Working Papers

FEDERAL RESERVE BANK OF BOSTON

No. 24-4

Risk Sharing and Amplification in the Global Banking Network

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Abstract:
We develop a structural model of the global banking network and analyze its role in facilitating risk sharing and amplifying shocks across countries and over time. Using bilateral international lending data, we uncover significant heterogeneity in the willingness and capacity of banks to provide cross-border interbank and corporate loans. This heterogeneity explains variation in risk sharing and amplification across countries. Moreover, we show that cross-border loan supply has become less elastic over time, resulting in a decline in risk sharing. While shock amplification has also declined on average, some countries may experience greater amplification in response to foreign funding shocks.

JEL Classifications: F34, G21
Keywords: global banking network, risk sharing, shock propagation, capital flows

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The authors thank Wenxin Du, Linda Goldberg, Pierre-Olivier Gourinchas, Galina Hale, Sebnem Kalemli-Özcan, Friederike Niepmann, Hélene Rey, and seminar participants at the Bank of Canada, the Banque de France, the Federal Reserve Bank of Boston, the Federal Reserve Bank of Chicago, the Federal Reserve Board, the Halle Institute for Economic Research, UC Berkeley, UC Santa Cruz, the University of Connecticut, the University of Rochester, the Becker Friedman Institute International Macro-finance Conference, the CEBRA Annual Meeting, the Early Career Women in Finance Conference, the NBER IFM Meeting, the Pacific Basin Research Conference, and the Women in International Economics Conference for helpful comments. Hannah Firestone and Ethan Lewis provided excellent research assistance.

This version: April 2024 **https://doi.org/10.29412/res.wp.2024.04**

1 Introduction

Banks intermediate more than $30 trillion in cross-border capital flows annually, including $15 trillion in cross-border bank-to-bank capital flows and $15 trillion in cross-border bank-to-firm capital flows.[1] During times of stress, they transmit and can amplify shocks to other banks and firms around the world, reducing the availability of credit in the global interbank and corporate lending markets.[2] At the same time, banks can provide "insurance" by increasing their supply of credit to countries experiencing shocks, playing a risk-sharing role. The nature and extent of risk sharing and amplification through the global banking system are fundamental questions in macro- and international finance. However, the existing literature on these questions is limited in scope, often analyzing them through the lens of models featuring a representative banking sector or reduced-form analysis of the loan supply impact of specific shocks for specific countries. As a result, important issues remain poorly understood. How does banks' role in facilitating risk sharing or amplifying shocks affect different countries in the global financial system? Do banks or firms from some countries receive more insurance in response to local shocks, or experience greater amplification in response to foreign shocks, and if so, why? How has banks' role evolved since the 2007–08 Global Financial Crisis (GFC) in light of major regulatory changes and other developments?

This paper aims to provide a systematic analysis of the role of global banking linkages in sharing risk and amplifying shocks, both across countries and over time. Our analysis starts by developing a structural model of the global banking network that incorporates a global interbank network and a global credit network. The former network captures the bilateral cross-border borrowing and lending relationships that banking sectors form with each other, and the latter captures the lending relationships that banking sectors form with foreign and domestic corporate sectors. The model jointly accounts for the quantity and price of loans and their endogenous supply and demand. We estimate the model using a complete set of bilateral lending data for 19 countries and provide, for the first time, time-varying estimates

[1] See Appendix Figure A.2 for illustrations of cross-border bank capital flows.

[2] For example, during the 2007–08 Global Financial Crisis (GFC), the global interbank market was severely constrained, with the LIBOR-OIS spread, a primary measure of interbank lending rates, increasing to more than 300 basis points. By contrast, the pre-crisis level was less than 10 basis points. Cross-border corporate lending also contracted significantly.

of bilateral and aggregate supply elasticities for cross-border interbank and firm lending.

The elasticity estimates reveal significant heterogeneity in banking sectors' willingness and capacity to lend to different countries. Using the estimated model, we conduct counterfactual analyses that further yield two key results. First, the heterogeneity in banks' willingness and capacity to lend across countries explains the variations in the extent of both the insurance that countries receive in response to local funding shocks and the amplification countries experience in response to foreign funding shocks. Second, risk sharing in the global banking network has significantly declined since the GFC, with countries now receiving less insurance against local funding shocks. At the same time, while the degree of shock amplification has also declined on average, some countries may experience greater amplification in response to foreign funding shocks. We show that these developments are plausibly influenced by the tightening of macroprudential policy instruments in the post-GFC era.

Our model of the global banking network builds on and adds important enhancements to the demand system approach by Koijen and Yogo (2019, 2020). Each banking sector's allocation of interbank and corporate loans across countries is a function of lending prices as well as observed and unobserved characteristics of borrower countries and bilateral relations between lender and borrower countries. We introduce a network structure in the framework, allowing each bank to borrow from the global interbank network and allocate assets both within the global interbank and credit networks and across the two networks. This structure endogenizes each banking sector's total assets and liabilities. We further allow each banking sector's demand for loans to adjust endogenously with changes in lending prices. In equilibrium, the banking sectors' loan quantity and interest rates are endogenous and must adjust to ensure that the market value of loans supplied equals the market value of loans demanded in both the banking and corporate sectors.

To estimate the model, we compile a database of cross-border interbank and cross-border and local corporate lending using the Locational Banking Statistics (LBS) from the Bank for International Settlements (BIS). The LBS data set contains data on bilateral interbank and bank-to-firm flows between source and destination countries, allowing us to construct complete global interbank and credit networks for 19 countries from 2009 through 2019.

We supplement the data with information on loan prices and variables that capture characteristics of the borrowers and bilateral borrower-lender relationships from Bloomberg, the World Bank, the International Monetary Fund (IMF), the Federal Reserve, and statistical databases from central banks. Using the data set, we estimate the supply curves for cross-border interbank and corporate lending using an instrumental-variables approach, following Koijen and Yogo (2020) and Jiang, Richmond and Zhang (2023), because the prices on loans may be endogenous to the latent supply of the lenders. Our estimation strategy exploits the variation in bank loan portfolios driven by exogenous cross-sectional variations across all borrower countries' characteristics. We also apply an instrumental-variables approach to estimate the demand curves for cross-border lending, exploiting exogenous variations in domestic loan supply driven by regulatory changes. We conduct the estimation using both the full sample period and 30-quarter rolling subsamples to study the evolution of supply and demand elasticities.

Our estimation results show that the price elasticities of cross-border interbank and corporate loan supply average 17.6 and 7.5, respectively, across the borrower countries over the sample period. If translated to elasticity with respect to yield, the estimates indicate that a 1 percentage point increase in the lending rate leads to a 4.4 (7.5) percent increase in the share of cross-border interbank (corporate) loan supply in total funding for the respective sector. Crucially, our estimation results show substantial variation in supply elasticities across the borrower countries, revealing stark heterogeneity in the willingness and capacity of financial intermediaries to provide loans in the global banking network.

To study the implications of this heterogeneity for international risk sharing and amplification, we conduct a series of counterfactual analyses using the estimated structural model. We introduce a metric called the "insurance ratio" to quantify the degree of insurance provision or shock amplification each country experiences in response to domestic or foreign funding shocks. The ratio is defined as the change in funding resulting from banking sectors' endogenous reallocation relative to the size of the shock effect. The shock effect encompasses all changes in funding driven by direct and higher-order effects of the shock before any endogenous reallocation (that is, holding all banking sectors' portfolio allocations fixed). A positive insurance ratio implies insurance provision: The affected country receives

net funding inflows from the global banking network in response to the shock, which counters the shock effect it experiences. A negative insurance ratio implies shock amplification: The country experiences net funding outflows in response to the shock, which exacerbates the shock effect. Hence, an insurance ratio of 1 implies insurance to the extent of a full shock effect offset; a ratio of 0 implies no insurance or amplification; and a ratio of –1 implies double amplification.[3]

More specifically, we compute the insurance ratio by sector to examine the extent of risk sharing and amplification for banks and firms in different shock scenarios. For each country's banking sector, we construct an interbank insurance ratio, defined as the change in funding inflows resulting from other banking sectors' endogenous reallocation, relative to the size of the affected banking sector's shock effect. For each country's corporate sector, we construct a credit insurance ratio and a self-insurance ratio. They measure the endogenous change in funding inflows from foreign and domestic banking sectors, respectively, relative to the size of the corporate sector's shock effect. Notably, self-insurance encompasses both the reallocation of funding by the domestic banking sector from the global banking network and domestic banks' intermediation of foreign funding that is reallocated through interbank insurance.

Our counterfactual analysis focuses on the risk-sharing and amplification effects of a 1 percent funding shock in a single country, for both that country and other countries in the global banking network. The scenario aims to capture a shock originating in a specific country, characterized by a limited initial decline in available funding for the country's banks to lend. This could, for example, be driven by policy changes such as stricter regulation or a contractionary monetary policy surprise. Based on the first subsample of the data, we find that the interbank insurance ratios vary from 0.1 to 0.8 for the banking sectors of the directly shocked countries. In other words, depending on the country experiencing the shock, endogenous funding inflows from the global banking network can offset the initial shock effect for its banking sector by 10 to 80 percent. For the corporate sectors of the directly shocked countries, the credit insurance ratios range from 0.03 to 0.3, and the self-insurance ratios range from 0.3 to 0.8, in response to the 1 percent local funding shock. Given the positive

[3]The ratios are not bounded by –1 and 1.

insurance ratios, our results indicate that the global banking network generally plays a risk-sharing role for countries experiencing a local funding shock. At the same time, the extent of insurance provision varies significantly by country.

On the other hand, the global banking network generally amplifies the shock effect for countries indirectly affected by a local funding shock from another country. For instance, in response to a 1 percent local funding shock in the United States, the insurance ratios for both the banking and corporate sectors of non-U.S. countries tend to be negative, indicating an amplification of the initial shock effect. At the same time, as with the degree of insurance provision across the directly shocked countries, we find significant heterogeneity in the extent of amplification across the indirectly affected countries.

What determines the variations in risk sharing and amplification across different countries in the global banking network? We show that they are governed by the heterogeneity in the elasticities of cross-border interbank and corporate loan supply. Borrower countries with lower cross-border supply elasticities receive less insurance against local funding shocks because entities in the global banking network are less willing or have a lower capacity to rebalance toward them. At the same time, countries with creditors that are more willing or have greater capacity to lend to the shocked country experience greater amplification. These findings provide a new perspective on how global bank intermediation affects individual countries' vulnerability to changes in domestic and foreign funding conditions.

In addition to studying risk sharing and amplification in the crosssection, we examine how they evolved over time. We show that the elasticities of cross-border loan supply in both the banking and corporate sectors significantly declined after the GFC, indicating that cross-border loan supply became less responsive to changes in prices. The average elasticity of cross-border interbank loan supply (expressed as a share of total interbank funding) with respect to yield for a given borrower country declined from 8.1 to 1.4 over the sample period, and that of cross-border corporate loan supply declined from 11.0 to 4.7.

We show that the decline in the elasticities of cross-border loan supply reduced the degree of risk sharing for all countries in the global banking network. In response to a 1 percent local funding shock, the interbank insurance ratio declined from 0.5 to 0.1 for a shocked country on average, and the sum of the credit and self-insurance ratios declined from 0.7 to

0.4. Accordingly, a country is expected to experience a greater decline in total funding in the present period compared with a decade ago in response to a local funding shock of the same magnitude.

At the same time, while the decline in the elasticities of cross-border loan supply reduces the average degree of shock amplification in the global banking network on average, not all countries experience a reduced amplification effect in response to foreign shocks. To be specific, in response to a 1 percent local funding shock in the United States, the degree of shock amplification to non-U.S. countries declined on average, with the average interbank insurance ratio improving from –2.1 to –1.8 and the average sum of the credit and self-insurance ratios improving from –5.5 to –3.8. However, this decline in amplification does not homogeneously apply to all countries, as the insurance ratios for some countries increased in magnitude in response to the U.S. funding shock. In other words, some countries may face greater amplification from foreign funding shocks given the change in the willingness and capacity of entities in the global banking network to provide intermediation.

Our results reveal significant changes in the global banking network over the past decade that affect the vulnerability of banks and firms to domestic and foreign funding shocks, which in turn could have important implications for financial stability and the real economy. We explore one potential explanatory factor for these changes: greater regulatory stringency. We provide suggestive evidence that stricter regulations have contributed to the decline in cross-border loan supply elasticities in the global banking network.

Related Literature. Our paper contributes to the literature on the propagation of liquidity shocks across markets and countries. A large number of studies show that banks serve as an important mechanism of propagation (for example, Peek and Rosengren 1997, Peek and Rosengren 2000, Khwaja and Mian 2008, Cetorelli and Goldberg 2012, Schnabl 2012, Ivashina, Scharfstein and Stein 2015, Baskaya et al. 2017, Amiti and Weinstein 2018, Morais et al. 2019, and Di Giovanni et al. 2022).[4] A key development in this literature over the past decade has been the use of national supervisory microdata to analyze the impact of bank liquidity shocks from specific countries on lending to domestic or foreign financial or

[4]See Buch and Goldberg (2020) for additional papers on the international transmission of liquidity shocks through banks.

nonfinancial entities. While this granular approach is valuable for identifying the impact of credit supply shocks through variations within and across bank and firm relationships, it is insufficient for addressing broader and more systemic questions on aggregate dynamics in the global financial system. We contribute to this literature by providing a systematic analysis of banks' role in transmitting liquidity shocks to the different countries and sectors in the system, underscoring their potential dual nature as either mitigators or amplifiers of financial risk. In particular, we introduce a framework that integrates multiple financial networks, sectors, and countries and thereby allows for a joint analysis of shock propagation both within and across countries and sectors.

One notable challenge in the literature on the micro and aggregate effects of bank liquidity shocks has been achieving a close mapping between theory and empirics. Our paper enables this mapping by fully modeling the observed global banking network structure and estimating it using perfectly mapped data. As a result, our paper is connected to both the theoretical strand of the literature (for example, Holmstrom and Tirole 1997, Gertler and Kiyotaki 2010, Dedola, Karadi and Lombardo 2013, Bruno and Shin 2015, Niepmann 2015, Morelli, Ottonello and Perez 2022) and the empirical literature that analyzes related questions using cross-country bank capital flow data (e.g., Hale 2012, Kalemli-Ozcan, Papaioannou and Peydro 2013, Kalemli-Ozcan, Papaioannou and Perri 2013, Correa et al. 2021, Temesvary, Ongena and Owen 2018, Hale, Kapan and Minoiu 2020, and Shen 2020). Moreover, our quantification of the heterogeneity in the willingness and capacity of banks to provide intermediation across countries underscores the importance of applying models featuring heterogeneous financial intermediaries for analyzing questions of international propagation. While the existing literature mostly studies propagation through the lens of models with a representative bank, our work complements a few recent papers such as Coimbra and Rey (2021) that emphasize the importance of heterogeneity across financial intermediaries in driving aggregate outcomes.

Our portfolio-based structural approach builds on the recent literature that uses similar frameworks to study asset pricing and allocation, including Gabaix and Maggiori (2015), Koijen and Yogo (2019, 2020), Camanho, Hau and Rey (2022), Jiang, Richmond and Zhang (2023), and Pellegrino, Spolaore and Wacziarg (2021). We extend the recent works on

demand system asset pricing by embedding a network structure and incorporating both the demand and supply of assets into the structural model, providing a more complete analysis of shock propagation in the global financial system.

In the rest of the paper, we provide a structural model of the global banking network in Section 2, followed by a discussion of model estimation and data in Section 3. In Section 4, we present the estimation results of loan supply and demand elasticities, with a focus on variations in the crosssection, and analyze their implications for international risk sharing and amplification. In Section 5, we study the time-series evolution of loan supply and demand elasticities and the resulting implications. Section 6 concludes.

2 A Structural Model of the Global Banking Network

In this section, we present a structural model of the global banking network. The network comprises two sub-networks: (1) a global interbank network in which banking sectors around the world borrow from and lend to each other; and (2) a global credit network in which banking sectors provide loans to foreign and domestic corporate sectors. Motivated by the international banking literature (such as Walter (1981), Aviat and Coeurdacier (2007), and Bruno and Shin (2015)), we model bank's lending decisions across countries and sectors from a portfolio-based perspective. The model builds on the demand-system approach introduced by Koijen and Yogo (2019, 2020).

Setup. Time is discrete, and there exist N countries. As illustrated in Figure 1, each country contains a representative banking sector (indexed by n) that allocates its total assets to the banking and corporate sectors of other countries through the global interbank and credit networks. We index the banking and corporate sectors by $\ell = 1, 2$, respectively. Each sector comprises $N+1$ potential borrowers (indexed by m), which include one representative borrower for each country plus an additional "outside" borrower ($m = 0$). The outside borrower accounts for bank loans provided to borrowers outside the N countries in the global banking network.

We denote the local currency price of a loan to sector ℓ of country m at time t by $P_t(m, \ell)$.

Given that the bulk of cross-border lending to firms is denominated in U.S. dollars rather than the local currency, we allow for a spread between the U.S. dollar price and the local currency price of loans in the corporate sector. We denote this spread by $SPRD_t(m, \ell)$. $E_{n,t}(m)$ denotes the exchange rate in terms of currency n per currency m. We use lowercase letters to denote logs: $p_t(m, \ell) = \log(P_t(m, \ell))$.

Loan Supply and Demand. We model the banking sector of country n's loan portfolio weight in country m, sector ℓ at time t as:

$$w_{n,t}(m, \ell) = w_{n,t}(m|\ell) w_{n,t}(\ell),$$

where $w_{n,t}(m|\ell)$ is country n's portfolio weight in country m within sector ℓ, and $w_{n,t}(\ell)$ is country n's portfolio weight in sector ℓ. Thus, the total supply of loans that country n's banking sector provides to sector ℓ of country m is $w_{n,t}(m, \ell)$ multiplied by the total assets of country n's banking sector.

We model country n's portfolio weight in country m sector ℓ at time t as a logistic function:

$$w_{n,t}(m|\ell) = \frac{\delta_{n,t}(m, \ell)}{1 + \sum_k \delta_{n,t}(k, \ell)}, \tag{1}$$

where $\delta_{n,t}(m, \ell)$ captures the relative desirability of the lending opportunity in country m, sector ℓ, and takes the functional form

$$\delta_{n,t}(m, \ell) = \exp\left(\beta_{\ell,t} p_{n,t}(m, \ell) + \Theta'_{\ell,t} \mathbf{x}_{n,t}(m) + \kappa_{n,t}(m, \ell)\right), \tag{2}$$

where

$$p_{n,t}(m, \ell) = \begin{cases} p_t(m, \ell) + sprd_t(m, \ell), & \text{if } n \neq m \text{ and } \ell = 2; \\ p_t(m, \ell), & \text{otherwise.} \end{cases}$$

$\mathbf{x}_{n,t}(m)$ is a set of borrower country m's characteristics at time t. These characteristics can be borrower country-specific (for example, GDP) or bilateral relative to lender country n (for example, distance). The coefficients $\beta_{\ell,t}$ and $\Theta_{\ell,t}$ are indexed by ℓ and t to allow for variation in loan supply elasticity across sectors and time.

