given by Equation (B.19) and is bounded by $d^{i,j} = \bar{k} - E^{i,j}$.

Households in country i maximize:

$$\max_{d^i} U^i = u(c_1^i) + \beta^i\,\mathbb{E}[c_2^i] \tag{B.20}$$

Their budget constraints in period 1 and 2 are given by:

$$c_1^i + d^i = W^i \tag{B.21}$$

$$c_2^j = R_H^i d^i \tag{B.22}$$

The supply of deposits d^i is given by households' first-order condition:

$$u'(W^i - d^i) = \beta^i R_H^i \tag{B.23}$$

B.4 Country Aggregates

B.4.1 Special case

The external assets of country i are given by:

$$A^i = \left(1-s^i\right)\int_j l_M^{i,j} + s^i\left[\sum_{i=1}^{N}\int_j \left(k-E^{i,j}-d^{i,j}\right)\mathbb{I}(R^{i,j}>R_M^d) - \int_j \left(k-E^{i,j}-d^{i,j}\right)\mathbb{I}(R^{i,j}>R_M^d)\right] \tag{B.24}$$

$$= \left(1-s^i\right)\left(\bar{E}_L+\bar{d}\right)G(R_M^l) + s^i\left[(N-1)\left(k-\bar{E}_L-\bar{d}\right)\left(1-G(R_M^d)\right)\right] \tag{B.25}$$

$$= \left(1-s^i\right)\frac{\bar{\lambda}}{N} + s^i\left(\frac{N-1}{N}\right)\left(\bar{E}_G+\bar{\lambda}\right) \tag{B.26}$$

Using equations (B.2) and (B.4) to move from the second to third line.

The external liabilities of country i are given by:

$$L^i = \left(1-s^i\right)\int_j d_M^{i,j} + s^i\left[\sum_{i=1}^{N}\int_j \left(E^{i,j}+d^{i,j}\right)\mathbb{I}(R^{i,j}<R_M^l) - \int_j \left(E^{i,j}+d^{i,j}\right)\mathbb{I}(R^{i,j}<R_M^l)\right] \tag{B.27}$$

$$= \left(1-s^i\right)\left(k-\bar{E}_L-\bar{d}\right)\left(1-G(R_M^d)\right) + s^i\left[(N-1)\left(\bar{E}_L+\bar{d}\right)G(R_M^l)\right] \tag{B.28}$$

$$= \left(1-s^i\right)\frac{\bar{E}_G+\bar{\lambda}}{N} + s^i\left(\frac{N-1}{N}\right)\bar{\lambda} \tag{B.29}$$

The derivatives of external positions with respect to the leverage of global banks and the share of global banks are:

$$\frac{dA^i}{d\bar{\lambda}} = \frac{dL^i}{d\bar{\lambda}} = \frac{1}{N} + \left(\frac{N-2}{N}\right)s^i > 0 \tag{B.30}$$

$$\frac{dA^i}{ds^i} = \left(\frac{N-1}{N}\right)\bar{E}_G + \left(\frac{N-2}{N}\right)\bar{\lambda} > 0 \tag{B.31}$$

$$\frac{dL^i}{ds^i} = \left(\frac{-1}{N}\right)\bar{E}_G + \left(\frac{N-2}{N}\right)\bar{\lambda} > 0 \tag{B.32}$$

B.4.2 General case

The external assets of country i are given by:

$$A^i = \left(1-s^i\right)\int_j l_M^{i,j} + s^i\left[\sum_{i=1}^{N}\int_j \left(k-E^{i,j}-d^{i,j}\right)\mathbb{I}(R^{i,j}>R_M^d) - \int_j \left(k-E^{i,j}-d^{i,j}\right)\mathbb{I}(R^{i,j}>R_M^d)\right] \tag{B.33}$$

$$= \left(1-s^i\right)\left(\bar{E}_L+\bar{d}\right)F_i(R_M^l) + s^i\left[N\left(k-\bar{E}_L-\bar{d}\right)\left(1-G(R_M^d)\right) - \left(k-\bar{E}_L-\bar{d}\right)\left(1-F_i(R_M^d)\right)\right] \tag{B.34}$$

