Risk Sharing and Amplification in the Global Financial Network*

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Abstract

We provide a systematic analysis of the role of banks in both facilitating risk sharing and propagating shocks in the global financial network. Using a structural model and bilateral international bank lending data, we estimate the price elasticities of cross-border loan supply and demand across 19 countries. We find significant heterogeneity in the willingness and capacity of banks to provide interbank and corporate loans. We show that this heterogeneity is key to explaining the variation in international risk sharing and shock propagation across countries and over time. In particular, cross-border lending supply has become less elastic since the global financial crisis, resulting in a decline of international risk sharing and shock propagation. We provide suggestive evidence that the tightening of macroprudential policy has contributed to the decline.

Keywords: global financial network, demand- and supply-based capital allocation, risk sharing, shock propagation.

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1 Introduction

The transmission of shocks across countries and the extent of international risk sharing are two central questions in international economics. Existing research has pointed out that international banking linkages play an important role in propagating shocks across borders.[1] Indeed, banks are central to the international financial architecture and domestic economies, as they intermediate more than $30 trillion of cross-border capital flows annually and provide around 65 percent of total private credit in a economy on average.[2] During crisis times such as the Global Financial Crisis (GFC), banks have transmitted shocks to both banks and firms around the world, causing a freezing of the global interbank market and significant contraction of cross-border corporate lending.[3] While existing research mostly focuses on estimating the impact of certain shocks on the quantity of bank capital flows between specific country pairs using reduced-form analysis, we provide a systematic analysis of the role of banks in *both* facilitating risk sharing and propagating shocks across countries *and* over time, accounting for quantity *and* price as well as endogenous supply of *and* demand for loans.

Our analysis starts by developing a structural model of the global financial network that features a two-tier network structure, incorporating a global interbank network and a global credit network. The former network captures the bilateral cross-border lending relationships that banking sectors form with each other, and the latter captures the relationships that banking sectors form with corporate sectors abroad. These two networks make up what we define as the global financial network. The model centers on banks' lending decisions across countries and sectors, jointly accounting for endogenous supply and demand of cross-border bank loans, as well as endogenous lending prices and exchange rates.

We estimate the model using bilateral cross-sector lending data from 19 countries over the period 2005–2019 and provide, for the first time, time-varying bilateral and aggregated

[1] See, for example, Cetorelli and Goldberg (2012), Schnabl (2012), Bruno and Shin (2015), Ivashina, Scharfstein, and Stein (2015), Baskaya, Di Giovanni, Kalemli-Özcan, Peydró, and Ulu (2017), Morais, Peydró, Roldán-Peña, and Ruiz-Ortega (2019), Hale, Kapan, and Minoiu (2020), Miranda-Agrippino and Rey (2020), and Di Giovanni, Kalemli-Özcan, Ulu, and Baskaya (2022), among others.

[2] As shown in Appendix Figure A.1, banks intermediate approximately $15 trillion of cross-border bank-to-bank capital flows and $15 trillion of cross-border bank-to-firm capital flows annually over the past decade.

[3] At the peak of the GFC, the LIBOR-OIS spread, a primary measure of interbank lending rates, increased to over 300 basis points, in contrast to the pre-crisis level of less than 10 basis points.

estimates of supply and demand elasticities for cross-border interbank and firm lending. Our estimates reveals significant *heterogeneity* in banks' willingness and capacity to lend across different countries in the global financial network. We show that this heterogeneity explains the variations in the amount of insurance different countries receive in response to a negative local funding shock, where insurance is defined as the extent of funding inflows relative to the size of the shock. Borrower countries with lower supply elasticities receive less insurance against local funding shocks because banks in the network are less willing or have lower capacity to rebalance toward them. At the same time, countries with creditors more willing to rebalance toward the country hit by the local shock experience greater transmission. As such, our results show that heterogeneity in global financial intermediation is key to determining the extent of risk sharing and shock transmission across countries.

Moreover, our analysis reveals that the elasticity of cross-border loan supply has significantly declined since the GFC. As a result, the extent of insurance provision by banks in the global financial network has weakened, to the extent that local funding shocks can get amplified in some countries that the network used to insure. Conversely, the degree of shock transmission also declined. We provide evidence suggesting that greater stringency of macroprudential policy instruments has contributed to the decline in international risk sharing and shock transmission.

Our analysis uses a portfolio-based approach to study how the global financial network contributes to risk sharing and shock propagation across countries and sectors. Building on the recent studies by Koijen and Yogo (2019) and Koijen and Yogo (2020), we model each banking sector's allocation of cross-border interbank and corporate loans across countries as a function of observed and unobserved characteristics of the borrower countries and of the bilateral relations between the lender and borrower countries. Moreover, we incorporate two new elements in the model. First, we introduce a two-layer network structure in the banks' portfolio choice framework, allowing each bank to borrow funds from the interbank network and allocate assets across countries within the interbank network and the bank-firm credit network as well as across the two networks. This endogenizes each banking sector's total assets and liabilities. Second, we allow demand for loans to adjust endogenously with changes in prices. In equilibrium, the banking sector lending quantity and prices, including

interest rates and exchange 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 bank and corporate sectors. Taken together, the estimated supply and demand curves, along with the market clearing conditions for loans in the bank and corporate sectors, constitute the global financial network.

To estimate the network system, we compile a database of cross-border and domestic interbank and bank-firm lending using the Locational Banking Statistics (LBS) from the Bank for International Settlements (BIS). The cross-border lending data contain bilateral interbank and bank-firm flows between source and destination countries, allowing us to construct a complete global interbank and credit network for 19 sample countries. We supplement the database with corresponding data on loan prices and variables that capture characteristics of the borrowers and their bilateral relationships from Bloomberg, statistical databases from central banks, the World Bank, and the IMF. Using the dataset, we estimate supply and demand curves for cross-border interbank and bank-to-firm lending using an instrumental variable approach, following Koijen and Yogo (2020) and Jiang, Richmond, and Zhang (2020), as prices on loans may be endogenous to the latent supply and demand of the lenders. We also estimate the loan supply and demand curves using 7-year rolling subsamples of the data in order to study the evolution of loan supply and demand over the sample period.