By construction, the sum of loan portfolio shares invested in each sector equals 1: $\sum_{k=0}^{N} w_{n,t}(k|\ell) = 1$. Accordingly, the portfolio weight of the outside borrower in sector ℓ is given by

$$w_{n,t}(0|\ell) = \frac{1}{1 + \sum_k \delta_{n,t}(k,\ell)}. \tag{3}$$

We model the aggregate portfolio weight in sector ℓ at time t using a nested logit structure. The banking sector of country n's portfolio weight in sector ℓ at time t is given by

$$w_{n,t}(\ell) = \frac{\left(1 + \sum_k \delta_{n,t}(k,\ell)\right)^{\lambda_{\ell,t}} \exp\left(\alpha_\ell + \xi_{n,t}(\ell)\right)}{\sum_j \left(\left(1 + \sum_k \delta_{n,t}(k,j)\right)^{\lambda_{j,t}} \exp\left(\alpha_j + \xi_{n,t}(j)\right)\right)}, \tag{4}$$

where $\lambda_{\ell,t} \in [0,1]$ governs the degree of substitution of country n's portfolio allocation across sectors. As lending opportunities in sector ℓ as a whole become more desirable through changes in prices and characteristics, the banking sector of country n shifts its aggregate loan portfolio toward sector ℓ. α_ℓ denotes the sector fixed effect, and $\xi_{n,t}(\ell)$ denotes sector-specific latent supply. Because the total amount of lending must equal total assets, there is only one degree of freedom in α_ℓ, and we normalize $\alpha_1 + \xi_{n,t}(1) = 0$ for interbank loans.

The total face value of loans provided to sector ℓ of country n is denoted by $Q_t(n,\ell)$, which can be interpreted as its demand for loans. We allow $Q_t(n,\ell)$ to adjust endogenously to changes in interest rates and business cycle conditions. The exact specification for loan demand is provided in Section 3.

The Interbank Network. To study the endogenous interaction between banks' portfolio allocation problem and the global banking network, we embed a network structure in our model. We allow banks to borrow funds in the global interbank market and use these funds to extend loans to the foreign and domestic corporate sectors. For each country n in period t, the total assets of its banking sector in U.S. dollars is given by

$$A_{n,t} = D_{n,t} + \sum_{k \neq n} A_{k,t} w_{k,t}(\ell = 1) w_{k,t}(n|\ell = 1),$$

where $D_{n,t}$ captures funding from domestic sources such as bank deposits, and the second term on the right-hand side captures the sum of international transfers, which is endogenous

to the total assets in each banking sector as well as the portfolio allocation problem of all banking sectors in the global banking network.

Market Clearing Conditions. Prices (interest rates and exchange rates) in the banking and corporate sectors are endogenous and must adjust to satisfy market clearing conditions for loan supply. In the banking sector, the total value of cross-border loans extended to the banking sector of country m through the global interbank network must equal the total value of loans demanded by the banking sector of country m:

$$\exp\left(p_t(m,\ell=1)+e_{m,t}(US)\right)Q_t(m,\ell=1)=D_{m,t}+\sum_{n\neq m}A_{n,t}w_{n,t}(\ell=1)w_{n,t}(m|\ell=1), \quad (5)$$

where the left-hand side represents the market value of the loans demanded by the banking sector of country m, and the right-hand side represents the sum of country m's domestic funding and the loans extended by foreign banking sectors.

Similarly, the total par value of all loans extended (within and across borders) to the corporate sector of country m must equal its total demand for loans:

$$\begin{aligned}\exp\left(e_{m,t}(US)\right)Q_t(m,\ell=2)=&\frac{A_{m,t}w_{m,t}(\ell=2)w_{m,t}(m|\ell=2)}{\exp\left(p_t(m,\ell=2)\right)}+\\&\sum_{n\neq m}\frac{A_{n,t}w_{n,t}(\ell=2)w_{n,t}(m|\ell=2)}{\exp\left(p_t(m,\ell=2)+sprd_t(m,\ell=2)\right)}.\end{aligned} \quad (6)$$

Each country m's exchange rate relative to the U.S. dollar depends on the difference between its interbank rate and the U.S. interbank rate as well as time fixed effects:

$$\Delta e_{m,t}(US)=\beta_e\Delta IRD_t^m+\xi_t+\varepsilon_{m,t}, \quad (7)$$

where $IRD_t^m=-p_t(m,\ell=1)+p_t(US,\ell=1)$ is the interbank interest rate differential between country n and the United States at time t, and Δ denotes the first difference between time t and $t-1$. Within our structural model, we consider the interbank interest rate differential at time t, $\beta_e\left(-p_t(m,\ell=1)+p_t(US,\ell=1)\right)$, to be an endogenous component of exchange rates. We treat $\xi_t+\varepsilon_{m,t}$ and the time $t-1$ exchange rate and interbank interest

rate differential as exogenous components of exchange rates. Bilateral exchange rates for non-U.S. dollar currencies are calculated as the differences between these exchange rates relative to the U.S. dollar.

The market clearing conditions constitute a system of $2N$ equations that determines interest rates in the global interbank and credit networks and an additional set of N equations that determines exchange rates.

3 Estimation of Loan Supply and Demand Curves

In this section, we discuss the estimation of the loan-supply and demand curves that govern the allocation of bank funding within and across the banking and corporate sectors. We present the estimation equations, the data, and the identification approach.

3.1 Estimation Equations

The estimation equation for loan supply within each sector is obtained by dividing equation (1) by equation (3), which yields

$$\log\left(\frac{w_{n,t}(m,\ell)}{w_{n,t}(0,\ell)}\right) = \beta_{\ell,t}p_{n,t}(m,\ell) + \Theta'_{\ell,t}\mathbf{x}_{n,t}(m) + \kappa_{n,t}(m,\ell). \tag{8}$$

Equation (8) is estimated separately for each sector ℓ. It asserts that the supply of lending to banks or firms of one country relative to those of another country is a function of their relative prices and characteristics. The coefficients on log price largely determine the price elasticities of loan supply within each sector. We discuss the exact translation to elasticities in the subsequent section.

The estimation equation for cross-sector loan supply is obtained by first dividing equation (4) for the banking sector ($\ell = 1$) by the same equation for the corporate sector ($\ell = 2$) and then plugging in equation (3):

$$\log\left(\frac{w_{n,t}(\ell=1)}{w_{n,t}(\ell=2)}\right) = \lambda_{1,t}\log\left(w_{n,t}(0|\ell=1)\right) - \lambda_{2,t}\log\left(w_{n,t}(0|\ell=2)\right) + \alpha_{2,t} + \xi_{n,t}(1). \tag{9}$$

Equation (9) shows that the supply of interbank loans relative to that of corporate loans depends on their relative prices and characteristics as well as the degree of substitution between the two sectors. As interbank lending becomes relatively more attractive, lenders will shift more loans from the corporate sector to the interbank sector, and vice versa.

To study the evolution of loan-supply curves, we allow for time variation in the coefficients of equations (8) and (9) using 30-quarter rolling subsamples of the data.[5] Given that our sample starts in 2009:Q1, the first subsample consists of data from 2009:Q1 through 2016:Q3, and the last subsample consists of data from 2012:Q2 through 2019:Q4. The estimation results based on each subsample are taken to characterize the supply curves for the corresponding subperiod.

The estimation equation for borrower country m's demand for cross-border loans is

$$\log Q_t(m,\ell) = q_t(m,\ell) = \beta_\ell^d p_t(m,\ell) + \theta_\ell^d \log GDP_{t-1}(m) + \tau_t + \nu_t^d(m,\ell), \tag{10}$$

which states that the log quantity of loans demanded through the global interbank and credit network is governed by changes in loan prices ($p_t(m,\ell)$), variations in the lagged business cycle conditions of the borrower countries ($GDP_{t-1}(m)$), and time fixed effects (τ_t). This specification is motivated by empirical evidence indicating that demand for credit tends to vary systematically across the business cycle (Jermann and Quadrini 2012). We estimate the demand for interbank loans using 30-quarter rolling regressions, as we did for the supply of interbank loans. As for the demand for cross-border corporate loans, we estimate equation (10) once using the full data sample.[6]

We estimate equations (8) through(10) using an instrumental-variables approach, which we discuss in detail in Section 3.3 after a brief description of the estimation data in Section 3.2.

[5] We choose 30 quarters for the rolling subsample to allow for ample time series variation for the regressions.

[6] We keep the estimation of the demand for cross-border corporate lending simple by design because the focus of the analysis is on lending decisions by the banking sectors.

3.2 Data

Our main data source for estimating loan supply is the BIS LBS database. This database is uniquely appropriate for our study because it contains bank lending information that perfectly maps to our framework of the global banking network: The data contain quarterly information on the aggregate cross-border and local claims of all banks domiciled in the reporting countries, broken down by reporting (source) and counterparty (destination) country pairs as well as by the sector of the counterparty.[7] We use the data to construct measures of cross-border interbank lending as well as cross-border and domestic bank-firm corporate lending.[8] Our sample runs from 2009:Q1 through 2019:Q4 and consists of 19 countries, including two financial centers; 13 advanced economies; and four emerging market economies. Appendix Table A.2 lists the sample countries.

Table 1 reports the quarterly mean and standard deviation of the cross-border and total lending to the banking and corporate sectors of the 19 countries in the global banking network over the first and last subsample periods: 2009:Q1 through 2016:Q3 (left panel) and 2012:Q2 through 2019:Q4 (right panel). There is notable variation in lending across countries and between the two sample periods. Cross-border lending and total lending to the banking and corporate sectors are highest in the United States and the United Kingdom, followed by France and Germany, whereas they are substantially lower in emerging-market economies.

To estimate equation (8), we combine the bank lending data with information on lending

[7] An alternative to the LBS is the BIS consolidated banking statistics (CBS), which aggregate claims by the reporting banks' nationality rather than their location and exclude cross-border intragroup positions. For our purpose, the LBS database is more appropriate as it reveals a more direct link between the portfolio allocation decisions of the source countries' banking sectors and their cross-border portfolio adjustments, which are likely to include changes in intragroup positions. Furthermore, the CBS database has several technical drawbacks, including its lack of adjustment for exchange rate fluctuations and breaks in the series that are difficult to adjust.

[8] The measure for cross-border interbank lending includes lending between affiliates of the same banking organizations, which accounts for over 50 percent of the total cross-border bank-to-bank lending, as shown in Appendix Figure A.3 and highlighted in papers such as Cetorelli and Goldberg (2012). However, data on intrabank lending is not systematically available prior to 2014, which hinders us from conducting a more thorough analysis of the price elasticity of interbank versus intrabank lending. Nevertheless, Appendix Figure A.3 shows that the allocation of bank lending to affiliated banks does not vary significantly over time, which mitigates potential concerns of bias. Our estimates of the elasticities for interbank lending can be considered as the average elasticities for cross-border interbank and intrabank lending. Also, the measure for cross-border corporate lending is derived from the LBS data on claims to nonbank sectors, which include information on both nonbank financial and nonfinancial institutions. While the ideal data for our setting would be claims to nonfinancial sectors only, such data are incomplete across countries and over time.

prices and the characteristics of the borrower countries. For the latter, we use variables that capture differences in expected returns and risks across countries, including log nominal GDP, log GDP per capita, stock price volatility, exchange rate volatility, monetary policy rate, an index of macroprudential regulation stringency, bilateral import and export exposures, and geographic distance between the lender and borrower countries. Appendix Table A.3 lists the variables for lending prices and country characteristics along with their respective data sources. In the regression estimations, we also include an indicator for a domestic loan to capture potential home bias and fixed effects for the borrower country's MSCI market classification.

3.3 Estimation Approach

Estimating loan supply. The main challenge to consistently estimating loan supply within and across sectors based on equations (8) and (9), respectively, is that lending prices may be endogenous to the latent supply of the lenders. As more bank capital flows into a country, the lending rates of that country are likely to decrease, which would lead to an upward bias in the coefficient on $p_{n,t}(m, \ell)$ from (8).

To address this endogeneity concern, we adopt the identification strategy used in Koijen and Yogo (2020) and Jiang, Richmond and Zhang (2023), which involves applying our model to construct instruments for prices. These instruments should contain cross-sectional variation in lending prices that is uncorrelated with latent supply. To this end, we use our model to construct instruments for prices with the assumption that bank loan portfolios are determined by *all* borrower countries' exogenous characteristics, including population, GDP per capita, distances from the different lender countries, and the extent of home bias. The identifying assumption underlying these instruments is that the relative cross-sectional differences in size and geographic distance among the borrower countries are exogenous to latent supply and mainly shift the quantity of cross-border loans demanded by each country and consequently influence the prevailing loan prices. For instance, a borrower country that is relatively large is more likely to demand more loans from a given lender and thereby faces a higher interest rate. Similarly, a borrower country that is more geographically distant from large lender countries is likely to demand more loans from nearby lender countries,

thus facing a higher interest rate.

Specifically, the estimation proceeds in four steps. First, we estimate a version of equation (8) using only borrower country characteristics ($\mathbf{x}_{n,t}(m)$) that are plausibly exogenous to the global banking network. The characteristics we use are population, GDP per capita, distances from lender countries, and an own-country indicator variable to capture home bias. The predicted values from equation (8) using only these exogenous characteristics are denoted by $\hat{\delta}_{n,t}(m,\ell)$.

In the second step, we compute an instrument for within-sector portfolio weights, $\hat{w}_{n,t}(0|\ell)$, to estimate across-sector loan supply. The instrument is computed using the predicted values $\hat{\delta}_{n,t}(m,\ell)$ based on equation (3): $\hat{w}_{n,t}(0|\ell) = 1/\left(1+\sum_k \hat{\delta}_{n,t}(k,\ell)\right)$. We then use the predicted portfolio weights $\hat{w}_{n,t}(0|\ell)$ as instruments for $w_{n,t}(0|\ell=1)$ and $w_{n,t}(0|\ell=2)$ from equation (9) and estimate $\hat{\lambda}_{\ell,t}$ and $\hat{\alpha}_{\ell,t}$.

In the third step, we compute the counterfactual lending prices and exchange rates that satisfy market clearing conditions (5) through (7) at the predicted portfolio weights. More concretely, these counterfactual prices are derived to clear the lending markets in both the banking sector and the corporate sector, in accordance with market clearing conditions (5) and (6), and follow the exchange rate determination equation (7) at the predicted weights $\hat{w}_{n,t}(m,\ell)$ conditional on lagged domestic funding and lagged loan demand:

$$\hat{p}_t(m,\ell=1) = \log\left(\frac{D_{m,t-1}+\sum_{n\neq m} A_{n,t-1}\hat{w}_{n,t}(m,\ell=1)}{Q_{t-1}(m,\ell=1)}\right) - \hat{e}_{m,t}(US),$$

$$\hat{p}_t(m,\ell=2) = \log\left(\frac{A_{m,t-1}\hat{w}_{m,t}(m,\ell=2)+\sum_{n\neq m}\left(A_{n,t-1}\hat{w}_{n,t}(m,\ell=2)/SPRD_t(m,\ell=2)\right)}{Q_{t-1}(m,\ell=2)}\right) - \hat{e}_{m,t}(US),$$

$$\Delta\hat{e}_{m,t}(US) = \hat{\beta}_e\Delta\left(\hat{p}_t(m,\ell=1)+\hat{p}_t(US,\ell=1)\right)+\hat{\xi}_t+\hat{\varepsilon}_{m,t}.$$

In Appendix Section C, we present an alternative estimation procedure that does not rely on lagged domestic funding and loan demand. We show that the resulting estimates are similar to those from the baseline procedure.

Finally, we use these counterfactual lending prices, $\hat{p}_t(m,\ell)$, as instruments for actual prices for estimating equation (8). These counterfactual prices are a nonlinear function of

all borrower countries' characteristics and determined by the cross-sectional differences in these characteristics among countries.

Estimating loan demand. Estimation of loan demand based on equation (10) faces an issue of endogeneity similar to that of loan-supply estimation. Greater loan demand is likely to drive up interest rates, which would lead to a downward bias in the coefficients on price from the equation. To address this concern, we apply a standard instrumental-variables approach. We instrument $p_{m,t}(n, \ell)$ with measures of bank regulatory stringency. Specifically, we construct an index of bank liquidity requirement stringency to instrument for interbank rates and an index of bank capital requirement stringency to instrument for corporate lending rates. Changes in these indexes are driven by regulatory policies aimed at addressing longer-term financial stability concerns. The identifying assumption is that regulatory stringency affects interest rates by shifting the supply of loans provided domestically but is uncorrelated with contemporaneous latent demand for loans. Within a given period, countries with a relatively greater regulatory burden face a relatively lower supply of loans from their domestic banking sector.

4 Global Financial Intermediation across Countries

In this section, we present the estimation results of loan supply elasticities in the global banking network with a focus on variations across countries and analyze their implications for international risk sharing and amplification. We first explain the computation and the economic interpretation of the within-sector loan supply elasticities. We then conduct counterfactual exercises to quantify the extent of insurance provision and shock amplification in the global banking network in response to country-specific funding shocks. In the interest of space, we relegate the discussion of cross-sector supply elasticities, demand elasticities, and estimates from the exchange rate determination equation to Appendix B.

4.1 Estimates of Loan Supply Elasticities

Table 2 shows the estimates for the within-sector loan-supply curves from equation (8) for the full sample period. The coefficients on price for both cross-border interbank lending (column 1) and corporate lending (column 2) are negative, which indicates that as the lending price increases (or the interest rate decreases) for a given borrower, banks are less likely to extend loans to that borrower. The coefficients on the borrower-characteristics variables are also consistent with our expectations. Banks prefer extending loans to banks and firms in larger and wealthier countries as well as those in countries that are closer in terms of geographic distance and trade relationships. The coefficient on the own-country indicator variable shows that there is a strong home bias in lending in the corporate sectors.[9]

The estimated coefficients on log price largely determine the elasticities of interbank and firm lending across different countries in the global banking network. In Appendix Section A, we derive the expressions for bilateral elasticities of loan supply with respect to price. The loan supply elasticities differ across bilateral lender-borrower pairs because the supply curves take into account bilateral characteristics. We also show that the aggregate loan supply elasticity for each borrower country can be computed as the weighted sum of the supply elasticities of its lender countries:

$$-\frac{\partial \hat{q}_t(m,\ell)}{\partial p_t(m,\ell)} = \frac{1}{\sum_k A_{k,t} w_{k,t}(m,\ell)} \sum_n \underbrace{\left(-\frac{\partial \hat{q}_{n,t}(m,\ell)}{\partial p_t(m,\ell)}\right) w_{n,t}(m,\ell)}_{\text{Willingness to Lend}} \underbrace{A_{n,t}}_{\text{Capacity to Lend}}, \tag{11}$$

where $\hat{q}_t(m,\ell)$ is the log quantity of loans extended to country m, sector ℓ, from all banking sectors, and $\hat{q}_{n,t}(m,\ell)$ is the log quantity of loans extended to country m, sector ℓ, from country n's banking sector.