$$= \left(1-s^i\right)\frac{\bar{\lambda}}{N}\frac{F_i(R_M^l)}{G(R_M^l)} + s^i\left[\left(\bar{E}_G+\bar{\lambda}\right) - \frac{\left(\bar{E}_G+\bar{\lambda}\right)\left(1-F_i(R_M^d)\right)}{N\left(1-G(R_M^d)\right)}\right] \tag{B.35}$$

$$= \left(1-s^i\right)\frac{\bar{\lambda}}{N}\frac{F_i(R_M^l)}{G(R_M^l)} + s^i\left(\bar{E}_G+\bar{\lambda}\right)\left[\frac{N\left(1-G(R_M^d)\right)-\left(1-F_i(R_M^d)\right)}{N\left(1-G(R_M^d)\right)}\right] \tag{B.36}$$

Using equations (B.2) and (B.4) to move from the second to third line.

The external liabilities of country i are given by:

$$L^i = \left(1-s^i\right)\int_j d_M^{i,j} + s^i\left[\sum_{i=1}^{N}\int_j \left(E^{i,j}+d^{i,j}\right)\mathbb{I}(R^{i,j}<R_M^l) - \int_j \left(E^{i,j}+d^{i,j}\right)\mathbb{I}(R^{i,j}<R_M^l)\right] \tag{B.37}$$

$$= \left(1-s^i\right)\left(k-\bar{E}_L-\bar{d}\right)\left(1-F_i(R_M^d)\right) + s^i\left[N\left(\bar{E}_L+\bar{d}\right)G(R_M^l) - \left(\bar{E}_L+\bar{d}\right)F_i(R_M^l)\right] \tag{B.38}$$

$$= \left(1-s^i\right)\frac{\bar{E}_G+\bar{\lambda}}{N}\frac{1-F_i(R_M^d)}{1-G(R_M^d)} + s^i\bar{\lambda}\left[\frac{NG(R_M^l)-F_i(R_M^l)}{NG(R_M^l)}\right] \tag{B.39}$$

The net external assets of country i, are given by:

$$N^i \equiv A^i - L^i = N^i = \frac{\bar{\lambda}}{N}\left[\frac{F_i(R_M^l)}{G(R_M^l)} - \frac{1-F_i(R_M^d)}{1-G(R_M^d)}\right] + \frac{\bar{E}_G}{N}\left[s^iN - \frac{1-F_i(R_M^d)}{1-G(R_M^d)}\right]$$

The derivatives of external positions with respect to the leverage of global banks are:

$$\frac{dA^i}{d\bar{\lambda}} = \left(1 - s^i\right) \frac{1}{N} \frac{F_i(R_M^l)}{G(R_M^l)} + s^i \frac{1}{N} \left[N - \frac{\left(1 - F_i(R_M^d)\right)}{\left(1 - G(R_M^d)\right)} \right] \tag{B.40}$$

$$\frac{dL^i}{d\bar{\lambda}} = \left(1 - s^i\right) \frac{1}{N} \frac{1 - F_i(R_M^d)}{1 - G(R_M^d)} + s^i \frac{1}{N} \left[N - \frac{F_i(R_M^l)}{G(R_M^l)} \right] \tag{B.41}$$

$$\frac{dN^i}{d\bar{\lambda}} = \frac{1}{N} \left[\frac{F_i(R_M^l)}{G(R_M^l)} - \frac{1 - F_i(R_M^d)}{1 - G(R_M^d)} \right] \tag{B.42}$$

C Appendix - Empirical Analysis

C.1 Sample - Countries

Table 9 Advanced Economies

Country Name	ISO	WEO	fincenter
United States	USA	111	0
Austria	AUT	122	0
Denmark	DNK	128	0
France	FRA	132	0
Germany	DEU	134	0
Italy	ITA	136	0
Norway	NOR	142	0
Sweden	SWE	144	0
Canada	CAN	156	0
Japan	JPN	158	0
Finland	FIN	172	0
Greece	GRC	174	0
Portugal	PRT	182	0
Spain	ESP	184	0
Australia	AUS	193	0
New Zealand	NZL	196	0
United Kingdom	GBR	112	1
Belgium	BEL	124	1
Netherlands, The	NLD	138	1
Switzerland	CHE	146	1
Ireland	IRL	178	1
China, P.R.: Hong Kong	HKG	532	1