We find that the price elasticities of cross-border interbank and corporate loan supply average 89 and 36, respectively, across the borrower countries over the sample period. If translated to elasticity with respect to yield, our estimates indicate that a one percentage point increase in lending rate leads to a 22 (36) percent increase in the quantity of cross-border interbank (corporate) loans supplied.

Moreover, our estimation results reveal substantial variation in supply elasticities across the borrower countries, which highlights stark heterogeneity in the willingness and capacity of intermediaries to provide loans in the global financial network. To quantify the implications of the heterogeneity for international risk sharing and shock transmission, we conduct a series of counterfactual analysis to study the extent of insurance and propagation provided by the global financial network in response to local funding shocks using the estimated structural

model. We propose a decomposition that dissects the aggregate effect of a negative local funding shock into a shock effect and three rebalancing effects. The shock effect captures all immediate effects of the funding shock, holding all banking sectors' portfolio allocations fixed. The three rebalancing effects—global interbank rebalancing, global credit rebalancing, and self-rebalancing—capture the effects from endogenous portfolio reallocation in response to the shock. Global interbank rebalancing captures the extent of fund reallocation toward or away from the banking sectors in response to a shock. Similarly, global credit rebalancing captures the extent of fund reallocation toward or away from the corporate sectors in response to a shock. Self-rebalancing captures domestic banks' retrenchment of funding back to their respective home countries as well as their intermediation of foreign funding from global interbank rebalancing.

Our analysis shows that the three margins of rebalancing serve as key mechanisms of insurance provision for the countries experiencing a local funding shock *and* of propagation for the countries not directly hit by the shock. In response to a one percent local funding shock, the network mitigates the shock effect for the country directly hit by the shock by an average of 16 percent for each banking sector through global interbank rebalancing and by an average of 39 percent for each corporate sector through global credit and self-rebalancing, with significant variation in the amount of insurance provision across countries. At the same time, the network significantly amplifies the shock effect for the countries not directly hit by the shock through the three margins of rebalancing. We show that the variation in insurance provision and propagation is governed by the heterogeneity in the elasticities of interbank and corporate loan supply. Borrower countries with lower supply elasticities receive less insurance against local funding shocks because banks in the network are less willing to rebalance toward that country's banks and firms, or the banks that are willing have lower capacity to do so. Countries with creditors that are more willing or have greater capacity to lend to the shocked country experience greater propagation.

In addition to studying the heterogeneity in loan supply elasticities in the cross section, we examine how these elasticities and thereby global insurance and shock propagation have evolved over time. We show that the elasticity of cross-border loan supply significantly declined after the GFC, indicating that loan supply has become less responsive to changes in

prices. The supply elasticity of cross-border interbank and corporate loans decreased by 92 percent and 36 percent, respectively, after 2010. The decline in the elasticities of cross-border loan supply has weakened the amount of insurance provision in the global financial network. The amount of insurance through global interbank rebalancing decreased from an average of 16 percent of the shock effect in 2010 to an average of 1 percent by the end of the sample period. Similarly, insurance through global credit rebalancing and self-rebalancing decreased from an average of 39 percent to an average of 30 percent. When we study the effects of a one percent local funding shock in the present year based on extrapolated elasticities of cross-border loan supply and demand, we find that the insurance mechanism is fully dominated by forces of shock amplification for a few banking sectors. Local funding shocks are amplified for a few banking sectors through the margin of global interbank rebalancing, as foreign banks reallocate funding away from the banking sectors hit by local funding shocks. At the same time, the degree of shock propagation is also lessened as a result of the decline in the elasticities.

Finally, we explore one potential explanatory factor for the decline in global insurance and transmission over the past decade—greater stringency in regulatory and macroprudential policies. We provide suggestive evidence that great stringency in macroprudential instruments has contributed to the decline in insurance provision in the network.

Related Literature. Our paper is related to several strands of literature. First, it contributes to the literature on the role of banks in propagating shocks in financial systems and, more broadly, on (international) transmission of liquidity shocks.[4] Theoretical and reduced-form empirical papers have highlighted how bank credit supply shocks can lead to a significant decline in lending to other banks and firms both in a one-country setting (Holmstrom and Tirole 1997, Khwaja and Mian 2008, Gertler and Kiyotaki 2010) and in an international context (Peek and Rosengren 2000, Schnabl 2012, Hale 2012, Dedola, Karadi, and Lombardo 2013, Kalemli-Ozcan, Papaioannou, and Peydro 2013, Kalemli-Ozcan, Papaioannou, and Perri 2013, Niepmann 2015, Bruno and Shin 2015, Amiti and Weinstein 2018, Miranda-Agrippino and Rey 2020, Hale et al. 2020, Shen 2020). In particular, building on

[4]Besides the papers that we discuss in the subsequent paragraphs, see Buch and Goldberg (2020) for additional literature on the international transmission of liquidity shocks through banks.

the closed-economy macro literature on channels of monetary policy transmission (Bernanke and Gertler 1995, Borio and Zhu 2012), the more recent international finance literature has tested for these transmission channels through global banks, including the bank-lending channel (Cetorelli and Goldberg 2012, Ivashina et al. 2015, Temesvary, Ongena, and Owen 2018) and the risk-taking channel (Morais et al. 2019, Correa, Paligorova, Sapriza, and Zlate 2021).