Equation (11) shows that the aggregate loan supply elasticity to a given borrower country m can be decomposed into two components: the *willingness* of lenders to allocate loans to country m and their *capacity* to do so. The term for the willingness of lender n to provide loans to country m in sector ℓ measures how much the lender adjusts its loan portfolio

[9] Appendix Table A.5 presents the estimates for the within-sector loan supply curves using ordinary least squares (OLS). The OLS coefficients on price are larger compared with those obtained using the instrumental-variables approach, suggesting an upward bias in OLS estimates.

weight in response to interest rate changes, expressed as a share of the lender's total portfolio size. This willingness-to-lend term depends on the estimated supply curves as well as the existing portfolio weights. As an example, Panels (a) and (b) of Figure 2 show the average willingness of the U.S. banking sector to lend to the banking and corporate sectors of different borrower countries as a function of the portfolio weight of each borrower country in U.S. banks' loan portfolios.[10] The U.S. banking sector is most willing to lend to U.K. banks and firms, followed by those of Japan and Canada. More generally, the figures reveal that each lender's willingness to lend to a given borrower is largely captured by the observed portfolio shares, which are determined by the characteristics of borrower countries and their bilateral relationships with the lender countries.

The extent to which borrower countries can obtain loans from a lender also depends on its capacity to provide loans, as captured by the lender's total assets, $A_{n,t}$, in equation (11). As an example, Panels (c) and (d) of Figure 2 plot different lender countries' willingness and capacity to lend to the U.K.'s banking and corporate sectors as a function of their willingness to lend to the respective U.K sectors. Panel (a) shows that even though both Germany and Italy are similarly willing to lend to banks in the United Kingdom, Germany has a much larger capacity to do so and is therefore more important than Italy for determining the United Kingdom's aggregate loan supply elasticity.

Using the estimation results from Table 2 and equation (11), we compute the average elasticities of cross-border interbank and corporate loan supply across countries over the sample period. We find that the supply of cross-border interbank and corporate loans as a share of total funding declines by 17.6 and 7.5 percent, respectively, for every 1 percent increase in their respective lending prices. Given that the maturity of interbank and corporate loans is 0.25 and one year, respectively, our estimates translate to a supply elasticity with respect to yield of 4.4 and 7.5. That is, the contribution of cross-border interbank and corporate loan supply to total funding decreases by 4.4 percent and 7.5 percent per 1 percentage point increase in the interbank and corporate lending rates, respectively. Our estimates are broadly comparable to that of the price elasticity with respect to yield for

[10]Loan supply elasticities change over time due to changes in prices and characteristics. Given that the emphasis of this section lies in the cross-sectional differences across countries, we focus on the average elasticities over the sample period.

short-term debt investment from Koijen and Yogo (2020), who report an estimate of 10.5.

Figure 3 shows the average aggregate loan supply elasticities for each borrower country over the sample period in the banking and corporate sectors. Panels (a) and (b) illustrate the cross-border interbank and corporate loan supply elasticities, respectively, across the borrower countries. Panel (c) illustrates the total loan supply elasticities in the corporate sector, which reflect changes in both cross-border lending from foreign banks and local lending from domestic banks in response to a 1 percentage point decrease in interest rates. Relative to the estimates from Panel (b), those from Panel (c) show that the total supply of loans is more responsive than cross-border lending alone to changes in interest rates, indicating that domestic banks tend to be more willing than foreign banks to provide additional loans in response to funding shortfalls.[11] In particular, the largest differences in supply elasticities between the two panels are among the advanced economies, which show that their banking sectors tend to have a greater willingness and capacity to lend when yields increase, controlling for country characteristics.

Overall, Figure 3 reveals substantial variation in supply elasticities across the borrower countries, reflecting stark heterogeneity in the willingness and capacity of banking sectors to provide global intermediation.

4.2 Insurance Provision for Directly Shocked Countries

What are the implications of the heterogeneity in loan supply elasticities for international risk sharing and amplification? We analyze this question by conducting a series of counterfactual analyses using the estimated structural model.

We focus on the effects of a local funding shock, represented by a 1 percent decline in $D_{n,t}$ in our structural model.[12] The shock represents a decline in available funding for the banking sector of country n to lend out, a scenario that could be driven by a decline in deposits if considered literally, or, more generally, by any policy or preference change that restricts the amount of capital that banks are willing to use to fund loans. For example,

[11] The difference in the estimates between Panels (b) and (c) is also driven by the fact that a large share of lending to each borrower country's corporate sector is provided by its domestic banking sector.

[12] For comparison, domestic funding declined by 5 percent in the United States and 4 percent in the United Kingdom during the GFC period.

stricter capital reserve requirements, contractionary monetary policy, or liquidity preference shocks could all prompt banks to hold more cash and reduce loan provisions.

To quantify the degree of risk sharing and amplification each country experiences in response to domestic or foreign shocks, we introduce a metric called the "insurance ratio," defined as the change in funding resulting from endogenous reallocation in the global banking network relative to the size of the shock effect. The shock effect encompasses all immediate effects of the shock before any endogenous reallocation (holding all banking sectors' portfolio allocations fixed). The effect consists of two margins of adjustment: a direct decline in funding from the shocked banking sector, and higher-order effects reducing funding from other countries' banking sectors.[13] A positive insurance ratio implies insurance provision: The affected country receives net funding inflows from the global banking network in response to the shock, which counters the shock effect it experiences. A negative insurance ratio implies shock amplification: The country experiences net funding outflows in response to the shock, which exacerbates the shock effect. Hence, an insurance ratio of 1 implies insurance to the extent of a full shock effect offset; a ratio of 0 implies no insurance or amplification; and a ratio of –1 implies double amplification.

The analysis in this section is based on the first subperiod of the data, which runs from 2009:Q1 through 2016:Q3. Columns (1) and (2) of Table 3 provide the estimates of the loan-supply curves in the banking and corporate sectors, respectively, using data from the first subperiod. We first analyze the local effects of the local funding shock to assess the extent of risk sharing or amplification for the directly shocked country. In the following subsection, we study the spillover effects of the shock to assess risk sharing or amplification for the indirectly affected countries.

A specific case: U.S. local funding shock. To introduce the margins of risk sharing and amplification in the global banking network, we first dissect the effects of a 1 percent decline in U.S. local funding ($D_{n,t}$) on funding to the banking and corporate sectors of the United States. The initial loan portfolio allocations are determined by the estimated loan

[13] As an example of high-order effects, a U.S. funding shock reduces cross-border lending from the United States to the German banking sector, which in turn reduces the lending to the U.S. corporate sector based on German banks' existing portfolio weight on the sector. Note that for the directly shocked banking sector, the shock effect is defined simply as the size of the shock, or 1 percent of local funding.

supply and loan demand curves for the first subperiod of 2009:Q1 through 2016:Q3. We compute the new equilibrium loan allocations after imposing the shock and compare them to those from the initial equilibrium.

The 1 percent local funding shock generates a shock effect of $132 billion and $108 billion for the U.S. banking and corporate sectors, respectively. The amounts reflect the immediate impact of the shock before any endogenous rebalancing of loan portfolios in the global banking network. In response to the shock, banking sectors in the global banking network could rebalance funding toward or away from the U.S. banking and corporate sectors. To quantify these margins of risk sharing or amplification, we compute measures of sector-specific insurance ratios. For the U.S. banking sector, we compute an interbank insurance ratio, defined as the change in funding inflows due to endogenous reallocation from non-U.S. banking sectors, normalized by the size of the sector's shock effect. For the U.S. corporate sector, we compute a credit insurance ratio and a self-insurance ratio. They are defined as the change in funding inflows resulting from endogenous reallocation of non-U.S. and U.S. banking sectors, respectively, normalized by the size of the corporate sector's shock effect. The normalization allows for abstraction from differences in the magnitude of the shock effects under different supply and demand curves, enabling comparability of insurance provision and shock amplification across countries. As discussed previously, positive ratios denote insurance provision, and negative ratios denote shock amplification.

Figure 4 illustrates the effects of the U.S. local funding shock on cross-border interbank funding (Panel (a)) and total (cross-border and domestic) corporate funding (Panel (b)) to the United States. For now, we focus on the dark purple bars, which present estimates based on the first subperiod. As shown in Panel (a), the U.S. local funding shock induces an interbank insurance ratio of 0.4. This means that banks in the global banking network rebalance toward the U.S. banking sector on net in response to the shock, mitigating the initial shock effect by 40 percent. Panel (b) of Figure 4 illustrates a credit insurance ratio of 0.11 and a self-insurance ratio of 0.55. This indicates that in response to the U.S. funding shock, non-U.S. banks actively rebalance toward the U.S. corporate sector to take advantage of the unmet loan demand, reversing 11 percent of the shock effect. Furthermore, U.S. domestic banks provide additional funding to U.S. firms, offsetting the shock effect by another

55 percent. Notably, self-insurance encompasses both the reallocation of funding by the U.S. banking sector from other countries and its intermediation of non-U.S. funding inflows from interbank insurance. Panel (a) of Appendix Figure A.5 decomposes self-insurance into the two components. Evidently, most of the self-rebalancing stems from the intermediation of funding from interbank insurance.

In sum, the positive interbank, credit, and self-insurance ratios show that the global banking network provides a significant amount of insurance to U.S. banks and firms in response to a local funding shock.

Local funding shocks, insurance provision, and loan supply elasticities. We apply the 1 percent local funding shock on each country in the global banking network and study the extent of risk sharing across countries through the lens of the three insurance ratios.

Panel (a) of Figure 5 illustrates the interbank insurance ratio for each country in response to a 1 percent local funding shock in the respective country.[14] For all countries, the ratio is positive, indicating that the global banking network generally provides insurance to the banking sectors of the shocked countries. At the same time, there is significant variation in the degree of insurance provision across different countries, ranging from 11 to 78 percent of the shock effect.

Panel (b) of Figure 5 illustrates the sum of the credit and self-insurance ratios for each country in response to a 1 percent decline in local funding.[15] The ratios are all positive, indicating that banks from the non-shocked countries tend to actively rebalance toward the corporate sector of the shocked country and thus mitigate the negative shock effect. Domestic banks in the shocked country tend to provide additional funding to their local firms through self-rebalancing. At the same time, as with interbank insurance, there is significant variation in the degree of credit and self-insurance across countries, ranging from 4 to 27 percent of the shock effect for the former margin and 29 to 81 percent for the latter.

We show that these variations in risk sharing across borrower countries are governed

[14]Columns (1) and (2) of Appendix Table A.9 report all outputs from the corresponding counterfactual analysis in detail, including the magnitude of the shock effect in column 1 and the interbank insurance ratios in column 2.

[15]Columns (1) through (3) of Appendix Table A.10 report the full set of results, including the credit and self-insurance ratios in columns (2) and (3), respectively.

by the aggregate supply elasticities of each country, which are determined by the lending prices and characteristics of the borrowers and borrower-lender relationships. Panels (c) and (d) of Figure 5 illustrate that countries with cross-border interbank loan supply and total corporate loan supply that are more elastic tend to receive greater insurance, as measured by the interbank ratio and the sum of the credit and self-insurance ratios, respectively, when they face a local funding shock. This is because banking sectors in the global banking network are more willing and have greater capacity to lend to these countries when their interest rates increase.

The bottom panels of Figure 5 provide a novel illustration of the heterogeneity in risk sharing through the global banking network. They also highlight that the heterogeneity in the willingness and capacity of banking sectors to provide global intermediation ultimately affects how sensitive countries are to fluctuations in funding conditions and business cycles.

4.3 Shock Amplification for Indirectly Affected Countries

Next, we study the spillover effects of a local funding shock to assess the extent of risk sharing and amplification for the countries in the global banking network that are not directly shocked. We focus on the effects of a 1 percent U.S. local funding shock to highlight the margins of mitigation or amplification. The same margins apply to shocks from other countries.

A specific case: Spillover effects of U.S. local funding shock on Mexico. We begin by describing the spillover effects of a 1 percent U.S. local funding shock on a specific foreign country—Mexico. The shock induces an initial shock effect of $105 million and $405 million for the Mexican banking and corporate sectors, respectively. The shock effect stems from the immediate declines in funding from the United States and all other countries in the global banking network due to direct and higher-order effects, holding all portfolio weights fixed.

Panel (a) of Figure 6 illustrates that the interbank insurance ratio for Mexico amounts to –0.6 in response to the U.S. shock. That is, banking sectors in the global banking network endogenously rebalance away from the Mexican banking sector, amplifying its shock effect by 60 percent. Panel (b) of Figure 6 shows that the credit and self-insurance ratios sum to

-0.3 for the Mexican corporate sector, indicating that the global banking network further amplifies the corresponding shock effect by 30 percent. More specifically, credit and self-insurance ratios amount to 0.3 and –0.6, respectively. The positive credit insurance ratio indicates that non-Mexican banks reallocate funding toward Mexican firms and mitigate the shock effect by 30 percent in response to the U.S. funding shock. However, Mexican banks reduce funding to Mexican firms by a greater magnitude.[16]

Overall, the negative insurance ratios show that the global banking network amplifies the shock effects for Mexican banks and firms, exacerbating the direct spillovers from the U.S. local funding shock.

Spillover effects of U.S. local funding shock and loan supply elasticities. We conduct the analysis on the spillover effects of a 1 percent U.S. funding shock for all non-U.S. countries in the global banking network. Columns (1) and (2) of Appendix Table A.11 present the effects of the shock on cross-border interbank funding to all countries based on the supply and demand curves estimated for the initial subperiod. Column (1) shows the magnitude of the shock effect, revealing notable variations in the immediate change in cross-border interbank funding to each country in response to the U.S. local shock. The banking sectors of the United Kingdom, Japan, and the euro area experience the greatest decline in funding, which is intuitive given that U.S. banks provide a large amount of funding to them ex-ante. Column (2) presents the interbank insurance ratios, which are negative for all countries. This indicates that endogenous rebalancing in the global interbank network generally serves as a mechanism of shock amplification for non-U.S. banking sectors in response to the U.S. funding shock. At the same time, there is significant heterogeneity in the extent of shock amplification across the different banking sectors.

Columns (1) through (3) of Appendix Table A.12 present the effects of the U.S. funding shock on funding to the corporate sectors of all non-U.S. countries based on supply and demand curves estimated using the initial subsample. As shown in columns (2) and (3),

[16]Panel (b) of Appendix Figure A.5 shows that this decline in funding through the self-rebalancing margin mostly stems from the funding loss resulting from amplification effects in the global interbank network. Because foreign banking sectors reallocate funding away from Mexican banks in response to the U.S. funding shock, Mexican banks have less funding to intermediate toward domestic firms. Even though Mexican banks retrench to offset this loss, doing so reverses the interbank funding loss only by a negligible margin.

the sum of the credit and self-insurance ratios are negative across all countries, indicating that endogenous rebalancing in the global interbank and credit networks generally amplifies the shock effect for firms.[17] Nevertheless, as with the banking sectors, there is significant heterogeneity in the degree of shock amplification across the corporate sectors of indirectly affected countries.

What governs the heterogeneity in the extent of shock amplification across countries? The bottom panels of Figure 6 show that it depends crucially on their creditor countries' willingness to lend. If a country's creditors are more willing to lend, then the banking and corporate sectors of that country tend to lose more funding as its creditors rebalance a larger share of their loan portfolio to insure the shocked country. Panels (c) and (d) of Figure 6 plot the magnitude of endogenous funding outflows from each country's banking and corporate sectors, respectively, against the aggregate willingness of its creditors to lend to the corresponding sector of the United States. For each sector ℓ of country m, we compute the aggregate willingness of its creditor countries to lend to the United States as a weighted sum of each creditor's willingness and capacity to lend to the United States, weighted by each creditor's portfolio allocation to sector ℓ of country m.[18] Overall, creditor willingness to lend to the United States explains 93 percent of the variation in shock amplification across the banking sectors and 71 percent of the variation in shock amplification across the corporate sectors.

We observe that, among the non-U.S. countries, emerging markets see a greater outflow of foreign capital in both the banking and corporate sectors in response to the U.S. local funding shock, as shown in Appendix Figure A.6. This observation is consistent with the empirical fact concerning the fickleness of foreign capital for emerging markets (Forbes and Warnock 2021).

[17] More specifically, while foreign bank sectors may play an amplifying or mitigating role depending on the country, corporate funding from the domestic banking sector declines significantly across all countries, dominating any mitigating effect from cross-border corporate funding and exacerbating the shock effect. The decline in self-insurance mostly stems from the loss of funding due to global interbank rebalancing.

[18] Specifically, the corresponding mathematical expression is $\sum_{i=1}^{n} w_{n,t}(m,\ell)\left(-\frac{\partial \hat{q}_{n,t}(US,\ell)}{\partial p_t(US,\ell)}\right) w_{n,t}(US,\ell)A_{n,t}$.

5 Global Financial Intermediation over Time

In this section, we study the evolution of loan supply elasticities and the resulting implications for international risk sharing and amplification. We also explore a potential driver of the observed change in loan supply elasticities: stringency of bank regulation.

5.1 Evolution of Supply Elasticities

Table 3 reports the estimates of the within-sector loan-supply curves for the initial and final subsamples of the data based on equation (8). As previously stated, columns (1) and (2) display the estimates based on the first subsample, covering the period from 2009Q1 to 2016Q3. Columns (3) and (4) provide the estimates based on the last subsample, covering the period from 2012:Q2 through 2019:Q4. The results reveal a substantial decrease in the size of the coefficients on both interbank lending prices, declining from –270 (column (1)) to –50 (column (3)), and corporate lending prices, declining from –94 (column (2)) to –42 (column (4)). These declines indicate that loan supply became less responsive to interest rate fluctuations in both the banking and corporate sectors across borrower countries, with a greater decline in the banking sector.