Table 10 Emerging Market Economies

Country Name	ISO	WEO	fincenter
Turkey	TUR	186	0
South Africa	ZAF	199	0
Argentina	ARG	213	0
Bolivia	BOL	218	0
Brazil	BRA	223	0
Chile	CHL	228	0
Colombia	COL	233	0
Costa Rica	CRI	238	0
Mexico	MEX	273	0
Peru	PER	293	0
Uruguay	URY	298	0
Israel	ISR	436	0
India	IND	534	0
Korea, Rep. of	KOR	542	0
Philippines	PHL	566	0
Thailand	THA	578	0
Armenia, Rep. of	ARM	911	0
Bulgaria	BGR	918	0
Russian Federation	RUS	922	0
China, P.R.: Mainland	CHN	924	0
Czech Rep.	CZE	935	0
Slovak Rep.	SVK	936	0
Latvia	LVA	941	0
Hungary	HUN	944	0
Lithuania	LTU	946	0
Croatia, Rep. of	HRV	960	0
Slovenia, Rep. of	SVN	961	0
North Macedonia, Republic of	MKD	962	0
Poland, Rep. of	POL	964	0
Romania	ROU	968	0

C.2 Variables - Definitions and Sources

The data set includes the period 2000:Q1-2019:Q4 (subject to availability) for the following variables:

Global banks leverage. U.S. Broker-Dealers leverage computed as the ratio of assets to equity of the U.S. broker-dealer sector and obtained from the Federal Reserve's Flow of Funds.

VIX. CBOE Volatility Index (VIX Index).

World GDP growth rate. Source: OECD, IMF, IFS,Bloomberg.

Nominal and Real GDP. Source: IMF IFS, Global Financial Database.

Consumer prices. Consumer price index. Source: IMF IFS, Global Financial Database.

Net Assets on Global Banks. Computed as liabilities (all instruments, in all currencies) of all BIS reporting banks vis-a-vis all counter-party sectors located in the country minus claims (all instruments, in all currencies) of all BIS reporting banks vis-a-vis all counter-party sectors located in the country. The net external position vis-a-vis global banks is normalized by the counter-party country's GDP. Source: BIS.

Banks Net Assets on Global Banks. Computed as liabilities (all instruments, in all currencies) of all BIS reporting banks vis-a-vis the banking counter-party sector located in the country minus claims (all instruments, in all currencies) of all BIS reporting banks vis-a-vis the banking counter-party sector located in the country. The net external position vis-a-vis global banks is normalized by the counter-party country's GDP. Source: BIS.

Net flows. Computed as the difference between total gross outflows and total gross inflows as a share of GDP. Total gross inflows are computed as the sum of FDI gross inflows, portfolio gross inflows, and other investment gross inflows. Total gross outflows are computed as the sum of FDI gross outflows, portfolio gross outflows, other investment gross outflows, and reserves outflows. Source: IMF BOP database.

Current account to GDP ratio. Current account balance as a share of nominal GDP. Source: IMF IFS, IMF BOP.

Investment. Gross fixed capital formation as a share of GDP. Source: IMF IFS.

Savings. Computed as the difference between the sum of the current account to GDP ratio and investment to GDP ratio.

Equity index. Equity price index deflated by consumer price index. Source: IMF IFS, Global Financial Database.

Real effective exchange rate. Index such that an increase is an appreciation. Source: IMF IFS, BIS, Global Financial Database.

Total net external assets. Total external assets minus total external liabilities, normalized by GDP. Source: Lane and Milesi-Ferretti (2001) updated database.