We contribute to this literature on four fronts. First, we provide a theoretical framework that integrates multiple financial networks, assets, sectors, and countries and thereby allows a joint analysis of shock propagation both within and across countries and sectors, whereas the existing literature mostly studies propagation through the lens of models with a single representative bank. To that end, our work is part of the recent literature that emphasizes the importance of heterogeneity in financial intermediaries for understanding questions of financial stability including Coimbra and Rey (2021). Second, we advance the existing literature, which tends to be either entirely theoretical or empirical, by connecting the theory to empirics as we formally estimate the elasticities of cross-border loan supply and demand in both the global interbank and credit networks, using data that fully map to the structure of the networks. To our knowledge, we provide the first estimates of supply elasticities for cross-border bank lending. Third, we offer new insights on the role of global financial intermediaries in facilitating international risk sharing and transmitting shocks by revealing the tight link between heterogeneity in cross-border loan supply elasticities, and insurance provision and shock propagation through different margins of loan rebalancing. Fourth, we are one of the first papers to quantify the changes in international risk sharing and shock propagation in the global financial system since the GFC. In particular, while Shin (2014), Avdjiev, Gambacorta, Goldberg, and Schiaffi (2020), and Forbes and Warnock (2021) call attention to a de-globalization in global banking during the post-GFC era, we show that de-globalization has been concentrated in global interbank lending.

Our portfolio-based structural approach builds on the recent literature that uses portfolio-based models to study asset pricing and allocation, including Gabaix and Maggiori (2015), Koijen and Yogo (2019), Koijen and Yogo (2020), Jiang et al. (2020), and Pellegrino, Spolaore, and Wacziarg (2021). We extend the recent work on demand system asset pricing

by embedding a network structure into the model and incorporating both the demand and supply of assets into the structural model, which allows 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 financial network (Section 2) followed by a discussion of our model estimation procedure and the data (Section 3). In Section 4, we present the estimation results of the loan supply and demand elasticities, focusing on variations in the cross section, and analyze their implications for the extent of risk sharing and shock propagation across countries. In Section 5, we study the evolution of loan supply and demand elasticities over the sample period and the resulting implications. We also explore the role of macroprudential instruments in explaining the evolution of risk sharing and shock propagation in the global financial network. Section 6 concludes.

2 A Structural Model of the Global Financial Network

In this section, we present a structural model of the global financial network. The network is comprised of two sub-networks: (i) a global interbank network in which banking sectors around the world borrow from and lend to each other; (ii) a global credit network in which banking sectors provide loans to foreign and domestic corporate sectors. The model takes a portfolio-based view to study each banking sector's lending decisions across countries and sectors, motivated by the international banking literature including Walter (1981), Aviat and Coeurdacier (2007), and Bruno and Shin (2015) and building on the demand system approach by Koijen and Yogo (2019) and Koijen and Yogo (2020).

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

N countries in the global financial network.

We denote the local currency price of a loan to sector ℓ in country n at time t by $P_t(n, \ell)$. Given that the bulk of international lending to firms is denominated in U.S. dollars rather than local currency, we allow for a spread between the U.S. dollar price and the local currency price of loans within the corporate sector. We denote this spread as $SPRD_t(m, \ell)$. $E_{n,t}(m)$ denotes the exchange rate in terms of currency n per currency m. Within our framework, we allow exchange rates to move endogenously with interbank rates. We use lowercase letters to denote logs: $p_t(n, \ell) = \log(P_t(n, \ell))$.

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

We model bank n's portfolio weight on country m in 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

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

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 characteristics for sector ℓ in country m in year t. These

characteristics can be borrower-specific (e.g., GDP) or bilateral (e.g., distance) in nature. We index the coefficients $\beta_{\ell,t}$, $\gamma_{\ell,t}$, and $\Theta_{\ell,t}$ by ℓ and t to allow for differences in loan supply elasticity across sectors and time.

By construction, the sum of loan portfolio shares invested into each sector equals 1: $\sum_{k=0}^{N} w_{n,t}(k|\ell) = 1$. As a result, the portfolio weight in the outside asset 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 based on a nested logit structure. Bank 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 in bank n's portfolio allocation across sectors. As lending opportunities to borrowers in sector ℓ as a whole become more desirable through changes in prices and characteristics, bank n shifts its aggregate loan portfolio toward sector ℓ. α_ℓ is a sector fixed effect, and $\xi_{n,t}(\ell)$ denotes sector-specific latent supply. Because the total amount of investment must equal the total liability, 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 the 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 interaction of the structure of the global financial network with banks' portfolio allocation problem, we embed a network structure in our model. We allow banks to borrow funds in the interbank market and use these funds to extend loans to the corporate sectors. For each country n in period t, the total liability of

the banking sector in US dollars is given by

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

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

Market Clearing Conditions. Prices (i.e., interest rates and exchange rates) in the bank 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 n through the interbank network must equal the total value of loans demanded by the banking sector of country n:

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

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

Similarly, the total par value of all loans extended (within and across borders) must equal the total demand for loans:

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

Each country n's exchange rate relative to the U.S. dollar depends on differences in interbank rates and time fixed effects:

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

where $IRD_t = -p_t(n, \ell = 1) + p_t(US, \ell = 1)$ 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 current interest rate differential, $\beta_e\left(-p_t(n,\ell=1)+p_t(US,\ell=1)\right)$, to be an endogenous component of exchange rates, and $\xi_t+\varepsilon_{n,t}$ as well as the time $t-1$ exchange rate and interest rate differential to be exogenous components of exchanges rates. Bilateral exchange rates for non-U.S. dollar currencies are calculated as the differences in these exchange rates relative to the U.S. dollar.