To observe the full evolution of within-sector supply curves over the sample period, we plot the time series of the average loan supply elasticities from all rolling subsamples in the top panels of Figure 7. Panel (a) illustrates that the decline in cross-border interbank and corporate loan supply elasticities from the initial to the final subperiod is part of a longer-term trend, not simply a reflection of the two endpoints. For every 1 percent increase in interbank and corporate lending prices, the supply of cross-border interbank and corporate loans as a share of total funding decreased from 32 to 5 percent and from 11 to 5 percent, respectively, over the sample period. Panel (b) plots the total funding supply elasticity for the corporate sector, which declined from 30 to 14 percent over the sample period. Taken together, Panels (a) and (b) show that both cross-border and domestic lending to firms became less elastic over time.[19]

[19]Appendix Figure A.4 shows the evolution of interbank loan demand elasticities over the sample period, revealing an increasing trend.

Altogether, our results show that the average loan supply in the global banking network became less responsive to changes in prices. This finding is consistent with the observations from recent literature that global banking flows have become less sensitive to global risk conditions during the post-GFC era (Avdjiev et al. 2020, Forbes and Warnock 2021). The decline in loan supply elasticity we document suggests that, on the one hand, funding shortages in individual countries may be met with smaller inflows of international capital. On the other hand, cross-border funding became more stable on average. We explicitly examine the implications of the changes in supply elasticities for international risk sharing and amplification in the subsequent subsection.

5.2 Change in Insurance Provision and Shock Amplification

To examine changes in the extent of insurance provision and amplification over time, we replicate the counterfactual analyses from Section 4, using supply and demand curves estimated for the final subsample of the data. We apply shocks of the same magnitude as the previous section and compare their effects on loan portfolio allocation under the initial and final subsamples' supply and demand curves.[20] As in the previous section, we first analyze the effects of a local funding shock on the directly shocked country and then study its spillover effects on the indirectly affected countries in the global banking network.

Insurance provision. We start by examining changes in insurance provision between the two subperiods under the scenario of a 1 percent U.S. local funding shock. To ensure comparability, we always set the pre-shock exogenous funding to its levels from the last quarter of the first subperiod. The magnitude of the shock is therefore identical for both subperiods.

Panel (c) of Figure 4 illustrates that the interbank insurance ratio for the U.S. banking sector declined from 0.4 in the initial subperiod (dark purple bar) to 0.1 in the final subperiod (light purple bar) in response to the shock. This decrease in insurance ratio indicates that,

[20]Changing the estimated supply curves in the counterfactual analysis (that is, replacing the supply curves estimated using the initial subsample with ones estimated using the final subsample) could result in different initial loan portfolio allocations across countries. To account for this, we compute the initial equilibrium loan allocation that is specific to each subperiod's supply and demand curves and assess the effects of the local funding shock relative to that initial allocation.

in response to a shock of the same magnitude, non-U.S. banks reallocate a notably smaller amount of funding toward U.S. banks by the end of the sample period, mitigating the shock effect by 10 percent compared with 40 percent in the initial subperiod. Similarly, insurance provision to the U.S. corporate sector also declined during this period, with the sum of the credit and self-insurance ratios decreasing from 0.65 to 0.37. These results point to a significant decline in the extent of insurance provision to the United States over the sample period, indicating that the U.S. banking and corporate sectors would experience a greater decline in total funding in the present period compared with a decade ago in response to a local funding shock of the same magnitude.

We next examine how insurance provision has evolved for all countries in the global banking network by conducting the same counterfactual exercise of a 1 percent local funding shock for each country. The bottom panels of Figure 7 summarize the changes in insurance provision in the banking and corporate sectors between the first and last subperiod for all countries. Panel (c) plots the interbank insurance ratios under loan supply and demand curves for the initial subsample on the x-axis and the final subsample on the y-axis. It also includes a 45-degree line. Points below the 45-degree line indicate that the insurance received from the global banking network by the banking sector decreased from the initial to the final subperiod, whereas points above the 45-degree line indicate an increase. Evidently, insurance to the banking sectors of all countries decreased in the final subperiod.

Panel (d) of Figure 7 shows that insurance provision also declined for corporate sectors in the network. It plots the sum of the credit and self-insurance ratios under loan supply and demand curves for the initial subsample on the x-axis and the final subsample on the y-axis. Since all ratios lie below the 45-degree line, our results show that the corporate sectors of all countries also receive less insurance in the final subperiod compared to the initial one.[21] These results can be explained by the substantial decline in the elasticity of cross-border interbank and total corporate loan supply over the sample period. Because banking sectors are less willing to provide intermediation, the risk-sharing mechanism in the global interbank and credit networks has been weakened.

[21] Appendix Tables A.9 and A.10 report all outputs from the counterfactual analyses, including the size of the shock effects and the insurance ratios.

Shock amplification. What are the implications for the shock amplification mechanism of the decline in supply elasticities in the global banking network? We explore this question by examining how changes in the supply curves from the initial to the final subperiod alter the impact of a 1 percent U.S. local funding shock on the non-directly shocked countries.

Given our earlier finding that funding shortages are met with smaller inflows of loans from the global banking network over time, we anticipate a broadly lower level of amplification following a local funding shock. Indeed, we find that, on average, both the interbank insurance ratios and the sum of credit and self-insurance ratios are smaller in magnitude in the last subperiod compared with the first across all non-U.S. countries in response to a 1 percent U.S. funding shock. As shown in Appendix Tables A.11 and A.12, the average interbank insurance ratio improved from –2.1 to –1.8 over the sample period, and the average sum of credit and self-insurance ratios improved from –5.5 to –3.8.

However, looking at changes in amplification for individual countries in response to the U.S. funding shock, we observe that not all countries experience a decline in amplification. Panels (a) and (b) of Figure 8 illustrate the interbank insurance ratios and the combined credit and self-insurance ratios, respectively, based on the initial (blue bar) and final (red bar) subsamples of the data. The bars are ordered by the magnitude of change in insurance ratios between the two subperiods, from countries experiencing the largest increase in amplification (decrease in insurance ratios) on the left, to those with the largest decrease (increase in insurance ratios) on the right. Panel (a) shows that the amplification effect increased for more than half of the banking sectors, as their interbank insurance ratios increased in magnitude between the two subperiods. Panel (b) illustrates a similar pattern, showing that the amplification effect increased for the corporate sectors of four countries over time.

These results indicate that, despite a decline in the amplification effects within the global banking network on average, the magnitude of this change is heterogeneous across different countries. In fact, some countries even experience an increase in amplification in response to foreign funding shocks.

5.3 The Role of Regulation

In this section, we explore one potential explanation for the decline in loan supply elasticity and risk sharing in the global banking network after 2009:Q1—bank regulation and macroprudential policies. Prompted by the GFC, many countries increased regulatory oversight of their financial sector by introducing new or more stringent regulatory standards and macroprudential policies. On the one hand, stricter bank regulation could reduce the likelihood of banking sector distress; on the other hand, regulations such as higher capital requirements could reduce liquidity in a banking network and hinder flows of capital.

We capture changes in regulatory oversight using the IMF's Integrated Macroprudential Policy (iMaPP) database, which provides indicator-type variables to denote the tightening and loosening of various policy instruments. Each tightening event is coded as +1, and each loosening event coded as –1. For each lender country, we compute two regulatory stringency indexes, one based on the liquidity coverage ratio and the other based on bank capital requirements. The indexes are constructed using the cumulative sum of the policy instrument indicators starting from 2000:Q1. We observe a significant tightening in these policy instruments, on average. The average liquidity coverage ratio stringency index increased from 0.1 in 2009 to 3.9 in 2019. The average capital requirement stringency index increased from 0.1 to 2.6.

Panel (a) of Figure 9 plots the change in lender countries' willingness and capacity to provide cross-border interbank lending as a function of the change in their liquidity coverage ratio stringency index between 2009:Q1 and 2019:Q4.[22] We focus on the liquidity coverage ratio because it captures the component of the bank regulation that is most relevant for interbank lending. The figure shows that more stringent liquidity requirements are associated with less elastic loan supply in the global interbank network. Similarly, in Panel (b) of Figure 9, we plot the change in lender countries' willingness and capacity to provide cross-border and domestic corporate lending as a function of the change in their capital requirement stringency index, as capital requirement is the component of the bank regulation that is most relevant for firm lending. It shows that more stringent capital requirements are associated with less elastic loan supply in the global credit network.

[22]See equation (11) for terms capturing a banking sector's willingness and capacity to lend.

This evidence suggests that bank regulatory changes may have contributed to the decline in insurance provision in the global banking network. Recent literature points out that regulatory changes may have induced risk migration from the banking to the nonbank sector (see, for example, Goldberg (2023)). Our finding is consistent with this view, as any increase in nonbank funding due to greater stringency in bank regulation could partly explain the decline in bank loan supply elasticities. Nevertheless, we do not observe a significant drop in cross-border bank lending at the aggregate level over the sample period, as shown in Appendix Figure A.2, and bank lending remains a key source of financing for the nonfinancial sector across countries.[23] Therefore, further research is needed to determine the extent to which bank regulation or other potential factors contribute to the decline in risk sharing in the global banking network.

6 Conclusion

Cross-border banking is a critical component of global financial markets and plays a central role in propagating shocks through the financial system. This paper provides a systematic analysis of the role of global banking linkages in facilitating international risk sharing and amplifying shocks, both across countries and over time. We develop a structural model of the global banking network that incorporates both the global interbank network and the global credit network, as well as endogenous loan supply, loan demand, and lending prices. We estimate the model using a complete set of bilateral international lending data across 19 countries and provide, for the first time, time-varying supply curves for cross-border interbank and corporate lending.

We uncover significant variation across countries in the estimates of cross-border supply elasticities, revealing significant heterogeneity in the willingness and capacity of banks to provide global intermediation. We show that this heterogeneity governs the extent of risk sharing and amplification across countries in response to local or foreign funding shocks. Countries with lower supply elasticities receive less insurance in response to local shocks, and

[23] According to data from the BIS on credit to the nonfinancial sector, banks provide 60 percent of total credit to the nonfinancial sector.

those with creditors that are more willing or have greater capacity to lend to the shocked country experience greater amplification. We further show that the elasticities of cross-border loan supply significantly declined after the GFC, resulting in less insurance provision in the global banking network. While the average degree of shock amplification also declined, some countries may experience greater amplification in response to foreign funding shocks.

Our framework provides a new approach to systematically study the evolving role of the global banking network. In future research, the framework could be extended to incorporate the nonbank and government sectors and, given data availability, used to estimate the elasticities of nonbank and government funding. Altogether, a greater understanding of the linkages in the global financial system can inform policies in support of financial stability.

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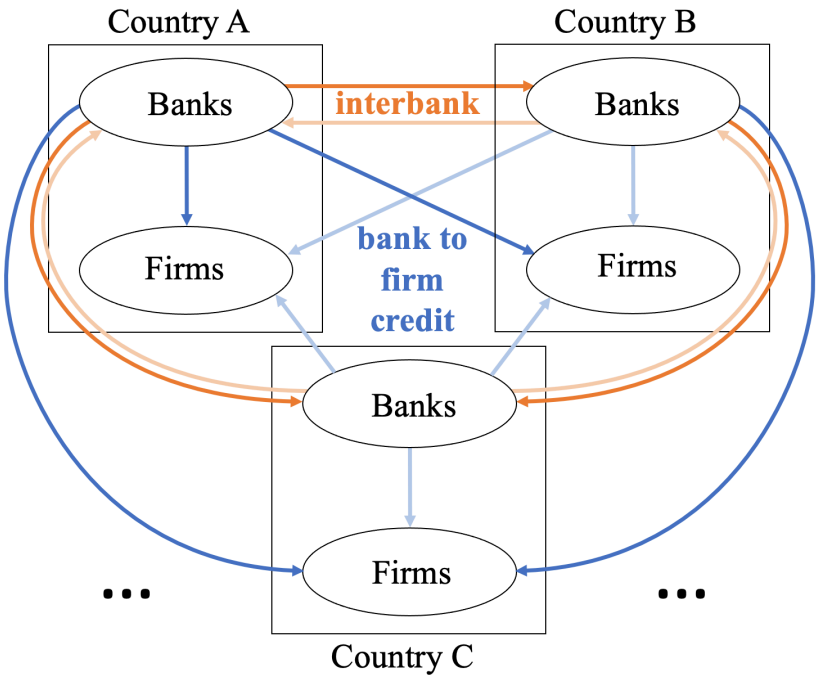
7 Figures and Tables

Figure 1: **Global Banking Network**

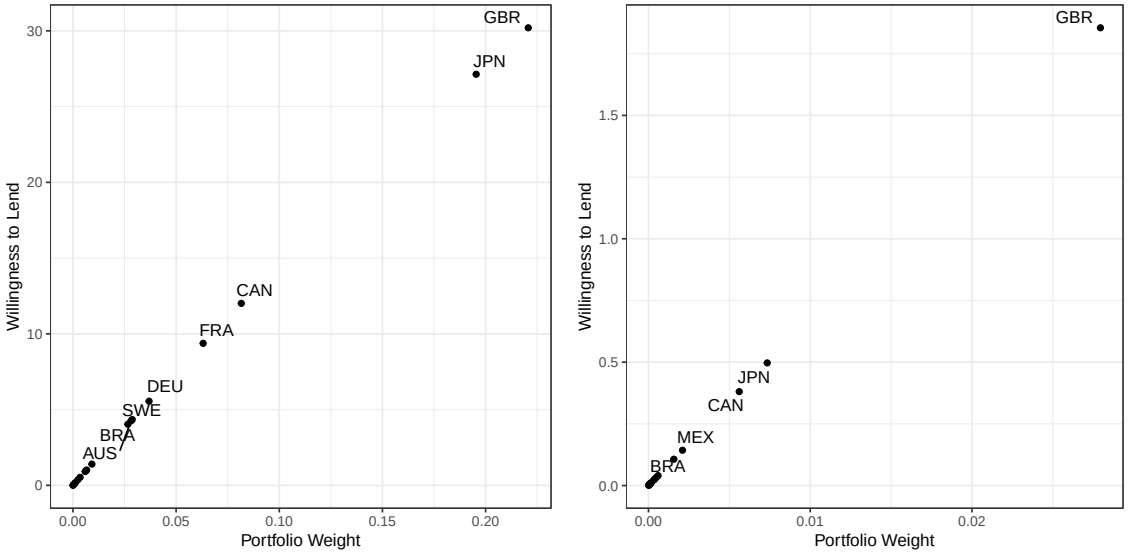


Notes: This plot provides a conceptual overview of the global banking network, which comprises the global interbank network and the global credit network. The global interbank network captures the bilateral cross-border borrowing and lending relationships that banking sectors form with each other. The global credit network captures the lending relationships that banking sectors form with foreign and domestic corporate sectors.

Figure 2: **Banking Sectors' Willingness and Capacity to Lend**

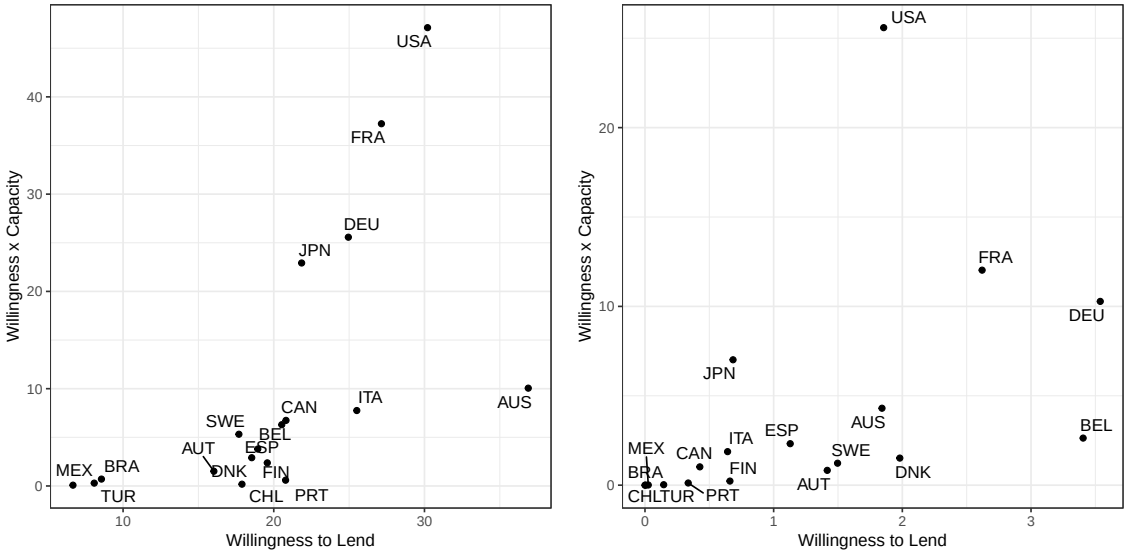
A. U.S. Banks' Willingness to Lend

(a) Banks (b) Firms



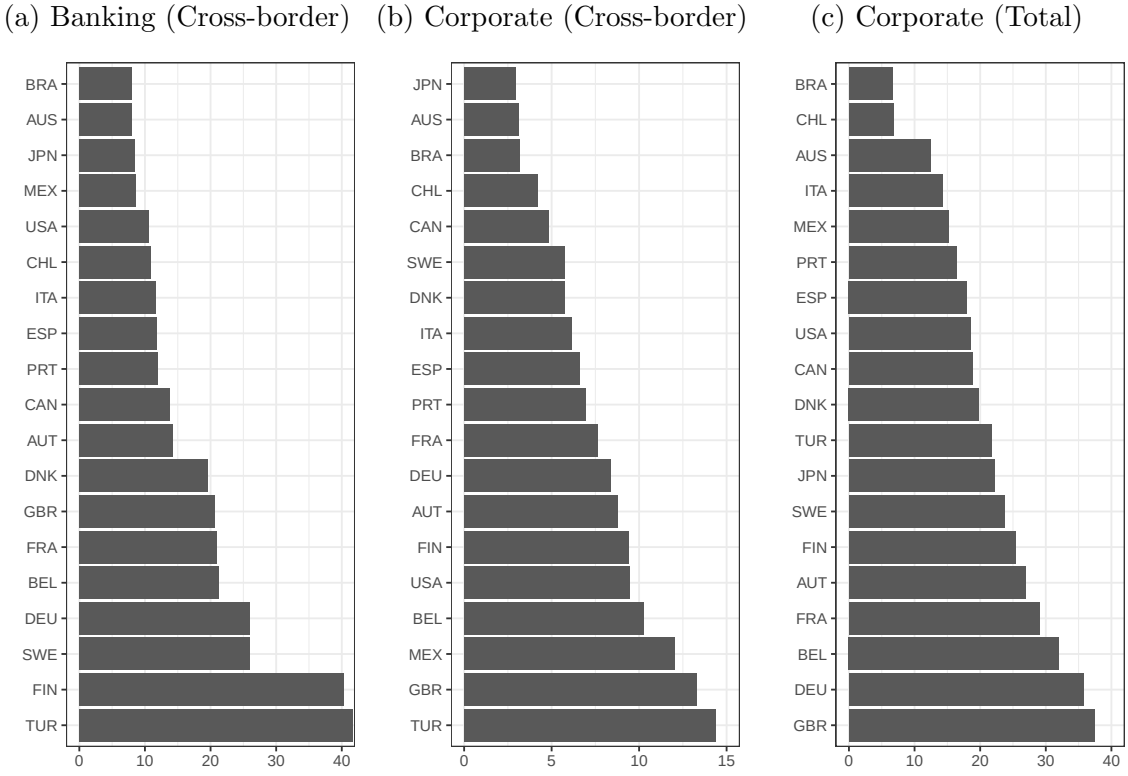
B. Banks' Willingness and Capacity to Lend to the United Kingdom

(c) Banks (d) Firms



Notes: The top panels of this exhibit plot the willingness of the U.S. banking sector to lend to different borrower countries as a function of its portfolio weights in the banking (Panel (a)) and corporate (Panel (b)) sectors of the respective countries, averaged over time. A lender country's willingness to lend to a borrower country in a given sector is computed as the product of their bilateral supply elasticity and the weight of the borrower country in the lender's loan portfolio in that sector, as specified in equation (11). Bilateral elasticity is computed according to equation (A.2) in Appendix A. The bottom panels plot the average willingness and capacity of different countries to lend to the United Kingdom's banking (Panel (a)) and corporate (Panel (b)) sectors as a function of the respective countries' willingness to lend to the United Kingdom. A lender's willingness and capacity to lend is computed by multiplying its willingness to lend and total assets. Source: Authors' calculations using the BIS Locational Banking Statistics and data sources listed in Appendix Table A.3.