C.3 Additional Empirical Results

Table 11 Summary Statistics

	All			Excl. Financial Centers		
	Count	Mean	Std	Count	Mean	Std
Global Banks Leverage	4160	28.12	9.18	3680	28.12	9.18
Δ Global Banks Leverage	4108	-0.16	1.86	3634	-0.16	1.86
Net Assets on Global Banks	4160	-0.09	0.29	3680	-0.10	0.16
Banks Net Assets on Global Banks	4160	-0.03	0.20	3680	-0.04	0.11
Total Net External Assets	4140	-17.39	63.87	3660	-27.20	41.42
World Real GDP Growth	4108	0.67	0.50	3634	0.67	0.50
VIX	4160	19.49	7.81	3680	19.49	7.81
Δ VIX	4108	-0.64	22.41	3634	-0.64	22.41
Current Account	4092	-0.36	6.28	3640	-0.85	5.98
Δ Current Account	4040	0.02	5.13	3594	0.03	4.83
Net Outflows	4090	-0.42	7.45	3638	-0.84	6.43
Δ Net Outflows	4037	-0.24	27.98	3591	-0.15	17.73
Investment	3539	23.06	5.24	3059	23.10	5.16
Δ Investment	3493	0.00	4.54	3019	-0.01	4.24
Savings	3491	22.87	6.89	3039	22.36	6.60
Δ Savings	3445	0.02	4.75	2999	0.02	4.88
Δ Real Equity Index	3068	0.91	9.30	2594	1.03	9.57
Δ Real GDP	3599	0.67	1.27	3128	0.68	1.19

Table 12 Net Debtors and Net Creditors vis a vis Global Banks

Country Name	ISO	WEO	Group	fincenter	Average Net Position (%GDP)	Prob.
Ireland	IRL	178	AE	1	-343	28%
Portugal	PRT	182	AE	0	-170	0%
Netherlands, The	NLD	138	AE	1	-169	0%
Austria	AUT	122	AE	0	-113	0%
Spain	ESP	184	AE	0	-113	0%
Norway	NOR	142	AE	0	-113	0%
Finland	FIN	172	AE	0	-110	13%
Hungary	HUN	944	EMDE	0	-109	6%
Italy	ITA	136	AE	0	-106	0%
Croatia, Rep. of	HRV	960	EMDE	0	-106	26%
Denmark	DNK	128	AE	0	-100	6%
Slovenia, Rep. of	SVN	961	EMDE	0	-94	40%
Sweden	SWE	144	AE	0	-85	4%
France	FRA	132	AE	0	-74	0%
Latvia	LVA	941	EMDE	0	-72	48%
Greece	GRC	174	AE	0	-69	40%
Lithuania	LTU	946	EMDE	0	-67	31%
New Zealand	NZL	196	AE	0	-66	4%
Slovak Rep.	SVK	936	EMDE	0	-62	15%
Australia	AUS	193	AE	0	-61	0%
Romania	ROU	968	EMDE	0	-58	40%
Turkey	TUR	186	EMDE	0	-48	28%
Poland, Rep. of	POL	964	EMDE	0	-46	34%
Czech Rep.	CZE	935	EMDE	0	-46	26%
Canada	CAN	156	AE	0	-42	23%
Korea, Rep. of	KOR	542	EMDE	0	-31	66%
Brazil	BRA	223	EMDE	0	-29	70%
Chile	CHL	228	EMDE	0	-27	74%
United States	USA	111	AE	0	-26	93%
Japan	JPN	158	AE	0	-18	78%
Bulgaria	BGR	918	EMDE	0	-17	63%
Thailand	THA	578	EMDE	0	-17	93%
India	IND	534	EMDE	0	-16	88%
Philippines	PHL	566	EMDE	0	-15	95%
Costa Rica	CRI	238	EMDE	0	-13	100%
Colombia	COL	233	EMDE	0	-5	100%
United Kingdom	GBR	112	AE	1	-4	65%
Mexico	MEX	273	EMDE	0	-3	100%
Peru	PER	293	EMDE	0	-2	100%
China, P.R.: Mainland	CHN	924	EMDE	0	-2	100%
Germany	DEU	134	AE	0	1	85%
Argentina	ARG	213	EMDE	0	4	98%
Russian Federation	RUS	922	EMDE	0	5	99%
Georgia	GEO	915	EMDE	0	6	98%
Armenia, Rep. of	ARM	911	EMDE	0	6	89%
South Africa	ZAF	199	EMDE	0	7	100%
North Macedonia, Republic of	MKD	962	EMDE	0	16	100%
Belgium	BEL	124	AE	1	21	84%
Israel	ISR	436	EMDE	0	38	100%
Bolivia	BOL	218	EMDE	0	44	100%
Uruguay	URY	298	EMDE	0	100	100%
Switzerland	CHE	146	AE	1	261	100%
China, P.R.: Hong Kong	HKG	532	AE	1	305	88%

Note. Average Net Position measures the average net position vis a vis global banks over the period 2000Q1-2019Q4 as a share of GDP. The cross-country average of this measure is equal to -35% GDP. Prob measures the probability that the net position vis a vis global banks is above this unconditional average of -35% GDP. The upper sample shows the net debtor countries, defined as countries with an average net position below the unconditional average and a Prob lower than 50%. The lower sample shows the net creditor countries, defined as countries with an average net position above the unconditional average and a Prob higher than 50%.