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

3 International Loan Supply and Demand Estimation

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 bank and corporate sectors in the global financial network. 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

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

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 banks or firms of another country is a function of their relative prices and characteristics. The coefficients on log price 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 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):

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

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

In order to study the evolution of loan supply curves, we allow for time variation in the regression coefficients. To this end, we estimate regressions (8) and (9) using 7-year rolling subsamples of the data.[5] Given that our sample starts in 2005Q1, the first subsample consists of data from 2005Q1 to 2012Q1. The results from this estimation are taken to characterize the supply curves for all quarters between 2005Q1 and 2012Q1. The last subsample consists of data from 2012Q4 to 2019Q4. In this paper, we denote supply curves based on the midpoint period of the subsample (e.g., the *2010Q4* supply curve denotes the supply curve estimated using the subsample from 2007Q2 to 2014Q2, and the *2016Q2* supply curve denotes that estimated using the subsample from 2012Q4 to 2019Q4).

The estimation equation for the demand for cross-border loans is given by

$$\log Q_t(n,\ell) = q_t(n,\ell) = \beta^d_\ell p_t(n,\ell) + \theta^d_\ell \log GDP_{t-1}(n) + \tau_t + \nu^d_t(n,\ell), \quad (10)$$

which states that the log quantity of loans demanded through the global interbank and credit network is governed by changes in loan prices ($p_t(n,\ell)$), changes in borrower countries' lagged business cycle conditions ($GDP_{t-1}(n)$), and time fixed effects (τ_t). This specification is motivated by the empirical evidence that demand for credit tends to vary systematically across the business cycle (Jermann and Quadrini 2012). We estimate the demand for interbank loans using 7-year 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]

[5] We choose 7 years 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

We estimate the regressions using an instrumental variable approach, where we construct instruments for $p_t(m, \ell)$ and $w_{n,t}(0, \ell)$ from equations (8), (9), and (10). We discuss the identification approach in detail in Section 3.3, after a brief description of the data used for the estimation in Section 3.2.

3.2 Data

Our main data source for estimating loan supply is the BIS LBS database. This data is uniquely appropriate for our study because it contains bank lending information that perfectly maps to our framework of the global financial network: The data contains 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 type of counterparty.[7] We use the data to construct measures of cross-border interbank lending as well as cross-border and domestic bank-firm lending.[8] Our sample runs from 2005Q1 to 2019Q4 and consists of 19 countries, including two financial centers, 13 advanced economies, and four emerging market economies, as listed in Appendix Table A.1.

Table 1 reports the quarterly mean and variance of cross-border lending and total funding to the bank sector and corporate sector of the 19 countries in the global financial network over two subsample periods, 2005Q1–2012Q1 (left panel) and 2012Q4–2019Q4 (right panel),

focus of the analysis is on lending decisions by the banking sectors.

[7] An alternative to the LBS is the BIS consolidated banking statistics (CBS), which aggregate claims by the banks' nationality rather than their location and exclude cross-border intragroup positions. For our purpose, the LBS data are more appropriate, as they reveal a more direct link between portfolio allocation decisions of the banking sectors in the source countries and their resultant cross-border portfolio adjustments, which are likely to include changes in intragroup positions. Furthermore, the CBS have a number of drawbacks from a technical standpoint, as they are not adjusted for exchange rate fluctuations and are prone to 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 makes up more than 50 percent of the total cross-border bank-to-bank lending, as shown in Appendix Figure A.2 and highlighted in papers such as Cetorelli and Goldberg (2012). Data on intrabank lending are limited in the time series dimension (not systematically available prior to 2014), which prevents us from a more thorough analysis of the price elasticity of interbank versus intrabank lending. Nevertheless, Appendix Figure A.2 shows that the allocation of bank-to-bank lending to affiliated banks does not vary significantly over time, alleviating 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. The measure for cross-border corporate lending is based on BIS LBS data on claims to nonbank sectors, which encompass non-bank financial and nonfinancial institutions. While the ideal data for our setting would be claims to nonfinancial sectors only, the BIS data on this dimension are incomplete across countries and over time.

corresponding to the first and last subsample for the loan supply curve estimations. There is notable heterogeneity in funding across countries and between the two sample periods. Cross-border lending and total funding to the bank and corporate sectors are highest in the United States and the United Kingdom, followed by France and Germany, while they are substantially lower in emerging markets. Appendix Figure A.3 illustrates the global interbank network and the global credit network for the reporting countries in 2005Q1 and 2019Q4. Each country is a node in the network, and each edge connecting a dyad (pair of nodes) represents total cross-border bank claims (Panels A and C) or total cross-border nonbank claims (Panels B and D) between a source country and a destination country. The edges are more numerous for countries with more interbank or credit relationships and thicker for dyads with greater bilateral cross-border banking and credit flows. The positioning of countries in the network graphs is closely related to their relative eigenvector centralities, as shown in Appendix Table A.2. In each network, a group of countries with close and more numerous interbank and credit relationships with other countries, often known as the core, is clustered around the center of the network, and the countries less central to the global financial network lie at the periphery of the network. In both the global interbank and credit networks, the core is made up of mostly financial centers and advanced economies, while the periphery is made up of emerging market economies.

To estimate equation (8), we combine the bank lending data with information about the characteristics of the borrower, lender, and their bilateral relationships. Specifically, we use variables that capture differences in expected returns and risks across countries, including log nominal GDP, log GDP per capita, stock price volatility, monetary policy rate, index of macroprudential regulation, monetary policy rate, bilateral import and export exposures, and geographical distance between the lender and borrower countries. Appendix Table A.3 lists the characteristic variables and the corresponding 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 classification.