Figure 3: **Loan Supply Elasticities by Borrower Country**

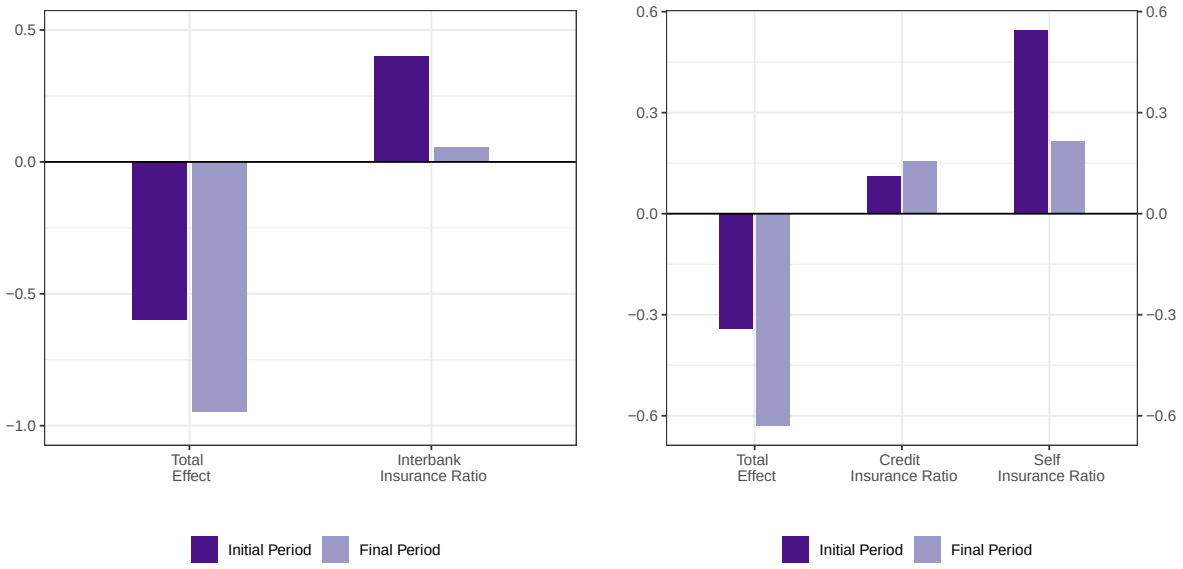


Notes: This exhibit presents the average cross-border loan supply elasticities for the banking (Panel (a)) and corporate sectors (Panel (b)) as well as the total (cross-border and local) lending elasticities for the corporate sector (Panel (c)) of the borrower countries in the global banking network. As specified in equation (11), the elasticities measure the percent change in the quantity of cross-border or total loans extended to a given sector of a given country as a share of its total funding in relation to a 1 percent increase in lending price. The elasticities are based on estimations using the full sample. Borrower countries are presented in ascending order from ones with the least elastic lending supply to the most elastic. Source: Authors' calculations using the BIS Locational Banking Statistics and data sources listed in Appendix Table A.3.

Figure 4: **Effects of U.S. Local Funding Shock on Funding to the United States**

(a) Banking Sector
(Initial and Final Period)

(b) Corporate Sector
(Initial and Final Period)



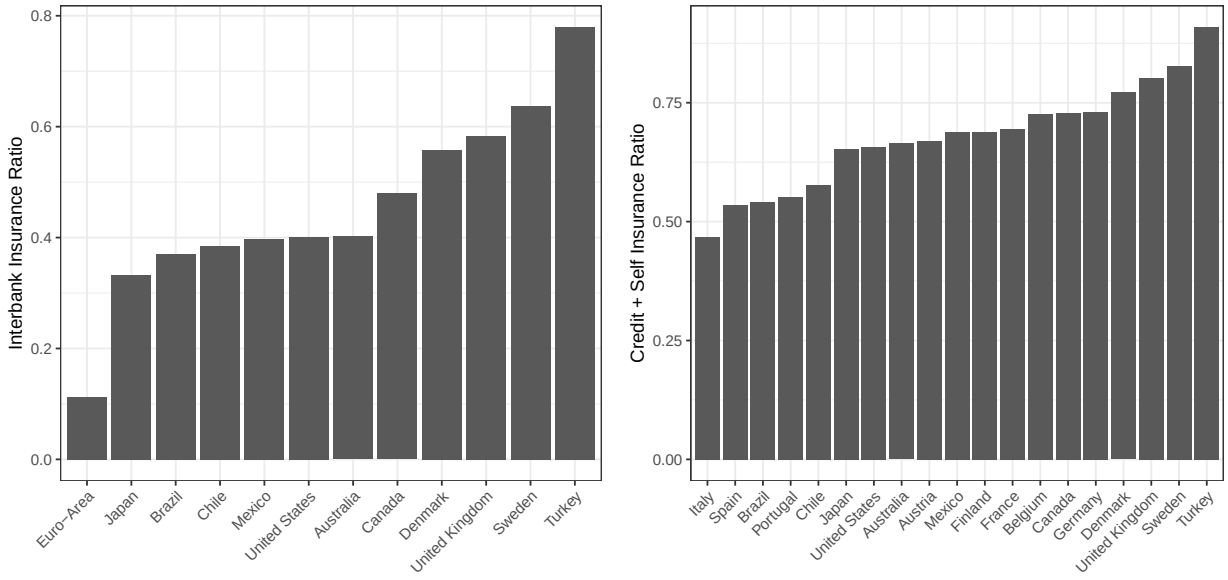
Notes: Panels (a) and (b) of this exhibit present the effects of a 1 percent decline in U.S. local funding on funding to the U.S. banking and corporate sectors. The dark (light) purple bars illustrate the effects based on the supply and demand curves estimated for the initial (final) sample period from 2009:Q1 through 2016:Q3 (2012:Q2 through 2019:Q4). The interbank insurance ratio measures the change in funding inflows to the U.S. banking sector resulting from endogenous reallocation of non-U.S. banking sectors' loan portfolios, relative to the size of the U.S banking sector's shock effect. The shock effect encompasses all immediate effects of the shock before any endogenous reallocation. The credit and self-insurance ratios measure the endogenous reallocation of funding to the U.S. corporate sector from non-U.S. (foreign) and U.S. (domestic) banking sectors, respectively, relative to the size of the corporate sector's shock effect. The total effect in each sector captures the share of the corresponding shock effect that is not insured by domestic or foreign banking sectors. Source: Authors' calculations using the BIS Locational Banking Statistics and data sources listed in Appendix Table A.3.

Figure 5: **Global Insurance Provision and Loan Supply Elasticity**

A. Heterogeneity in Global Insurance

(a) Interbank Insurance

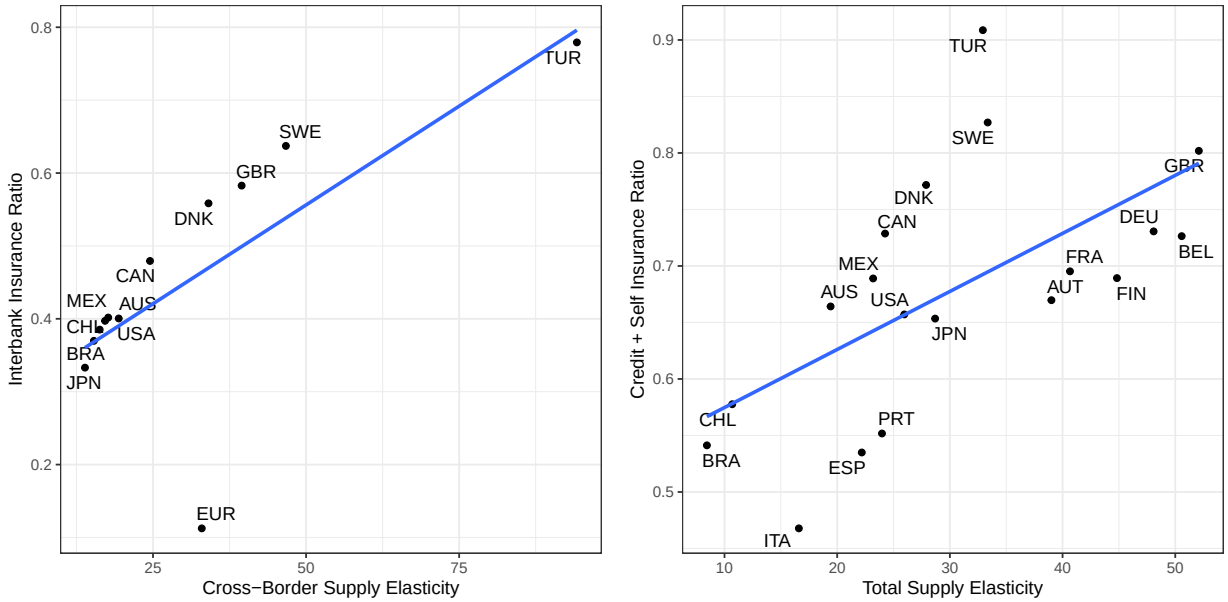
(b) Credit and Self-insurance



B. Global Insurance and Supply Elasticity

(c) Banking Sector

(d) Corporate Sector

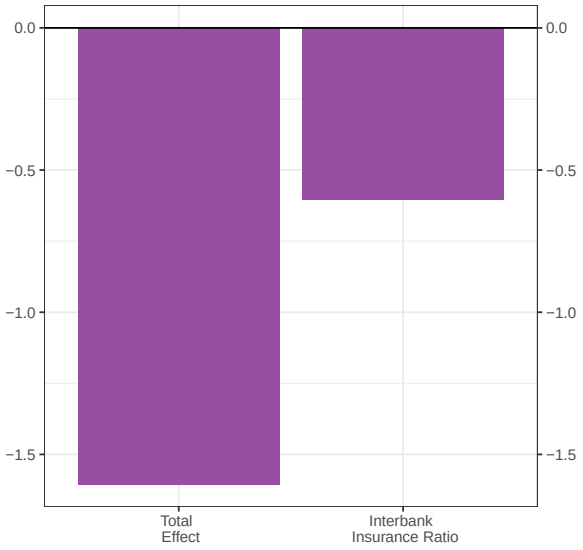


Notes: The top panels of this exhibit present the interbank insurance ratio (Panel (a)) and the sum of the credit and self-insurance ratios (Panel (b)) of each borrower country in response to a 1 percent local funding shock in own banking sector. The interbank insurance ratio measures the change in funding inflows to the shocked banking sector resulting from endogenous reallocation of all other banking sectors' loan portfolios, relative to the size of the shocked banking sector's shock effect. The shock effect encompasses all immediate effects of the shock before any endogenous reallocation. The credit and self-insurance ratios measure the endogenous reallocation of funding to the shocked corporate sector from the foreign and domestic banking sectors, respectively, relative to the size of the corporate sector's shock effect. Appendix Tables A.9 and A.10 list the corresponding magnitudes. The bottom panels present the interbank insurance ratio (Panel (c)) and the sum of the credit and self-insurance ratios (Panel (d)) from Panels (a) and (b), respectively, as a function of the corresponding aggregate loan supply elasticities for each borrower country and sector. See notes from Figure 3 for additional details on the calculation of the loan supply elasticities. All the estimates in this panel are based on the supply and demand curves estimated for the initial sample period from 2009:Q1 through 2016:Q3. Source: Authors' calculations using the BIS Locational Banking Statistics and data sources listed in Appendix Table A.3.

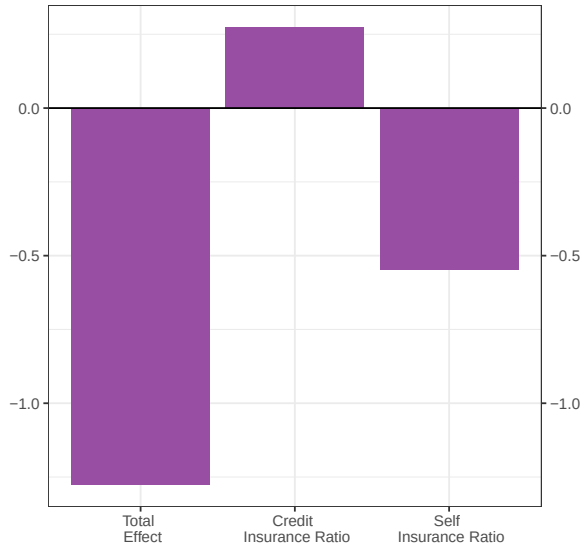
Figure 6: **Global Transmission of U.S. Local Funding Shock**

A. Effects of U.S. Funding Shock on Funding to Mexico

(a) Banking Sector

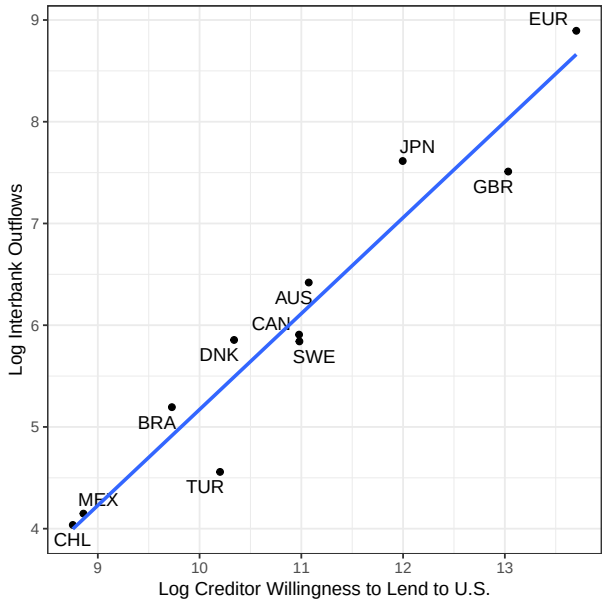


(b) Corporate Sector

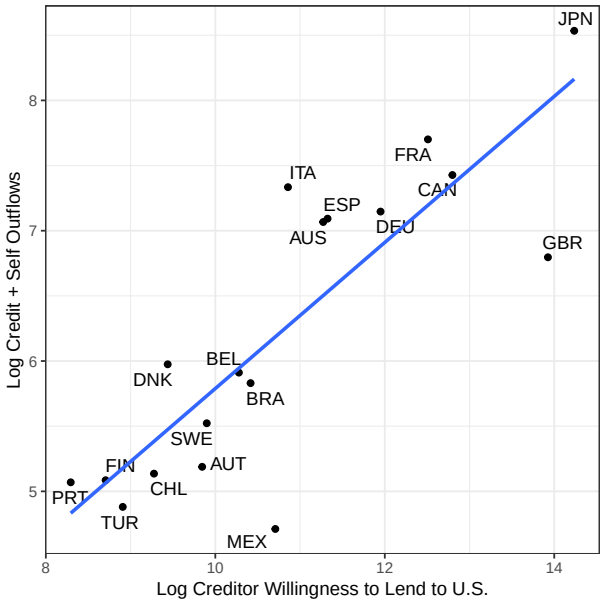


B. Funding Outflow and Creditors' Willingness and Capacity to Lend to the United States

(c) Banking Sector



(d) Corporate Sector

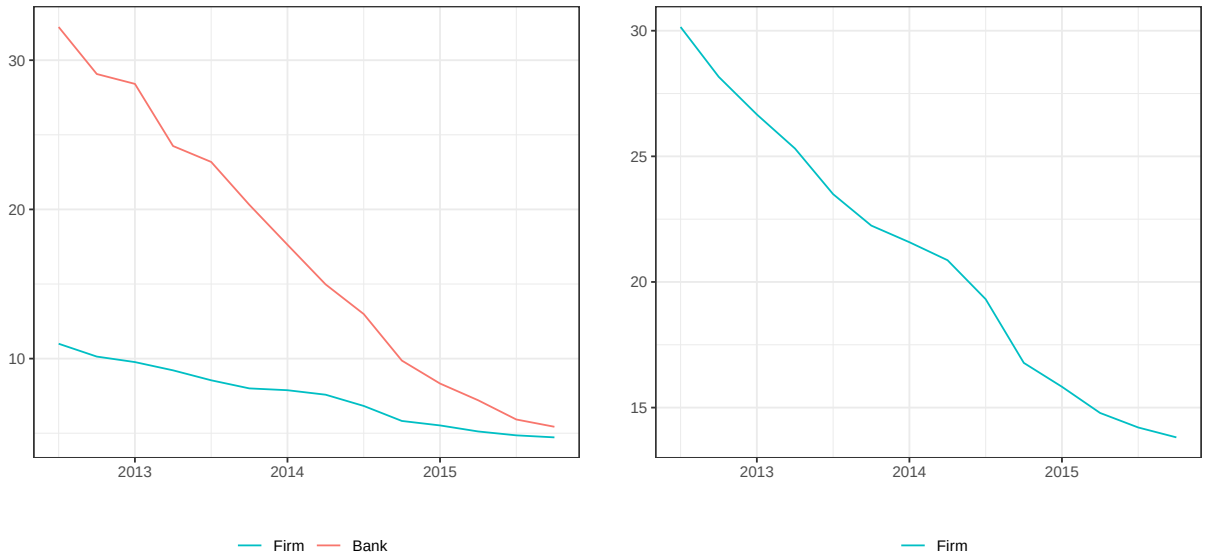


Notes: The top panels of this exhibit present the effect of a 1 percent decline in U.S. local funding on funding to the banking (Panel (a)) and corporate (Panel (b)) sectors in Mexico. Refer to the notes accompanying Figure 4 for definitions of the insurance ratios and the total effect, which are adapted for Mexico in this scenario. The bottom panels of this exhibit illustrate the log amount of endogenous funding outflow from each country's banking (Panel (a)) and corporate (Panel (b)) sectors in response to a 1 percent decline in U.S. local funding as a function of the aggregate willingness of its creditor countries to lend to the corresponding sector of the United States. For each sector ℓ of country m, the measure capturing its creditors' aggregate willingness to lend is computed as a weighted sum of each of its creditor country's willingness and capacity to lend to the United States, with the creditor's portfolio weight on the respective sector and country as weights. All the estimates in this panel are based on the supply and demand curves estimated for the initial sample period from 2009:Q1 through 2016:Q3. Source: Authors' calculations using the BIS Locational Banking Statistics and data sources listed in Appendix Table A.3.