Table 13 Baseline Results - Excluding Financial Centers

	Dependent Variable			
	Current Account	Net Outflows	Investment	Savings
	(1)	(2)	(3)	(4)
Global Banks Leverage	0.385**	0.573***	-0.293**	0.098
# Net Assets on Global Banks	[0.148]	[0.173]	[0.129]	[0.137]
Global Banks Leverage	-0.024	-0.018	0.098**	0.086**
	[0.034]	[0.048]	[0.041]	[0.041]
Net Assets on Global Banks	-7.901	-12.860**	9.176**	1.729
	[5.068]	[5.853]	[3.822]	[4.829]
World Real GDP Growth	-0.078	-0.447	0.419	0.285
	[0.246]	[0.318]	[0.463]	[0.360]
VIX	-0.023	-0.062***	0.035	0.013
	[0.020]	[0.021]	[0.026]	[0.023]
Lagged Dependent Variable	0.256*	0.225***	0.244***	0.108**
	[0.132]	[0.054]	[0.060]	[0.047]
Constant	0.864	1.696	13.885***	17.715***
	[1.186]	[1.608]	[1.840]	[1.831]
Country FE	Yes	Yes	Yes	Yes
Country-specific Time Trend	Yes	Yes	Yes	Yes
Observations	3,594	3,591	3,019	2,999
R-squared	0.589	0.459	0.585	0.696
R-squared (within)	0.129	0.121	0.165	0.041

Robust standard errors in brackets
*** p<0.01, ** p<0.05, * p<0.1

Note. All regressions are estimated via OLS, include country fixed effects and country-specific linear time trends, and double-clustured standard errors by country and time. Excluding financial centers.

Table 14 Baseline Results - Excluding Financial Centers and Financial Crisis Years (2007-2009)

	Dependent Variable			
	Current Account	Net Outflows	Investment	Savings
	(1)	(2)	(3)	(4)
Global Banks Leverage	0.491***	0.698***	-0.288*	0.152
# Net Assets on Global Banks	[0.180]	[0.195]	[0.167]	[0.200]
Global Banks Leverage	0.000	0.019	0.093*	0.092
	[0.043]	[0.052]	[0.050]	[0.061]
Net Assets on Global Banks	-10.763*	-16.042***	10.020**	0.996
	[5.674]	[5.735]	[4.711]	[6.291]
World Real GDP Growth	-0.093	-0.564	0.256	0.174
	[0.404]	[0.343]	[0.332]	[0.457]
VIX	-0.015	-0.048***	0.034	0.018
	[0.024]	[0.017]	[0.022]	[0.026]
Lagged Dependent Variable	0.165	0.158***	0.186***	0.086
	[0.129]	[0.049]	[0.062]	[0.053]
Constant	-0.009	0.495	15.607***	18.163***
	[1.290]	[1.506]	[1.935]	[2.595]
Country FE	Yes	Yes	Yes	Yes
Country-specific Time Trend	Yes	Yes	Yes	Yes
Observations	2,996	2,993	2,525	2,505
R-squared	0.562	0.445	0.589	0.704
R-squared (within)	0.055	0.061	0.079	0.028

Robust standard errors in brackets
*** p<0.01, ** p<0.05, * p<0.1

Note. All regressions are estimated via OLS, include country fixed effects and country-specific linear time trends, and double-clustured standard errors by country and time. Excluding financial centers and financial crisis years (2007-2009).