3.3 Estimation Approach

The main identification challenge to consistently estimate within-sector and across-sector loan supply according to 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 in that country are likely to decrease, which would bias the coefficient on $p_{n,t}(m,\ell)$ in (8) upward. On the demand side, greater loan demand is likely to drive up interest rates, which would bias the coefficients on price from equation (10) downward. Moreover, changes in interbank rates also affect the endogenous exchange rates. To address the issue, we apply the identification strategy used in Koijen and Yogo (2020) and Jiang et al. (2020).

Estimating loan supply. To estimate loan supply curves, we use the characteristics of all countries to construct instruments for prices $p_t(m|\ell)$ and exchange rates $e_{n,t}(m)$ in each country, and then we estimate equation (8). The key intuition underlying the instruments is that countries that happen to be geographically closer to other countries, more populous, located in regions that experienced less social unrest, or located near large banking sectors, as well as those that have lower average loan demand, tend to have higher prices and lower interest rates. Our exclusion restriction requires that the only way other countries' characteristics matter for a bank's weight on a given borrower country is through their effect on the borrower's interest rate.

More specifically, the estimation proceeds in four steps. First, we estimate a version of equation (8) using only borrower and bilateral characteristics ($\mathbf{x}_{n,t}(m)$) that are plausibly exogenous to the global financial network. The characteristics we use include historical regional waves of social unrest based on the measure from Acemoglu, Naidu, Restrepo, and Robinson (2019), historical population, bilateral distance, and an own-country indicator variable. Using these characteristics, we generate predicted values $\hat{\delta}_{n,t}(m,\ell)$ based on predicted the portfolio weights from our regression.

In the second step, we compute an instrument for within-sector portfolio weights, $\hat{w}_{n,t}(0|\ell)$, using the predicted values $\hat{\delta}_{n,t}(m,\ell)$, in order to estimate across-sector loan supply: $\hat{w}_{n,t}(0|\ell) = 1/\left(1+\sum_k \hat{\delta}_{n,t}(k,\ell)\right)$. We then use the predicted portfolio weights $\hat{w}_{n,t}(0|\ell)$ as instruments

for $w_{n,t}(0|\ell=1)$ and $w_{n,t}(0|\ell=2)$ and estimate $\hat{\lambda}_{\ell,t}$ and $\hat{\alpha}_{\ell,t}$ according to equation (9).

In the third step, we use the structural model to derive prices and exchange rates that would clear markets if demand were solely determined by the exogenous characteristics used in the first step. We use the model to compute instruments based on the characteristics of all countries. Specifically, we use the predicted values $\hat{\delta}_{n,t}(m,\ell)$, and the estimated across-sector parameters $\hat{\lambda}_{\ell,t}$, and $\hat{\alpha}_{\ell,t}$ to compute predicted portfolio weights $\hat{w}_{n,t}(m,\ell)$ based on equations (1) and (4). We then compute counterfactual lending prices and exchange rates that clear lending markets in both the bank and corporate sectors according to the market clearing conditions (5) and (6) and satisfy the exchange rate determination equation (7) at the predicted weights.

The instrument for the interbank lending price and exchange rate clears the global interbank market at the predicted weights, and the instrument for the corporate lending price and exchange rate clears the global credit market at the predicted weights:

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

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

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

In the fourth step, we estimate within-sector loan supply based on equation (8) using the above-specified instruments for lending prices and the exchange rate.

Estimating loan demand. To estimate loan demand (10), we apply a standard instrumental variable approach. We instrument $p_{m,t}(n,\ell)$ with historical regional waves of democratization and regional waves of social unrest based on the measures from Acemoglu et al. (2019). The identifying assumption is that these variables are uncorrelated with contemporaneous latent demand for capital flows.

4 Global Financial Intermediation Across Countries

In this section, we report the estimation results of loan supply and demand in the global financial network and analyze their implications. We first characterize the key features of the loan supply and demand curves over the whole sample period. We uncover significant variation in elasticities of loan supply across countries, reflecting heterogeneity in the willingness and capacities of bank sectors to provide intermediaries services. We then conduct counterfactual exercises to study the implications of such heterogeneity for international risk sharing. In particular, we quantify the variations in insurance provided by banks in the global financial network in response to country-specific funding shocks.

4.1 Estimates of Bank Supply and Demand Elasticities

This section discusses the variation and determinants of loan supply across countries within each sector. We describe the computation and the economic interpretation of the within-sector loan supply elasticities. In the interest of space, we relegate the discussion of cross-sector supply elasticities, demand elasticities and the exchange rate forecasting equation to Appendix B.

Table 2 shows the estimates for within-sector loan supply curves over the whole sample period, based on equation (8). The coefficients on price for both cross-border interbank lending and corporate lending are negative, which indicates that as the lending price increases (interest rate decreases) for a given borrower, banks are less likely to extend loans to that borrower. The coefficients on the borrower characteristic variables are intuitive as well. Banks prefer extending loans to larger and wealthier countries and countries that are closer in terms geography and trade relationships. Finally, the last row of Table 3 shows there is strong home bias in lending in the corporate sectors.[9]

The estimated coefficients on log price determine the elasticities for interbank and firm lending across different countries in the global financial network. In Appendix Section A, we derive expressions for bilateral elasticities of loan supply with respect to price and aggregate

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

loan supply elasticities for each borrower country. Loan supply elasticities differ for each bilateral lender-borrower pair because supply curves account for bilateral characteristics. We show that the aggregate loan supply elasticity for each borrower country can be computed as the weighted sum of the supply elasticities of each individual lender country:

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

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

Equation (11) shows that the aggregate loan supply elasticity to a given borrower in country m can be conveniently decomposed into two components: each lender's *willingness* and *capacity* to lend to country m. The willingness of lender n to provide loans to country m in sector ℓ captures how much a lender adjusts its loan portfolio 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 curve as well as current portfolio weights. As an example, Figure 2 shows the willingness of the U.S. bank sector to lend to different destination countries as a function of the average portfolio weight of each borrower country in the U.S. loan portfolio.[10] The U.S. bank sector is most willing to lend to U.K. banks and firms, followed by those of Japan and Canada. More generally, Figure 2 reveals that each lender's willingness to lend to a given borrower is largely captured by observed portfolio shares, which is determined by the characteristics of borrowers and of the corresponding bilateral relationships.