Figure 7: **Loan Supply Elasticity and Global Insurance over Time**

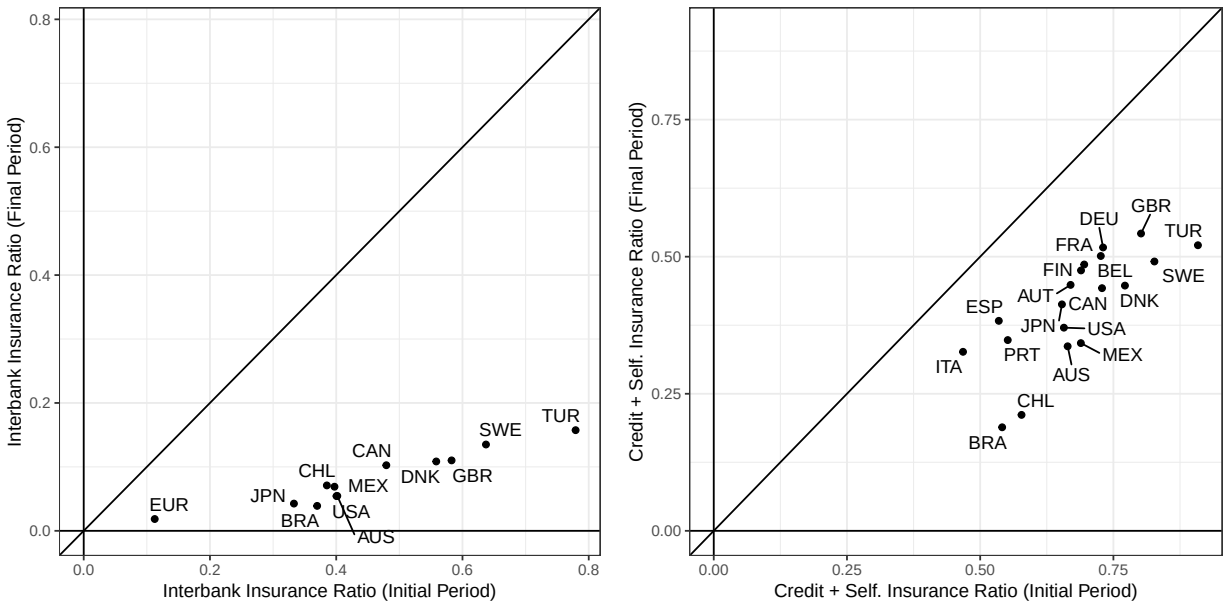
(a) Cross-Border Lending Elasticities

(b) Total Lending Elasticity, Corporate Sector



(c) Interbank Insurance

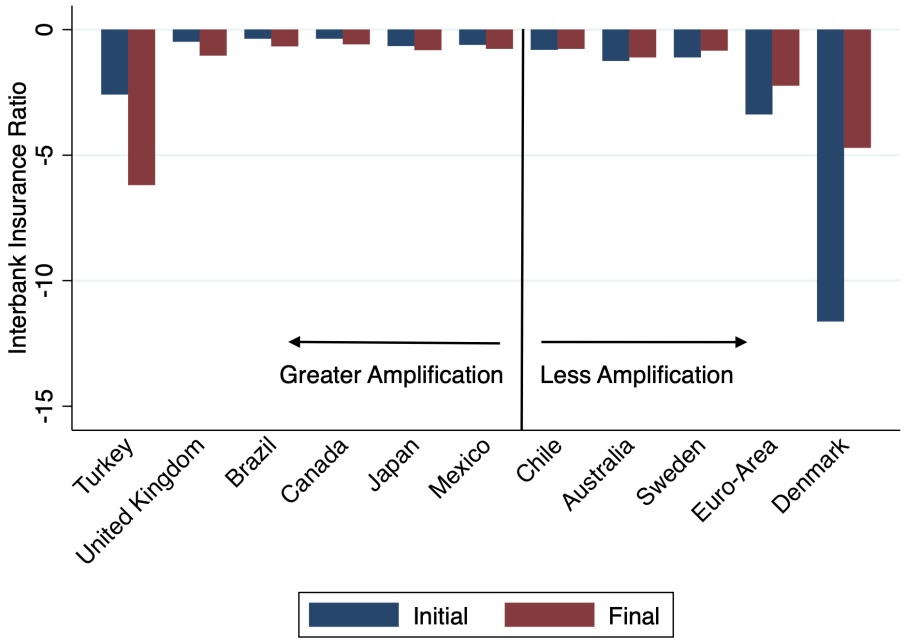
(d) Credit and Self-insurance



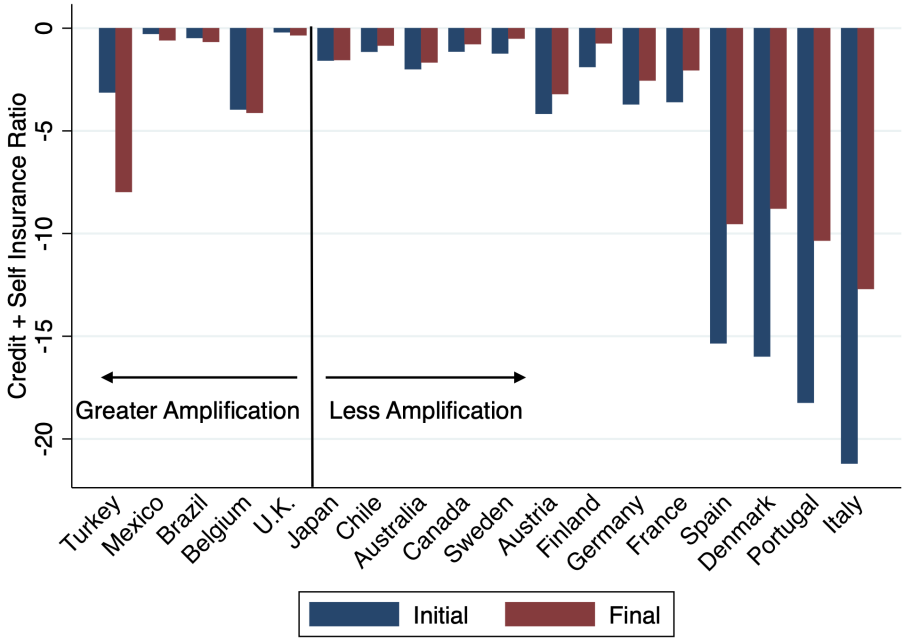
Notes: Panel (a) presents the cross-border loan supply elasticities for the banking and corporate sector from 2009:Q1 through 2019:Q4, averaged across countries. Panel (b) presents the average total (cross-border and local) loan supply elasticities for the corporate sector. The supply elasticities for each borrower country are computed based on rolling regressions using 30-quarter subsamples of the data. See Figure 3 for more detailed descriptions of the cross-border and total lending elasticities. Panels (c) and (d) compare the amount of insurance provision to each country's bank and corporate sectors, as measured by the interbank insurance ratio and the credit and self-insurance ratios, respectively, in the initial (x-axis) and final (y-axis) periods in response to a 1 percent local funding shock in own banking sector. See Figure 5 for definitions of the insurance ratios. A 45-degree line is included in the two panels. Points below the 45-degree line indicate a lower degree of insurance provision in the final subperiod. Source: Authors' calculations using the BIS Locational Banking Statistics and data sources listed in Appendix Table A.3.

Figure 8: **Amplification of U.S. Funding Shock, Initial and Final Period**

(a) Banking Sector



(b) Corporate Sector

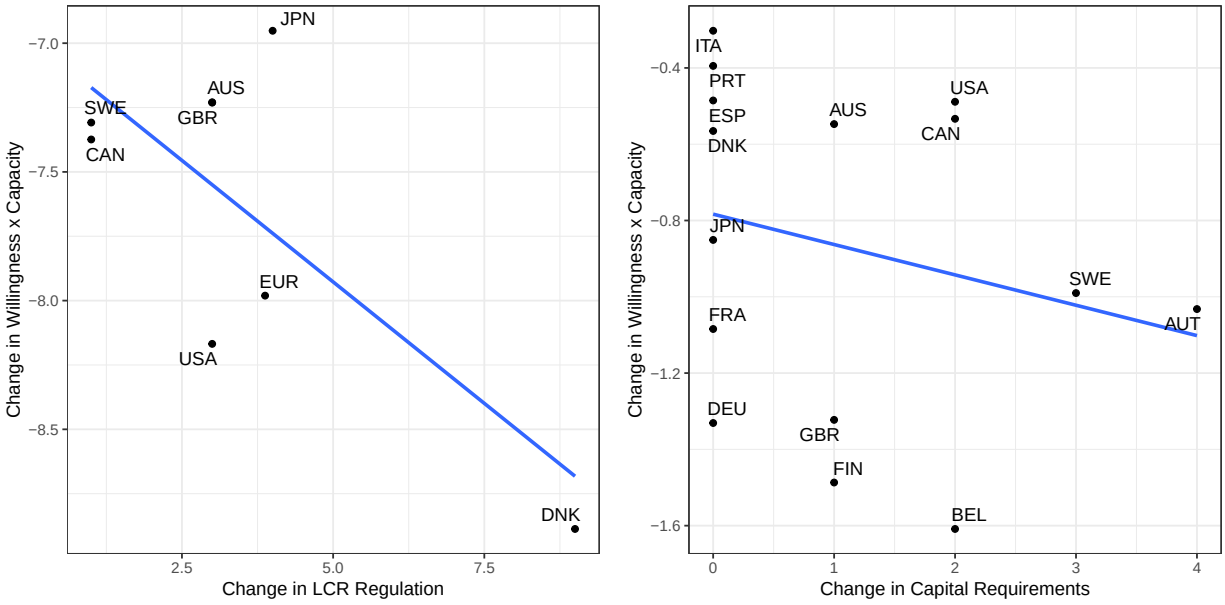


Notes: This exhibit compares the effects of a 1 percent decline in U.S. local funding for the banking (Panel (a)) and corporate sectors of non-U.S. countries between the initial (blue bar) and final (red bar) subsample periods. Refer to the notes accompanying Figure 5 for definitions of the insurance ratios. Negative insurance ratios denote shock amplification. The countries are ordered by the magnitude of change in insurance ratios between the two subperiods, from those experiencing the largest increase in amplification (decrease in insurance ratios) on the left, to those with the largest decrease (increase in insurance ratios) on the right. Appendix Tables A.11 and A.12 list the corresponding magnitudes. Source: Authors' calculations using the BIS Locational Banking Statistics and data sources listed in Appendix Table A.3.

Figure 9: **Regulatory Stringency and Global Insurance Provision**

(a) Banking Sector

(b) Corporate Sector



Notes: This exhibit presents the changes in lender countries' willingness and capacity to provide cross-border interbank (Panel (a)) and total (cross-border and domestic) corporate lending (Panel (b)) from 2009:Q1 through 2019:Q4 as a function of the corresponding changes in the stringency of the relevant regulatory measure over the period. Refer to the notes accompanying Figure 2 for definitions of a country's willingness and capacity to lend. In Panel (a), the regulatory measure is based on the stringency of the liquidity coverage ratio. The slope of the fitted line is –0.19 (s.e. = 0.09) with R-squared = 0.44. In Panel (b), the regulatory measure is based on the stringency of the capital ratio. The slope of the fitted line is –0.05 (s.e. = 0.03) with R-squared = 0.20. Source: Authors' calculations using the Integrated Macroprudential Policy (iMaPP) database, BIS Locational Banking Statistics, and data sources listed in Appendix Table A.3.

Table 1: **Summary Statistics on Total Lending by Sector (Billions of USD)**

	Initial Period						Final Period					
	CB Bank		CB Firm		Total Firm		CB Bank		CB Firm		Total Firm	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Australia	150	16	90	11	1701	218	149	15	93	10	2039	261
Austria	129	26	61	7	519	49	90	27	66	7	532	42
Belgium	178	30	103	10	675	69	156	16	105	8	700	61
Brazil	70	17	75	14	1183	405	75	9	71	13	1393	204
Canada	214	16	115	11	2020	149	234	26	134	20	2098	130
Chile	18	4	17	2	183	43	19	3	18	1	239	37
Denmark	153	19	71	6	709	35	136	21	65	9	708	41
Finland	136	23	44	6	296	35	139	14	47	5	326	19
France	831	83	418	43	3523	228	816	90	442	27	3736	243
Germany	708	104	405	58	3828	997	680	81	331	74	2853	1033
Italy	405	116	237	51	3158	265	292	47	241	60	3166	262
Japan	519	103	220	69	9622	1454	623	52	305	60	8607	1155
Mexico	19	6	68	6	338	73	21	2	74	3	409	31
Portugal	80	35	44	10	449	44	44	18	37	3	402	54
Spain	389	160	194	26	2670	298	233	68	184	16	2328	413
Sweden	167	16	75	6	694	80	188	18	69	8	755	43
Turkey	50	16	52	6	140	41	59	9	50	7	186	30
United Kingdom	2022	423	816	97	5512	322	1557	326	960	140	5485	322
United States	1204	105	1879	119	11698	823	1183	56	2053	196	13284	1512

Notes: This table reports the quarterly means and standard deviations of cross-border (CB) lending to the banking (columns 2 and 3, columns 7 and 8) and corporate (columns 4 and 5, columns 9 and 10) sectors, and of total (cross-border and domestic) lending to the corporate sectors (columns 6 and 7, columns 11 and 12) of the 19 countries in the global banking network over the initial subsample period of 2009:Q1 through 2016:Q3 (left panel) and the final subsample period of 2012Q2 through 2019Q4 (right panel). Source: BIS Locational Banking Statistics.

Table 2: **Within-sector Loan Supply Estimation (Full Sample)**

	(1) Banks	(2) Firms
Log Price	-152.40*	-67.16**
	(80.13)	(28.38)
Policy Rate Differential	17.42	3.43
	(12.72)	(5.67)
Log GDP (Lagged)	1.49***	0.97***
	(0.11)	(0.17)
Log GDP per capita (Lagged)	0.64*	0.18
	(0.34)	(0.27)
Distance	-1.78***	-1.67***
	(0.24)	(0.25)
Trade Exposure	0.02	0.04
	(0.11)	(0.12)
Vol.	-0.43***	-0.37***
	(0.11)	(0.12)
FX Vol.	-0.16	0.10
	(0.15)	(0.21)
Regulation (Borrower)	-0.47***	-0.36**
	(0.16)	(0.13)
Indicator: Own Country		1.51
		(1.82)
Observations	13,949	14,144
F-test (1st stage), Log Price	816.6	176.9
Lender fixed effects	✓	✓
Time fixed effects	✓	✓
Market fixed effects	✓	✓

Notes: This table presents the estimation results from equation (8) for the banking (column 1) and corporate (column 2) sectors using the full sample period from 2009:Q1 through 2019:Q4. The estimation is based on the instrumental variable approach described in Section 3. All specifications include lender country, time, and borrower country MSCI market fixed effects. Standard errors (in parentheses) are clustered by lender country and time. $^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$. Source: Authors' calculations using the BIS Locational Banking Statistics and data sources listed in Appendix Table A.3.

Table 3: **Within-sector Loan Supply Estimation (Initial and Final Periods)**

	Initial Period		Final Period	
	(1) Banks	(2) Firms	(3) Banks	(4) Firms
Log Price	-269.69***	-94.43**	-50.06	-41.89*
	(77.61)	(39.44)	(87.53)	(21.86)
Policy Rate Differential	36.78**	7.86	1.91	-0.34
	(16.40)	(15.82)	(13.39)	(2.93)
Log GDP (Lagged)	1.46***	0.95***	1.61***	1.07***
	(0.10)	(0.20)	(0.12)	(0.15)
Log GDP per capita (Lagged)	0.37	0.39	0.84**	0.24
	(0.34)	(0.26)	(0.36)	(0.28)
Distance	-1.82***	-1.98***	-1.93***	-1.55***
	(0.22)	(0.37)	(0.27)	(0.23)
Trade Exposure	0.01	-0.10	-0.02	0.12
	(0.09)	(0.17)	(0.12)	(0.10)
Vol.	-0.53***	-0.26*	-0.33***	-0.32***
	(0.11)	(0.13)	(0.11)	(0.10)
FX Vol.	-0.09	0.28	0.04	0.04
	(0.08)	(0.37)	(0.20)	(0.16)
Regulation (Borrower)	-1.07***	-0.71***	-0.25*	-0.25**
	(0.22)	(0.17)	(0.14)	(0.11)
Indicator: Own Country		-0.20		2.77**
		(2.78)		(1.26)
Observations	9,735	9,825	9,801	9,902
F-test (1st stage), Log Price	1,570.8	81.8	593.7	259.9
Lender fixed effects	✓	✓	✓	✓
Time fixed effects	✓	✓	✓	✓
Market fixed effects	✓	✓	✓	✓

Notes: This table presents the estimation results from equation (8) for the banking (columns 1 and 3) and corporate (columns 2 and 4) sectors using the initial (2009:Q1 through 2016:Q3) and final (2012:Q2 through 2019:Q4) subsample. The estimation is based on the instrumental-variables approach described in Section 3. All specifications include lender country, time, and borrower country MSCI market fixed effects. Standard errors (in parentheses) are clustered by lender country and time. $^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$. Source: Authors' calculations using the BIS Locational Banking Statistics and data sources listed in Appendix Table A.3.