Table 15 Baseline Results - Using Banks Net Assets on Global Banks

	Dependent Variable			
	Current Account	Net Outflows	Investment	Savings
	(1)	(2)	(3)	(4)
Global Banks Leverage	0.236**	0.438***	-0.254***	-0.075
# Banks Net Assets on Global Banks	[0.090]	[0.113]	[0.060]	[0.070]
Global Banks Leverage	-0.061*	-0.081*	0.121***	0.059**
	[0.033]	[0.043]	[0.030]	[0.028]
Banks Net Assets on Global Banks	-3.791	-10.955***	8.639***	5.230**
	[2.872]	[3.489]	[2.818]	[2.201]
World Real GDP Growth	0.074	-0.357	0.289	0.346
	[0.234]	[0.295]	[0.410]	[0.317]
VIX	-0.022	-0.077***	0.027	0.003
	[0.019]	[0.024]	[0.023]	[0.021]
Lagged Dependent Variable	0.225*	0.130	0.215***	0.148***
	[0.116]	[0.090]	[0.057]	[0.051]
Constant	1.878	3.632**	14.100***	17.694***
	[1.152]	[1.495]	[1.664]	[1.571]
Country FE	Yes	Yes	Yes	Yes
Country-specific Time Trend	Yes	Yes	Yes	Yes
Observations	4,040	4,037	3,493	3,445
R-squared	0.589	0.423	0.544	0.728
R-squared (within)	0.092	0.057	0.133	0.048

Robust standard errors in brackets
*** p<0.01, ** p<0.05, * p<0.1

Note. All regressions are estimated via OLS, include country fixed effects and country-specific linear time trends, and double-clustured standard errors by country and time. Using banks position vis a vis global banks.

Table 16 Baseline Results - Using Banks Net Assets on Global Banks and Excluding Financial Centers

	Dependent Variable			
	Current Account	Net Outflows	Investment	Savings
	(1)	(2)	(3)	(4)
Global Banks Leverage	0.530**	0.775***	-0.379*	0.124
# Banks Net Assets on Global Banks	[0.238]	[0.286]	[0.204]	[0.187]
Global Banks Leverage	-0.043	-0.046	0.114***	0.074*
	[0.035]	[0.046]	[0.038]	[0.038]
Banks Net Assets on Global Banks	-12.200	-18.632*	11.420*	0.705
	[8.077]	[9.490]	[6.082]	[6.394]
World Real GDP Growth	-0.106	-0.476	0.404	0.239
	[0.248]	[0.321]	[0.463]	[0.369]
VIX	-0.025	-0.064***	0.032	0.007
	[0.021]	[0.022]	[0.026]	[0.023]
Lagged Dependent Variable	0.266**	0.237***	0.247***	0.116**
	[0.132]	[0.057]	[0.059]	[0.046]
Constant	1.266	2.329	13.371***	17.690***
	[1.209]	[1.558]	[1.683]	[1.731]
Country FE	Yes	Yes	Yes	Yes
Country-specific Time Trend	Yes	Yes	Yes	Yes
Observations	3,594	3,591	3,019	2,999
R-squared	0.586	0.455	0.584	0.694
R-squared (within)	0.122	0.114	0.163	0.034

Robust standard errors in brackets
*** p<0.01, ** p<0.05, * p<0.1

Note. All regressions are estimated via OLS, include country fixed effects and country-specific linear time trends, and double-clustured standard errors by country and time. Excluding financial centers and using banks position vis a vis global banks.

Table 17 Baseline Results - Using Banks Net Assets on Global Banks and Excluding Financial Centers and Financial Crisis Years (2007-2009)

	Dependent Variable			
	Current Account	Net Outflows	Investment	Savings
	(1)	(2)	(3)	(4)
Global Banks Leverage	0.701**	1.003***	-0.370	0.219
# Banks Net Assets on Global Banks	[0.266]	[0.354]	[0.258]	[0.264]
Global Banks Leverage	-0.023	-0.014	0.108**	0.078
	[0.043]	[0.050]	[0.044]	[0.055]
Banks Net Assets on Global Banks	-15.837*	-23.446**	11.983*	-0.406
	[8.246]	[9.838]	[7.053]	[8.190]
World Real GDP Growth	-0.084	-0.549	0.227	0.142
	[0.406]	[0.343]	[0.329]	[0.459]
VIX	-0.015	-0.048***	0.031	0.014
	[0.023]	[0.017]	[0.021]	[0.027]
Lagged Dependent Variable	0.169	0.164***	0.189***	0.091*
	[0.129]	[0.050]	[0.060]	[0.053]
Constant	0.479	1.205	15.067***	18.164***
	[1.298]	[1.459]	[1.733]	[2.416]
Country FE	Yes	Yes	Yes	Yes
Country-specific Time Trend	Yes	Yes	Yes	Yes
Observations	2,996	2,993	2,525	2,505
R-squared	0.560	0.442	0.588	0.702
R-squared (within)	0.051	0.056	0.077	0.024