The extent to which borrower countries can obtain loans also depends on the capacity of each lender to provide loans, as captured by the lender's total assets, $A_{n,t}$. As an example, Figure 3 plots each lender country's willingness and capacity to lend to the United Kingdom as a function their willingness to lend to the United Kingdom. Panel (a) shows that even though both Spain and the United States are similarly willing to lend to banks in the United Kingdom, the United States has much larger capacity to do so and is thereby more important

[10]Loan supply elasticities change over time due to changes in characteristics and prices. For the cross-sectional results in this section, we present the averages of the elasticities over time.

for determining the U.K. aggregate loan supply elasticity than Spain.

Using equation (11), we derive the average elasticities of cross-border interbank and corporate loan supply using results from Table 2. We find that the supply of cross-border interbank and corporate loans in total funding declines by 7.5 and 4.4 percent, respectively, per one percent increase in their respective lending price. Given that the maturity of interbank and corporate loans is 0.25 and 1 year, respectively, our estimates translate to a supply elasticity with respect to yield of 1.9 and 4.4. That is, the contribution of cross-border interbank and corporate loan supply to total funding decreases by 1.9 percent and 4.4 percent per one percentage point increase in the interbank and corporate lending rates, respectively.[11]

Figure 4 shows the aggregate loan supply elasticities for each borrower country estimated over the entire sample period in both the bank and non-bank sectors. Panel (a) and (b) illustrate the cross-border interbank and corporate loan supply elasticities, respectively, across the borrower countries. Panel (c) illustrates the total funding supply elasticities in the corporate sector, which reflect changes in both cross-border lending from foreign banks and lending from domestic banks in response to a one 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 to changes in interest rates than cross-border lending alone, indicating that domestic banks tend to be more willing to provide additional loans in response to funding shortfalls than foreign banks.[12] In particular, the largest differences in supply elasticities between the two panels are within advanced economies, which shows that their bank sectors tend to have the greatest willingness and capacity to lend when yields increase.

Overall, Figure 4 reveals substantial variation in supply elasticities across the borrower countries, which reflects stark heterogeneity in the willingness and capacity of intermediaries

[11]By comparison, Koijen and Yogo (2020) estimate a price elasticity with respect to yield of 42 for long-term debt investment. The discrepancy in the elasticity estimates is due to the fact that we always normalize our elasticity measures by the sum of both cross-border and domestic lending, whereas Koijen and Yogo (2020) only take into account cross-border lending. After adjusting for this difference, our estimation implies an average interbank (corporate) loan supply elasticity with respect to yield of 22.4 (35.7). Thus, our estimate of the elasticity for cross-border corporate loan supply is slightly smaller than but broadly comparable to the elasticity estimate from Koijen and Yogo (2020).

[12]The difference in estimates between Panels (b) and (c) is also driven by the fact that the vast majority of lending to each borrower country's firms is provided by its domestic bank sector.

to provide loans in the global financial networks.

4.2 Insurance Across Countries

What are the implications of the heterogeneity in loan supply elasticities for international risk sharing? We conduct counterfactual analysis to study the extent of insurance provided by the global financial network in response to local funding shocks using the estimated structural model. Insurance is defined as the increase in funding inflows relative to the size of the shock. In the analysis, a local funding shock represents a decline in available funding for banks to lend out, which could be driven by a decline in deposits if taken literally or, more generally, any policy or preference change that restricts the amount of capital banks are willing to use to fund loans. For example, more stringent capital reserve requirements, contractionary monetary policy, or liquidity preference shocks all could induce banks to hold greater amounts of cash and lower loan provision, which would ultimately translate to a decline in local funding ($D_{n,t}$) in our structural model.

The analysis in this section is based on the 2007Q2–2014Q2 subsample of the data.[13] Columns (1) and (2) of Table 3 provide estimates of the loan supply curve in both the bank and corporate sectors using data from this subsample. In the following, we refer to this subsample by its midpoint period, 2010Q4, or simply "the 2010 subsample."

A specific case: U.S. local funding shock. To introduce the key mechanisms of risk sharing in the global financial network, we first dissect the effects of a one percent decline in U.S. local funding ($D_{n,t}$) on funding in the United States. [14]

Figure 6 illustrates the effects of the shock on cross-border interbank lending (Panel a) and total (cross-border and domestic) corporate funding (Panel b) to the United States. Focusing first on the interbank market, a one percent local funding shock results in a 0.9 percent decline in total funding in the U.S. bank sector, amounting to $97 billion. This "total

[13] We are focusing on the 2007Q2–2014Q2 subsample here because estimates of loan supply elasticities based on this subsample are the highest across all subsamples. In the subsequent section, we study the evolution of loan supply and demand curves over the sample period.

[14] To examine the effects of a one percent local funding shock in a particular period, we set all the exogenous variables in the structural model to values from that period and impose the one percent negative shock on local funding.

effect" can be decomposed into two components: a "shock effect" and a "global interbank rebalancing effect."

The shock effect captures the immediate impact of the funding shock before global banks rebalance their loan portfolios. The shock effect comprises of two channels: a direct decline in domestic funding and a higher-order effect driven by a decline in foreign funding to the U.S. bank or corporate sector due to the U.S. funding shock affecting foreign interbank funding. As an example, the U.S. funding shock lowers cross-border lending from the United States to the German bank sector, which in turn lowers cross-border lending to U.S. banks based on its existing portfolio weight on the U.S. bank sector. The interbank rebalancing effect captures banks' endogenous reallocation of funding within and across networks in response to the shock. Continuing with the above example, German banks could reallocate funding from other bank or corporate sectors toward U.S. banks, or away from U.S. banks toward other bank or corporate sectors, in response to the shock.