Appendix
-For online publication only-

A Deriving Loan Supply Elasticities

In this section, we derive the expressions for the elasticities of lending supply with respect to price within the banking and corporate sectors. We show the expressions for both the bilateral elasticity of loan supply for each borrower-lender country pair and the aggregate loan supply elasticity for each borrower country.

The log quantity of loans provided to sector ℓ of country m is given by

$$\hat{q}_{n,t}(m,\ell) = \log\left(A_{n,t}w_{n,t}(\ell)w_{n,t}(m|\ell)\right) - p_t(m,\ell). \tag{A.1}$$

Equation (A.1) shows that changes in the log price of loans affect the quantity of loans supplied through their influence on the across-sector weight $w_{n,t}(\ell)$, the within-sector weight $w_{n,t}(m|\ell)$, and the price of the loan itself $p_t(m,\ell)$.

To derive the elasticity of loan supply for a given lender n to borrower m in sector ℓ, we plug equations (1), (2) and (4) into equation (A.1) and differentiate with respect to $p_t(m,\ell)$:

$$-\frac{\partial \hat{q}_{n,t}(m,\ell)}{\partial p_t(m,\ell)} = 1 - \underbrace{(1-w_{n,t}(\ell))w_{n,t}(m|\ell)\beta_\ell\lambda_\ell}_{\frac{\partial \log(w_{n,t}(\ell))}{\partial p_t(m,\ell)}} - \underbrace{(1-w_{n,t}(m|\ell))\beta_\ell}_{\frac{\partial \log(w_{n,t}(m|\ell))}{\partial p_t(m,\ell)}}. \tag{A.2}$$

The aggregate log quantity of loans supplied to sector ℓ of country m is equal to

$$\hat{q}_t(m,\ell) = \log\left(\sum_n A_{n,t}w_{n,t}(\ell)w_{n,t}(m|\ell)\right) - p_t(m,\ell).$$

To derive the aggregate elasticity of loan supply to sector ℓ of country m, we take the derivative of the above expression with respect to $p_t(m,\ell)$:

$$-\frac{\partial \hat{q}_t(m,\ell)}{\partial p_t(m,\ell)} = \sum_n \left(\frac{A_{n,t}w_{n,t}(m,\ell)}{\sum_k A_{k,t}w_{k,t}(m,\ell)}\right)\left(-\frac{\partial \hat{q}_{n,t}(m,\ell)}{\partial p_t(m,\ell)}\right) \tag{A.3}$$

Equation (A.3) shows that the aggregate supply elasticity for lending to sector ℓ of country m is a weighted sum of the supply elasticities of each of its lender countries.

B Additional Estimation Results

Appendix Table A.6 reports the estimation results for cross-sector loan supply based on equation (9). The estimates for λ_ℓ capture the degree of substitutability in lending between the bank sector and corporate sector. They should fall between 0 and 1, which implies some substitutability between the two sectors when the relative value of lending to one sector changes.[1] As shown in column (1), our estimates for λ_ℓ average 0.6 for the banking sector (λ_1) and 0.6 for the corporate sector (λ_2) over the sample period, indicating substantial substitutability in lending between the two sectors. In addition, the estimate for $\alpha_{2,t}$ captures the relative desirability of lending to the corporate sector. On average, we find a positive estimate for α_2, indicating a stronger desirability of directly lending to the corporate sector relative to the banking sector.

Demand. Appendix Table A.7 provides estimates of loan demand curves based on equation (10). In both the bank and corporate sectors, the coefficients on price are positive, which indicates that both banks and firms demand more loans as interest rates decline. Between the two sectors, the coefficient on price in the banking sector is larger, indicating that bank demand for cross-border interbank funding is more responsive to changes in loan prices. Compared with the supply curve estimation results in Table 2, the coefficient on price for corporate lending demand is notably smaller in absolute value, which shows that the demand for corporate loans tends to be more elastic than the supply of these loans.[2] The coefficients on GDP are positive, indicating that loan demand tends to be procyclical across countries.

Exchange rate. Appendix Table A.8 reports the results of estimating exchange rates based on equation (7). The estimate of –0.57 for β_e indicates that an increase in the country n interbank rate is associated with an appreciation in currency n contemporaneously. This result is consistent with existing estimates of exchange rate movements in response to high-frequency monetary policy shocks (for example, Zhang 2021).

C Robustness

To assess the robustness of our elasticity estimates from the baseline estimation methodology from Section 3.3, we apply an alternative estimation procedure for constructing the instruments. We find that it generates loan supply elasticities that are similar to those obtained from the baseline procedure.

Our benchmark estimation constructs exogenous portfolio weights as a function of all borrower countries' exogenous characteristics including population, GDP per capita, distances from different lender countries, and home bias. We then construct instruments for

[1] By contrast, $\lambda_\ell = 0$ implies no substitutability in lending between the two sectors, and the allocation of bank funding to borrowers from the bank or corporate sector would remain constant when the relative value of lending to the other sector changes.

[2] To our knowledge, these are the first estimates of demand elasticities for loans or any given asset class in the literature.

price using the market clear conditions with lagged domestic funding and lagged loan demand. One potential concern with this procedure is that lagged domestic funding may be correlated with latent supply. To address this concern, we construct the instruments using an alternative procedure that does not rely on observed values for domestic funding.

Instead of using lagged domestic funding, we predict the supply of domestic funding using a regression of log domestic funding on the log population of the lender country and a lender fixed effect. As a result, we capture only variation in domestic funding that varies with the size of the country as proxied by its population, which alleviates possible concerns about the endogeneity of domestic funding.

Table A.1 presents the supply elasticities of cross-border interbank lending, cross-border corporate lending, and total corporate lending based on the benchmark and alternative estimation methodology. The magnitudes of the supply elasticities based on the alternative methodology are smaller than but qualitatively similar to the benchmark estimates.

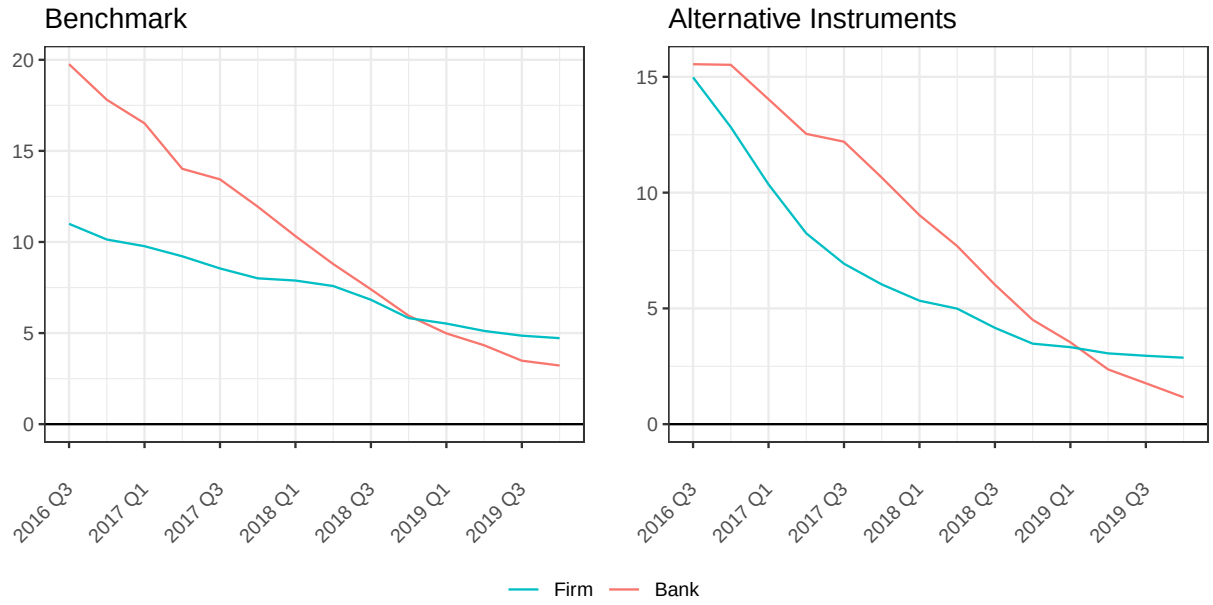
Table A.1: Loan Supply Elasticities, Robustness

	(1)	(2)	(3)
Version	Cross-border Bank	Cross-border Firm	Total Firm
Benchmark	20.1	8.0	21.6
Alternative	16.5	4.2	11.6

Notes: This table presents the supply elasticities of cross-border interbank lending, cross-border firm lending, and total firm lending based on the benchmark and alternative estimation methodologies for constructing the instruments. The estimation is conducted for the full sample period. Elasticities are computed using the formulas in Appendix A.

Figure A.1 presents the time series of cross-border loan supply elasticities for the banking and corporate sectors, estimated using 30-quarter rolling windows. The first subperiod corresponds to 2009:Q1 through 2016:Q3, and the final subperiod corresponds to 2012:Q2 through 2019:Q4. The figure shows that the elasticities of cross-border interbank and corporate lending have declined dramatically over the 2009–2019 period based on both estimation methodologies. Therefore, the main estimation results of the paper are robust, and the results of the paper are not sensitive to the construction of the instruments.

Figure A.1: Loan Supply Elasticities over Time, Robustness

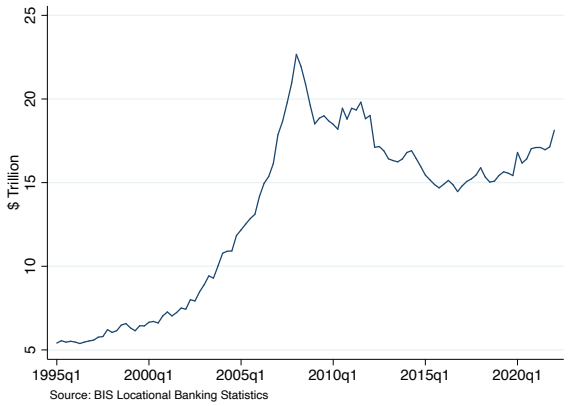


Notes: This exhibit presents the time series of average cross-border interbank and firm loan supply elasticities estimated using the benchmark and alternative methodologies for constructing the instruments. The left panel replicates the results from the benchmark estimation, also shown in Panel (a) of Figure 7. The right panel presents the estimation results using the alternative methodology. Source: Authors' calculations using the BIS Locational Banking Statistics and data sources listed in Appendix Table A.3.

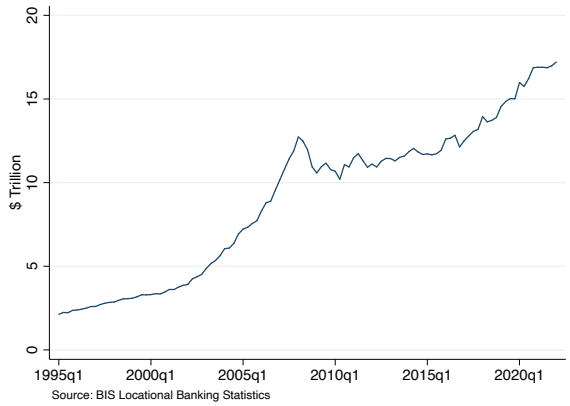
D Additional Figures and Tables

Figure A.2: **Capital Flows in the Global Banking Network**

(a) Cross-border Bank-to-bank Flows

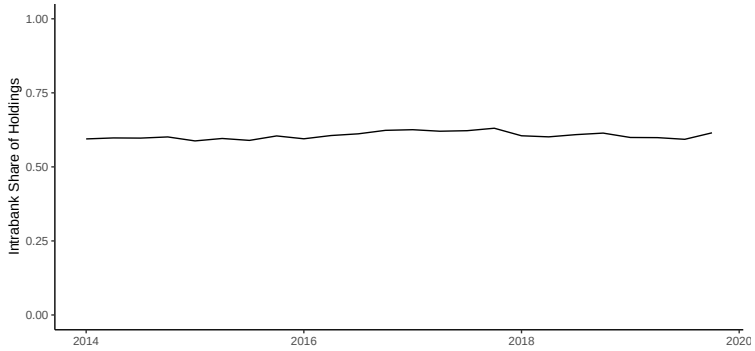


(b) Cross-border Bank-to-Firm Flows



Notes: This exhibit presents the aggregate cross-border bank-to-bank flows in the global interbank network (Panel (a)) and bank-to-firm flows in the global credit network (Panel (b)). Source: BIS Locational Banking Statistics.

Figure A.3: **Share of Interbank Loans between Affiliated Banks**



Notes: This figure shows the average share of cross-border interbank loans between affiliates of the same organizations for the 19 countries in the global banking network over time. Source: BIS Locational Banking Statistics.

Table A.2: Country List

Financial Center:	*Advanced Economy:*	*Emerging Economy:*
United States	Australia	Brazil
United Kingdom	Austria	Chile
	Belgium	Mexico
	Canada	Turkey
	Denmark	
	Finland	
	France	
	Germany	
	Italy	
	Japan	
	Portugal	
	Spain	
	Sweden	

Notes: This table lists the 19 countries in the global banking network.

Table A.3: Description of Characteristic Variables

Characteristic	Code	Definition	Source
Bank Regulation	reg_d	Cumulative sum of macroprudential regulations.	IMF iMaPP
Distance	distw	Distance (km) between two countries, where distance is measured as the weighted arithmetic average of geodesic distances between the main population centers (cities) of each country. City populations are used as weights.	CEPII
Exchange Rate	fx_rate_od	Units of destination country's currency required to purchase one unit of origin country's currency.	Bloomberg
GDP	gdp_d	Nominal GDP (USD)	WDI
GDP Per Capita	gdpcap_d	Nominal GDP Per Capita (USD)	WDI
Interbank Rate	interbank_d	3-month interbank rate	Bloomberg
Lending Rate	lending_rate_d	Lending interest rate	See note
Dollar Rate Spread	sprd_d	Spread between local currency rate and U.S. dollar lending rate	Federal Reserve Y-14Q
Market Type	market_d	Emerging vs. Advanced Foreign Economy Dummy Variable.	
Policy Rate	policy_rate_d	Central bank policy rate	BIS
Trade Intensity	trade	Trade intensity between a country pair; measured as $Trade_{i,j} = \frac{Imports_{i,j} + Exports_{i,j}}{\sqrt{GDP_i \times GDP_j}}$.	IMF DOTS
Volatility	vol	Destination country stock market volatility.	Bloomberg

Note: This table presents the list of characteristics variables used in estimating loan supply and demand curves, as well as their definitions and data sources. The default source for lending rates is the IMF's International Financial Statistics database. In cases where observations are missing, we obtain data from Bloomberg, Danmarks Nationalbank, ECB Statistical Data Warehouse, Central Bank of Turkey, World Bank World Development Indicators, and Central Bank of Chile.

Table A.4: Within-sector Loan Supply Estimation (OLS, Full Sample)

	(1) Banks	(2) Firms
Log Price	-49.83**	-14.29***
	(17.56)	(4.89)
Policy Rate Differential	2.17	-3.15
	(2.42)	(2.10)
Log GDP (Lagged)	1.51***	1.10***
	(0.10)	(0.08)
Log GDP per capita (Lagged)	0.67*	0.16
	(0.33)	(0.25)
Distance	-1.86***	-1.33***
	(0.22)	(0.19)
Trade Exposure	0.00	0.21**
	(0.11)	(0.09)
Vol.	-0.40***	-0.38***
	(0.11)	(0.08)
FX Vol.	0.02	-0.08
	(0.08)	(0.06)
Regulation (Borrower)	-0.32**	-0.20**
	(0.13)	(0.08)
Indicator: Own Country		4.10***
		(0.47)
Observations	13,949	14,144
Lender fixed effects	✓	✓
Time fixed effects	✓	✓
Market fixed effects	✓	✓

Notes: This table presents the OLS estimation results from equation (8) for the banking (column 1) and corporate (column 2) sectors using the full sample period from 2009:Q1 through 2019:Q4. All specifications include lender country, time, and borrower country MSCI market fixed effects. Standard errors (in parentheses) are clustered by lender and time. $^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$. Source: Authors' calculations using the BIS Locational Banking Statistics and data sources listed in Appendix Table A.3.

Table A.5: Loan Supply Estimation Within Sectors (OLS, Initial and Final Periods)

	Initial Period		Final Period	
	(1) Banks	(2) Firms	(3) Banks	(4) Firms
Log Price	-78.19***	-13.00***	-48.10**	-15.74**
	(26.34)	(4.66)	(21.59)	(6.80)
Policy Rate Differential	1.75	-4.88	1.63	-2.44
	(4.87)	(3.72)	(2.32)	(2.03)
Log GDP (Lagged)	1.48***	1.09***	1.62***	1.16***
	(0.10)	(0.09)	(0.12)	(0.08)
Log GDP per capita (Lagged)	0.48	0.19	0.84**	0.20
	(0.32)	(0.24)	(0.36)	(0.28)
Distance	-1.89***	-1.37***	-1.93***	-1.41***
	(0.21)	(0.19)	(0.23)	(0.21)
Trade Exposure	-0.02	0.18*	-0.02	0.18*
	(0.10)	(0.09)	(0.12)	(0.09)
Vol.	-0.50***	-0.39***	-0.33***	-0.35***
	(0.10)	(0.09)	(0.10)	(0.08)
FX Vol.	0.00	-0.08	0.04	-0.06
	(0.08)	(0.07)	(0.09)	(0.08)
Regulation (Borrower)	-0.73***	-0.43***	-0.25*	-0.16**
	(0.17)	(0.13)	(0.12)	(0.07)
Indicator: Own Country		3.96***		3.97***
		(0.48)		(0.53)
Observations	9,735	9,825	9,801	9,902
Lender fixed effects	✓	✓	✓	✓
Time fixed effects	✓	✓	✓	✓
Market fixed effects	✓	✓	✓	✓

Notes: This table presents the OLS estimation results from equation (8) for the banking (columns 1 and 3) and corporate (columns 2 and 4) sectors using the initial (2009:Q1 through 2016:Q3) and final (2012:Q2 through 2019:Q4) subsamples of the data. All specifications include borrower country MSCI market fixed effects. Standard errors (in parentheses) are clustered by lender and time. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.10$. Source: Authors' calculations using the BIS Locational Banking Statistics and data sources listed in Appendix Table A.3.