Robust standard errors in brackets
*** p<0.01, ** p<0.05, * p<0.1

Note. All regressions are estimated via OLS, include country fixed effects and country-specific linear time trends, and double-clustured standard errors by country and time. Excluding financial centers and financial crisis years (2007-2009) and using banks position vis a vis global banks.

Table 18 Robustness - Without Lagged Dependent Variable - Using Banks Net Assets on Global Banks

	Dependent Variable			
	Current Account	Net Outflows	Investment	Savings
	(1)	(2)	(3)	(4)
Global Banks Leverage	0.299***	0.499***	-0.314***	-0.087
# Banks Net Assets on Global Banks	[0.109]	[0.127]	[0.069]	[0.085]
Global Banks Leverage	-0.076*	-0.091*	0.153***	0.070**
	[0.038]	[0.048]	[0.036]	[0.032]
Banks Net Assets on Global Banks	-4.210	-11.818***	10.265***	6.198**
	[3.523]	[3.858]	[3.312]	[2.601]
World Real GDP Growth	0.207	-0.277	0.135	0.326
	[0.218]	[0.293]	[0.419]	[0.321]
VIX	-0.026	-0.083***	0.032	0.003
	[0.019]	[0.025]	[0.026]	[0.023]
Constant	2.250*	3.959**	18.157***	20.828***
	[1.277]	[1.645]	[1.452]	[1.268]
Country FE	Yes	Yes	Yes	Yes
Country-specific Time Trend	Yes	Yes	Yes	Yes
Observations	4,044	4,043	3,497	3,452
R-squared	0.568	0.413	0.524	0.722
R-squared (within)	0.045	0.041	0.092	0.026

Robust standard errors in brackets
*** p<0.01, ** p<0.05, * p<0.1

Note. All regressions are estimated via OLS, include country fixed effects and country-specific linear time trends, and double-clustured standard errors by country and time. Without lagged dependent variable in control variables using banks positions vis a vis global banks.

Table 19 Robustness - With Time Fixed Effects - Using Banks Net Assets on Global Banks

	Dependent Variable			
	Current Account	Net Outflows	Investment	Savings
	(1)	(2)	(3)	(4)
Global Banks Leverage	0.277**	0.447***	-0.250***	-0.016
# Banks Net Assets on Global Banks	[0.129]	[0.145]	[0.077]	[0.093]
Banks Net Assets on Global Banks	-4.860	-11.847*	9.263**	5.888*
	[4.891]	[5.984]	[3.924]	[3.363]
Constant	-0.279***	-0.421***	23.172***	23.108***
	[0.062]	[0.098]	[0.086]	[0.048]
Country FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
Observations	4,044	4,043	3,497	3,452
R-squared	0.489	0.338	0.457	0.698
R-squared (within)	0.029	0.023	0.014	0.033

Robust standard errors in brackets
*** p<0.01, ** p<0.05, * p<0.1

Note. All regressions are estimated via OLS, include country fixed effects and time fixed effects, and double-clustured standard errors by country and time. Using banks positions vis a vis global banks.

Table 20 Impact on the Current Account, Investment, and Savings
Additional Results

	Dependent Variable			
	Δ Current Account	Δ Net Outflows	Δ Investment	Δ Savings
	(1)	(2)	(3)	(4)
Δ Global Banks Leverage	0.099*	0.512***	-0.076***	0.018
# Net Assets on Global Banks	[0.050]	[0.162]	[0.026]	[0.047]
Δ Global Banks Leverage	-0.040	0.110	0.052	0.000
	[0.083]	[0.088]	[0.083]	[0.030]
Net Assets on Global Banks	-0.818	-2.041	1.579***	0.422
	[0.711]	[1.444]	[0.482]	[0.349]
World Real GDP Growth	-0.130	-0.582**	0.787***	0.598***
	[0.219]	[0.279]	[0.292]	[0.119]
Δ VIX	-0.003	-0.015**	0.013**	0.008**
	[0.005]	[0.007]	[0.005]	[0.003]
Constant	0.042	0.241	-0.353*	-0.327***
	[0.130]	[0.190]	[0.196]	[0.082]
Country FE	Yes	Yes	Yes	Yes
Country-specific Time Trend	Yes	Yes	Yes	Yes
Lags Dependent Variable	Yes	Yes	Yes	Yes
Observations	3,832	3,825	3,309	3,261
R-squared	0.638	0.408	0.667	0.774
R-squared (within)	0.638	0.407	0.667	0.774