As shown in Panel (a) of Figure 6, the U.S. local funding shock induces a shock effect of -0.9 percent, which translates to a decline of $112.7 billion in cross-border interbank lending. At the same time, banks in the global financial network actively reallocate toward the U.S. bank sector, mitigating the shock effect by 14 percent. This shows that the interbank rebalancing effect—*global interbank rebalancing*— serves as a source of insurance to the U.S. bank sector in this subsample period.

Panel (b) of Figure 6 illustrates the effects of the U.S. shock on funding in the U.S. corporate sector. Overall, total funding to firms declines by 0.5 percent in response to the shock. This total effect can also be decomposed into a "shock effect," a "global credit rebalancing effect" and a "self-rebalancing effect." As in the bank sector, the shock effect captures the immediate change in lending to firms in the United States holding all countries' loan portfolio weights fixed. The global credit rebalancing effect captures reallocation of cross-border lending by non-U.S. banks to or from the U.S. corporate sector in response to the shock. The self-rebalancing effect is specific to the corporate sector, capturing the reallocation of loans by U.S. banks.

The U.S. funding shock generates a shock effect of -0.8 percent in the corporate sector, which translates to a decline of 89.9 billion dollars in lending to U.S. firms. Non-U.S.

banks actively reallocate funding toward the U.S. corporate sector to take advantage of the unmet loan demand, reversing 12 percent of the shock effect. Furthermore, domestic U.S. banks provide additional funding to U.S. firms through retrenchment of their own funding and intermediation of funding from global interbank rebalancing, reversing an additional 27 percent of the shock effect.[15]

In sum, global credit rebalancing and self-rebalancing serve as mechanisms of insurance for U.S. firms in response to a local funding shock, reversing about half of the losses from the shock effect. Taking together with the result on global interbank rebalancing, our results show that banks in the global financial network provide a significant amount of insurance to U.S. banks and firms in response to a U.S. domestic funding shock through the three margins of rebalancing.

Global Insurance and Loan Supply Elasticities. We now generalize the one percent local funding shock for each country in the network and study the variation in insurance provision through the various margins of rebalancing.

Table 6 shows the amount of shock effect (column 1) in the interbank market and the share of global interbank rebalancing relative to the shock effect (column 2) in response to the local funding shock for *each* origin country. For all countries, global credit rebalancing mitigates direct shock effects, like in the case of the U.S. local funding shock. Moreover, there is a significant amount of variation in the degree of insurance through global interbank rebalancing, ranging from 8 to 47 percent.

Table 7 presents the results of the effects of a one percent decline in local funding on firms in each origin country. As before, column (1) shows the shock effect, and columns (2) and (3) show the share of global credit rebalancing and self-rebalancing relative to the shock effect, respectively. The shares of global credit rebalancing are all positive, indicating that banks from the non-shocked countries tend to actively reallocate funding toward the corporate sectors of the country experiencing the local funding shock and thus mitigate

[15]More specifically, the self-rebalancing effect encompasses both a retrenchment effect—endogenous reallocation of funding by U.S. banks—and an indirect global interbank effect—U.S. banks' intermediation of foreign funding from global interbank rebalancing). Panel (a) of Appendix Figure A.6 decomposes the self-rebalancing effect into the two components. Evidently, most the self-rebalancing effect results from indirect global interbank rebalancing.

the negative shock effect. Domestic banks from the shocked countries provide additional funding to the firms from their home country through self-balancing. Similar to insurance through interbank rebalancing, there is also a significant amount of variation in the degree of insurance through global credit rebalancing and self-rebalancing across countries, ranging from 3 to 19 percent for the former margin and 12 to 52 percent for the latter.

What governs these variations? We show that they are governed by the aggregate supply elasticities of each country and sector, which are determined by prices and characteristics of borrowers and borrower-lender relationships. Figure 7 shows countries with more elastic cross-border interbank loan supply and total corporate loan supply receive greater insurance provision, as measured by the share of global interbank rebalancing, global credit rebalancing, and self-rebalancing when they face a local funding shock. This is because banks in the global financial network are more willing and have greater capacity to provide lending to these countries when their interest rates increase.

The results in Figure 7 provide a novel illustration of heterogeneity in risk sharing in the global financial network. They also imply that the heterogeneity in the willingness and capacity of global financial intermediaries to provide intermediary services ultimately affects how sensitive countries are to fluctuations in funding conditions and business cycles.

4.3 Shock Transmission Across Countries

The various margins of rebalancing also apply when analyzing spillover effects of local funding shocks. However, instead of serving as insurance mechanisms, global rebalancing can act as a source of shock amplification in countries experiencing shock spillover effects.

A specific case: Mexico. We begin by describing the transmission of the U.S. local funding shock to an illustrative foreign country—Mexico. Panel (c) of Figure 6 illustrates the transmission of the U.S. local funding shock on cross-border interbank lending to Mexico. As shown in Panel (a) from Figure 6, the shock effect captures the immediate change in cross-border interbank lending to Mexico, holding all portfolio weights fixed. While the U.S. funding shock induces a drop of $98 million in cross-border interbank lending to Mexican banks, interbank rebalancing amplifies the negative shock effect by 55 percent, exacerbating

the direct spillover effects from the shock.