Table A.6: Loan Supply Estimation across Sectors

Variable	Symbol	(1) Full Sample	(2) Initial Period	(3) Final Period
Log outside borrower weight:				
Banks	λ_1	0.57	0.54	0.58
		(0.86)	(0.94)	(0.76)
Firms	λ_2	0.57**	0.59**	0.56**
		(0.22)	(0.22)	(0.22)
Sector fixed effects:				
Firms	α_2	0.52	0.38	0.66
		(0.79)	(0.87)	(0.68)
Obs.		836	589	589
F-test (1-st stage), λ_1		297.3	217.7	194.8
F-test (1-st stage), λ_2		64.3	46.6	49.9

Notes: This table presents the estimation results from equation (9) using the full sample (column 1) as well as the initial (2009:Q1 through 2016:Q3, column 2) and final (2012:Q2 through 2019:Q4, column 3) subsamples. The estimation is based on an instrumental variable approach, as described in Section 3. Standard errors (in parentheses) are clustered by lender and time. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.10$. Source: Authors' calculations using the BIS Locational Banking Statistics and data sources listed in Appendix Table A.3.

Table A.7: Loan Demand Estimation

	Banks		Firms
	(1) Initial Period	(2) Final Period	(3) Full Sample
Log Price	25.72	51.42**	17.88
	(43.02)	(22.22)	(19.55)
Log GDP (Lagged)	0.96***	0.96***	1.23***
	(0.10)	(0.09)	(0.25)
Observations	372	372	836
F-test (1st stage), Log Price	149.8	67.6	16.6

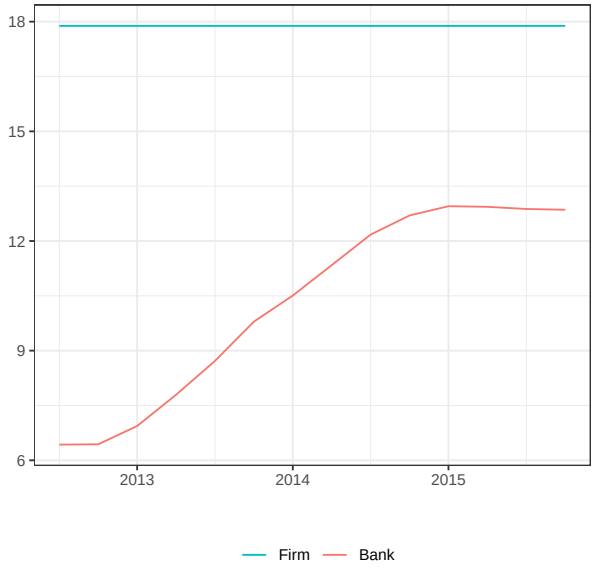
Notes: This table presents the estimation results from equation (10) for the banking (columns 1 and 2) and corporate (column 3) sectors. Loan demand elasticities are estimated using 30-quarter rolling windows for the banking sector and the full sample for the corporate sector. The estimation is based on an instrumental variable approach, as described in Section 3, and includes time fixed effects. Standard errors are clustered by date. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.10$. Source: Authors' calculations using the BIS Locational Banking Statistics and data sources listed in Appendix Table A.3.

Table A.8: Exchange Rate Estimation

Variable	Estimate
ΔIRD	-0.57
	(0.39)
Num. obs.	649

Notes: This table presents the estimation results from equation (7) using quarterly data from 2005 to 2020. ΔIRD for each country n is calculated by subtracting the U.S. interbank rate from country n's interbank rate and taking differences over time. Estimation includes a time fixed effect. Standard errors are clustered by date. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.10$. Source: Authors' calculations using the data sources on interest rates and exchange rates listed in Appendix Table A.3.

Figure A.4: Loan Demand Elasticity over Time

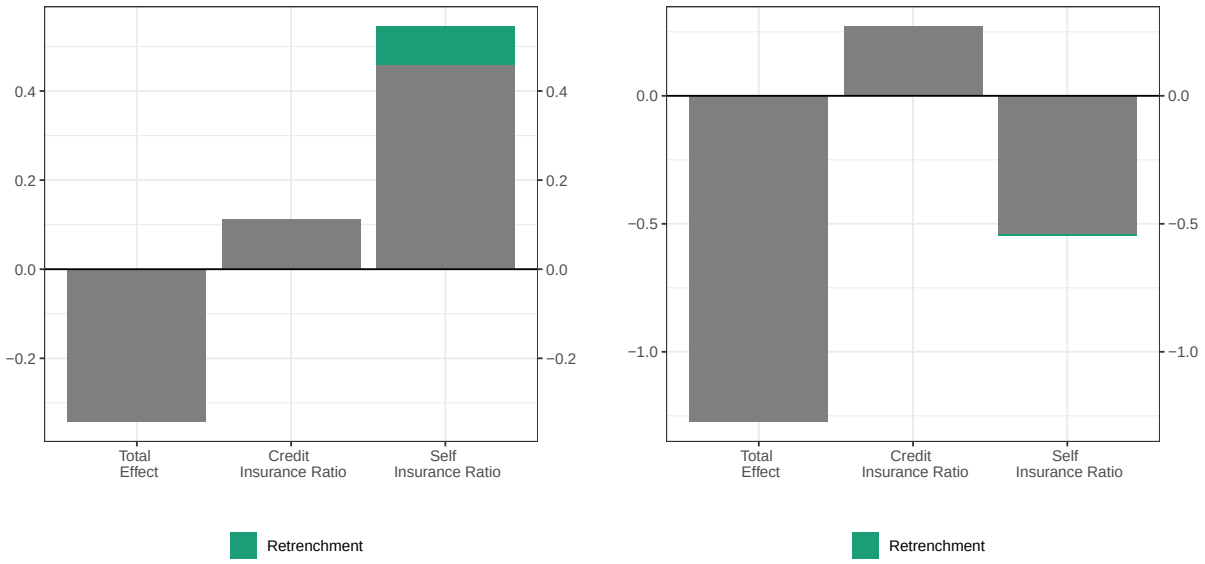


Notes: This figure shows the estimates of loan demand elasticities in the banking and corporate sectors. The demand elasticities are a function of the coefficients on *Log Price* from equation (10). The coefficients on price for the banking sector are annualized by multiplying by 1/4. The estimate of the demand elasticity for the corporate sector is time-invariant. Source: Authors' calculations using the BIS Locational Banking Statistics and data sources listed in Appendix Table A.3.

Figure A.5: Effects of U.S. Local Funding Shock: Decomposing Self-insurance

(a) U.S. Corporate Funding

(b) Mexico Corporate Funding

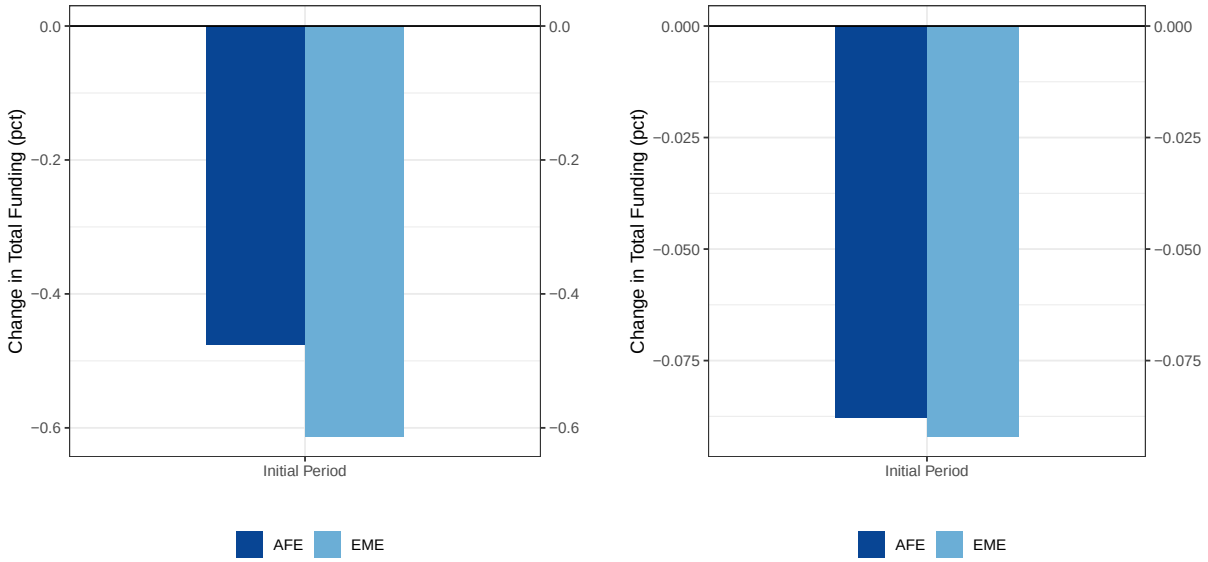


Notes: This exhibit decomposes the change in funding to the corporate sectors in the United States (Panel (a)) and Mexico (Panel (b)) due to self-insurance in response to a 1 percent U.S. local funding shock. The retrenchment component of the self-insurance ratio captures the endogenous reallocation of funding by the domestic banking sector of the corresponding country from other countries. The estimations are based on the supply and demand curves for the initial subperiod (2009:Q1 through 2016:Q3). Source: Authors' calculations using the BIS Locational Banking Statistics and data sources listed in Appendix Table A.3.

Figure A.6: Effects of U.S. Local Funding Shock on Total Funding to Non-U.S. Advanced Economies and Emerging Markets

(a) Interbank Funding

(b) Corporate Funding



Notes: This figure shows the change in total funding in the banking and corporate sectors of advanced (non-U.S.) foreign economies (AFE) and emerging market economies (EME) in response to a 1 percent U.S. local funding shock. The changes in funding are normalized by the pre-shock cross-border funding in each sector. Thus, the bars indicate the extent of funding outflows in response to the shock. Source: Authors' calculations using the BIS Locational Banking Statistics and data sources listed in Appendix Table A.3.

Table A.9: Local Effects of Local Funding Shock, Banking Sector

Country	Initial Period		Final Period	
	(1) Shock Effect (Mil.USD)	(2) Interbank Insurance Ratio (Net Inflows/ Shock Effect Size)	(3) Shock Effect (Mil.USD)	(4) Interbank Insurance Ratio (Net Inflows/ Shock Effect Size)
Australia	-21352.5	0.40	-21352.5	0.05
Brazil	-13430.9	0.37	-13430.9	0.04
Canada	-21896.7	0.48	-21896.7	0.10
Chile	-2285.3	0.39	-2285.3	0.07
Denmark	-7389.8	0.56	-7389.8	0.11
Euro-Area	-152821.2	0.11	-152821.2	0.02
Japan	-112287.1	0.33	-112287.1	0.04
Mexico	-2996.6	0.40	-2996.6	0.07
Sweden	-8711.6	0.64	-8711.6	0.13
Turkey	-1171.4	0.78	-1171.4	0.16
United Kingdom	-70263.1	0.58	-70263.1	0.11
United States	-131942.4	0.40	-131942.4	0.05

Notes: This table presents the effects of a 1 percent decline in each country's local funding on cross-border funding to the respective country's banking sector, based on the supply and demand curves for the initial subsample period of 2009:Q1 through 2016:Q3 (columns 1 and 2) and the final subsample period of 2012:Q2 through 2019:Q4 (columns 3 and 4). The shock effect encompasses all immediate effects of the shock before any endogenous reallocation. The interbank insurance ratio measures the change in funding inflows to each banking sector resulting from endogenous reallocation of all other banking sectors' loan portfolios, relative to the size of the affected banking sector's shock effect. Source: Authors' calculations using the BIS Locational Banking Statistics and data sources listed in Appendix Table A.3.

Table A.10: Local Effects of Local Funding Shock, Corporate Sector

	Initial Period			Final Period		
	(1) Shock Effect (Mil.USD)	(2) Credit Insurance Ratio (Net Inflows/ Shock Effect Size)	(3) Self-insurance Ratio (Net Inflows/ Shock Effect Size)	(4) Shock Effect (Mil.USD)	(5) Credit Insurance Ratio (Net Inflows/ (Shock Effect Size)	(6) Self-insurance Ratio (Net Inflows/ Shock Effect Size)
Australia	-17257.8	0.07	0.59	-16684.2	0.06	0.28
Austria	-3790.2	0.22	0.45	-3941.6	0.14	0.31
Belgium	-4729.3	0.21	0.52	-5150.4	0.14	0.36
Brazil	-12631.4	0.10	0.45	-12068.8	0.04	0.14
Canada	-16888.5	0.07	0.66	-15368.5	0.09	0.35
Chile	-2155.8	0.13	0.45	-2131.3	0.07	0.14
Denmark	-5333.1	0.06	0.71	-5210.6	0.10	0.35
Finland	-1987.7	0.20	0.49	-2016.9	0.14	0.33
France	-26480.7	0.17	0.53	-24832.1	0.13	0.36
Germany	-16774.3	0.16	0.57	-16114.9	0.12	0.40
Italy	-25580.2	0.18	0.29	-24453.1	0.14	0.18
Japan	-79525.6	0.04	0.62	-73490.4	0.04	0.37
Mexico	-2845.1	0.25	0.43	-2870.4	0.24	0.11
Portugal	-3018.4	0.27	0.29	-2988.7	0.14	0.21
Spain	-17541.4	0.20	0.34	-16244.7	0.15	0.23
Sweden	-5419.5	0.05	0.78	-5148.6	0.07	0.43
Turkey	-992.9	0.10	0.81	-677.2	0.11	0.41
U.K.	-34181.9	0.05	0.75	-32462.8	0.15	0.40
U.S.	-107780.4	0.11	0.55	-106327.1	0.16	0.21

Notes: This table presents the effects of a 1 percent decline in each country's local funding on funding to the respective country's corporate sector, based on the supply and demand curves for the initial subsample period of 2009:Q1 through 2016:Q3 (columns 1 through 3) and the final subsample period of 2012:Q2 through 2019:Q4 (columns 4 through 6). The shock effect encompasses all immediate effects of the shock before any endogenous reallocation. The credit and self-insurance ratios measure the endogenous reallocation of funding to each corporate sector from foreign and domestic banking sectors, respectively, relative to the size of the corporate sector's shock effect. Source: Authors' calculations using the BIS Locational Banking Statistics and data sources listed in Appendix Table A.3.

Table A.11: Effects of U.S. Local Funding Shock on Cross-border Interbank Funding

	Initial Period		Final Period	
	(1) Shock Effect (Mil.USD)	(2) Interbank Insurance Ratio (Net Inflows/ Shock Effect Size)	(3) Shock Effect (Mil.USD)	(4) Interbank Insurance Ratio (Net Inflows/ Shock Effect Size))
Australia	-493.7	-1.24	-386.0	-1.10
Brazil	-496.0	-0.36	-326.6	-0.66
Canada	-1024.7	-0.36	-1591.9	-0.58
Chile	-71.1	-0.80	-92.7	-0.76
Denmark	-30.0	-11.62	-46.7	-4.70
Euro-Area	-2164.2	-3.37	-2449.5	-2.23
Japan	-3124.0	-0.65	-2781.8	-0.81
Mexico	-104.7	-0.60	-102.9	-0.76
Sweden	-311.4	-1.10	-472.7	-0.83
Turkey	-37.0	-2.58	-8.6	-6.19
United Kingdom	-3787.0	-0.48	-2987.9	-1.03
Average	-1058.5	-2.11	-1022.5	-1.79

Notes: This table presents the effects of a 1 percent decline in U.S. local funding on cross-border funding to the bank sectors of non-U.S. countries, based on the supply and demand curves for the initial subsample period of 2009:Q1 through 2016:Q3 (columns 1 and 2) and the final subsample period of 2012:Q2 through 2019:Q4 (columns 3 and 4). The shock effect encompasses all immediate effects of the shock before any endogenous reallocation. The interbank insurance ratio measures the change in funding inflows to each banking sector resulting from endogenous reallocation of all other banking sectors' loan portfolios, relative to the size of the banking sector's shock effect. The last row computes the mean of shock effects and insurance ratios. Source: Authors' calculations using the BIS Locational Banking Statistics and data sources listed in Appendix Table A.3.

Table A.12: Effects of U.S. Local Funding Shock on Cross-border and Local Corporate Funding

	Initial Period			Final Period		
	(1) Shock Effect (Mil.USD)	(2) Credit Insurance Ratio (Net Inflows/ Shock Effect Size)	(3) Self-insurance Ratio (Net Inflows/ Shock Effect Size)	(4) Shock Effect (Mil.USD)	(5) Credit Insurance Ratio (Net Inflows/ Shock Effect Size)	(6) Self-insurance Ratio (Net Inflows/ Shock Effect Size)
Australia	-586.2	-0.18	-1.82	-351.4	-0.41	-1.26
Austria	-43.0	-3.40	-0.77	-35.9	-2.07	-1.14
Belgium	-93.2	-1.06	-2.90	-46.6	-2.46	-1.66
Brazil	-710.2	-0.21	-0.27	-386.6	-0.27	-0.40
Canada	-1474.9	0.21	-1.35	-1866.7	-0.12	-0.66
Chile	-148.2	0.10	-1.25	-129.4	-0.21	-0.64
Denmark	-24.6	-3.61	-12.38	-29.3	-2.09	-6.70
Finland	-85.5	-0.24	-1.65	-114.0	-0.21	-0.53
France	-615.3	-0.49	-3.11	-747.9	-0.39	-1.66
Germany	-341.8	-1.29	-2.42	-364.1	-0.67	-1.88
Italy	-72.3	-4.29	-16.91	-68.4	-4.73	-7.97
Japan	-3221.3	-0.09	-1.49	-2846.6	-0.26	-1.29
Mexico	-405.8	0.27	-0.55	-314.6	-0.25	-0.34
Portugal	-8.7	-9.14	-9.10	-7.4	-5.15	-5.20
Spain	-78.4	-2.64	-12.71	-72.5	-2.70	-6.84
Sweden	-203.7	-0.53	-0.70	-275.0	-0.14	-0.37
Turkey	-42.1	-0.03	-3.10	-5.1	-1.79	-6.19
U.K.	-4586.7	0.09	-0.29	-4871.1	-0.23	-0.12
Average	-707.9	-1.47	-4.04	-696.3	-1.34	-2.49

Notes: This table presents the effects of a 1 percent decline in U.S. local funding on funding to the corporate sectors of non-U.S. countries, based on the supply and demand curves for the initial subsample period of 2009:Q1 through 2016:Q3 (columns 1 through 3) and the final subsample period of 2012:Q2 through 2019:Q4 (columns 4 through 6). The shock effect encompasses all immediate effects of the shock before any endogenous reallocation. The credit and self-insurance ratios measure the endogenous reallocation of funding to each corporate sector from the foreign and domestic banking sectors, respectively, relative to the size of the corporate sector's shock effect. The last row of the table computes the mean of the shock effects and insurance ratios. Source: Authors' calculations using the BIS Locational Banking Statistics and data sources listed in Appendix Table A.3.