Robust standard errors in brackets
*** p<0.01, ** p<0.05, * p<0.1

Note. All regressions are estimated via OLS, include country fixed effects and country-specific linear time trends, and double-clustured standard errors by country and time.

Table 21 Impact on the Current Account, Investment, and Savings
Additional Results - Robustness - With Time Fixed Effects

	Dependent Variable			
	Δ Current Account	Δ Net Outflows	Δ Investment	Δ Savings
	(1)	(2)	(3)	(4)
Δ Global Banks Leverage	0.112***	0.549***	-0.083**	0.027
# Net Assets on Global Banks	[0.040]	[0.145]	[0.031]	[0.055]
Net Assets on Global Banks	-0.739**	-0.908	1.501***	0.692**
	[0.325]	[0.905]	[0.514]	[0.311]
Constant	-0.029	-0.058	0.144***	0.094***
	[0.022]	[0.064]	[0.033]	[0.025]
Country FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
Lags Dependent Variable	Yes	Yes	Yes	Yes
Observations	3,832	3,825	3,309	3,261
R-squared	0.652	0.426	0.687	0.779
R-squared (within)	0.633	0.408	0.664	0.759

Robust standard errors in brackets
*** p<0.01, ** p<0.05, * p<0.1

Note. All regressions are estimated via OLS, include country fixed effects and time fixed effects, and double-clustured standard errors by country and time.

Table 22 Impact on the Current Account, Investment, and Savings Additional Results - Robustness - With Time Fixed Effects and Using Bank Net Assets on Global Banks

	Dependent Variable			
	Δ Current Account	Δ Net Outflows	Δ Investment	Δ Savings
	(1)	(2)	(3)	(4)
Δ Global Banks Leverage	0.147**	0.761***	-0.146**	0.007
# Banks Net Assets on Global Banks	[0.061]	[0.229]	[0.058]	[0.077]
Banks Net Assets on Global Banks	-1.225**	-1.518	1.898**	0.604
	[0.479]	[1.147]	[0.856]	[0.471]
Constant	-0.002	-0.023	0.063**	0.046***
	[0.017]	[0.034]	[0.029]	[0.014]
Country FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
Lags Dependent Variable	Yes	Yes	Yes	Yes
Observations	3,832	3,825	3,309	3,261
R-squared	0.652	0.426	0.686	0.778
R-squared (within)	0.634	0.408	0.663	0.759

Robust standard errors in brackets
*** p<0.01, ** p<0.05, * p<0.1

Note. All regressions are estimated via OLS, include country fixed effects and time fixed effects, and double-clustured standard errors by country and time. Using banks positions vis a vis global banks.

D Appendix - List of Global Banks

List of Global Systemically Important Banks (G-SIBs) as of November 2021:

- U.S. (8): JP Morgan Chase, Citigroup, Bank of America, Goldman Sachs, Bank of New York Mellon, Morgan Stanley, State Street, Wells Fargo.
- China (4): Bank of China, China Construction Bank, Industrial and Commercial Bank of China, Agricultural Bank of China.
- France (4): BNP Paribas, Groupe BPCE, Groupe Crédit Agricole, Société Générale.
- U.K. (3): HSBC, Barclays, Standard Chartered.
- Japan (3): Mitsubishi UFJ FG, Mizuho FG, Sumitomo Mitsui FG.
- Canada (2): Royal Bank of Canada, Toronto Dominion.
- Switzerland (2): Credit Suisse, UBS.
- Germany (1): Deutsche Bank.
- Italy (1): UniCredit.
- Netherlands (1): ING Bank.
- Spain (1): Santander.

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