Panel (d) of Appendix Figure 6 illustrates the effects of the funding shock on total funding to the corporate sector in Mexico. In response to the shock, cross-border lending immediately declines by $334 million. Non-U.S. banks further reallocate funding away from Mexican firms through global credit rebalancing, exacerbating the shock effect by an additional 21 percent. Global credit rebalancing serves as a mechanism of shock amplification in this case. In addition to the negative shock effect and credit rebalancing effect, Mexican banks further lower funding to Mexican firms through the self-rebalancing margin. Panel (b) of Figure A.6 in the Appendix shows that the decline in Mexican corporate funding through self-rebalancing mostly results from the indirect effects of interbank rebalancing. Mexican banks lose funding through interbank rebalancing and therefore have to lower their funding to the domestic corporate sector. Mexican banks retrench to offset this loss in domestic corporate funding but reverse the indirect interbank rebalancing effect only a little.

Generalization. Columns (1)–(2) of Table 4 present the effects of the U.S. funding shock on interbank funding across all destination countries based on the estimated 2010 supply and demand curves. Column (1) shows the amount of shock effect, revealing significant heterogeneity in immediate changes in cross-border interbank lending to each destination country. Bank sectors of the United Kingdom, Japan, and the euro area experience the greatest decline in cross-border interbank lending as a result of the U.S. funding shock, which is intuitive given U.S. banks provide a large amount of funding to them ex-ante. Column (2) of Table 4 shows the share of global interbank rebalancing relative to the shock effect across all destination countries. Note that in this and all subsequent tables, we adjust the sign of the ratio such as a positive number denotes mitigation of the shock effect, and a negative number denotes exacerbation of the shock effect. All countries witness an exacerbation of the shock effect, like Mexico, which shows that global interbank rebalancing serves a mechanism of shock amplification when bank sectors experience spillover effects from foreign funding shocks.

Columns (1)–(3) of Table 5 present the effects of the U.S. funding shock on corporate funding across all destination countries based on the estimated 2010 supply and demand

curves. Column (1) shows the amount of shock effect, and columns (2) and (3) show the share of global credit rebalancing and self-rebalancing relative to the shock effect, respectively, across the destination countries. Firms across most destination countries, like Mexico, experience an exacerbation of the shock effect as a result of global credit rebalancing. Therefore, global credit rebalancing serves as a mechanism of shock amplification for the corporate sectors. The corporate sectors of all countries also suffer substantial funding losses due to the indirect effects of interbank rebalancing.

Figure 8 shows the transmission of the U.S. local funding shock to a sector depends crucially on its creditors' willingness to lend to the United States. If a sectors' creditors are more willing to lend, then that sector tends to lose more funding as its creditors rebalance a larger share of their loan portfolio to insure the United States. Figure 8 plots the decrease in lending to each country's bank (panel a) and corporate (panel b) sector against its creditors' willingness to lend to the United States. For sector ℓ in country m, we compute its creditors' willingness to lend to the United States as a weighted sum of each creditor's willingness and capacity to lend to the United States and the weights are each creditor's weight on sector ℓ in country m.[16] Overall, creditor willingness to lend to the United States explains 90% of the variation in shock transmission in the bank sector and 82% of the variation in shock transmission in the corporate sector.

Finally, we observe that emerging markets witness greater outflow of foreign capital in both the bank and corporate sectors in response to the U.S. local funding shock, as shown in Appendix A.7. This observation is consistent with the established empirical fact on the fickleness of foreign capital for emerging markets in the literature (Forbes and Warnock 2021).

5 Global Financial Intermediation Over Time

In this section, we study the evolution of loan supply elasticities and global insurance. We also explore a potential driver of the observed change in insurance provision by the global financial network over time—bank regulation and macroprudential policies.

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

5.1 Supply Elasticities Over Time

Table 3 reports the estimates of within-sector loan supply curves based on equation (8) for two subsamples of data. As discussed earlier, columns (1) and (2) show estimates for 2010 supply curves for banks and firms based on the 2007Q2–2014Q2 subsample of the data. Columns (3) and (4) provide estimates based on the 2012Q4–2019Q4 subsample. We refer to this second subsample as the 2016Q2 or 2016 subsample. Our results indicate that loan supply in both the bank and corporate sectors has become less responsive to interest rate fluctuations over time. The magnitude of the coefficient on price governing interbank loans has decreased substantially from -367.1 based on the 2010 subsample to -20.6 based on the 2016 subsample. Similarly, the coefficient on price governing loans to the corporate sectors has decreased in magnitude from -41.3 to -24.5.

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 each subsample in Figure 5. Panel (a) shows that the decline in cross-border interbank and corporate loan supply elasticities from 2010 to 2019 is part of a longer-term trend, not simply a reflection of the two endpoints of the sample. Panel (b) plots the total funding supply elasticity for the corporate sector. It reveals that both cross-border and domestic lending to firms have become less elastic in the latter half of the sample period.[17]

Altogether, our results show that loan supply in the global financial network has become less responsive to changes in price over time. Increases in interest rates on loans are met with smaller increases in cross-border lending. On the one hand, this change suggests that cross-border funding has become more stable. On the other hand, funding shortages in individual countries are met with smaller inflows of international capital.

We also observe a notable change in loan substitution across the two sectors over time. Columns (2) and (3) of Appendix Table A.6 report the estimates for cross-sector loan supply based on equation (9) using the 2010 and 2016 subsamples of the data, respectively. For both the bank and corporate sectors, we observe a decline in the degree of substitutability in lending to the other sector, as captured by the decline in λ_ℓ. Moreover, we observe an

[17] Appendix Figure A.4 shows the evolution of interbank loan demand elasticities over the sample period, revealing a decline in these elasticities as well.

increase in the relative desirability of lending to the corporate sector, as captured by the estimates for α_2. This result suggests that banks have become more willing to directly lend to the corporate sector over the sample period. This trend of greater cross-sector substitutability toward direct firm lending partly explains why the decline in the elasticity of cross-border firm loan supply is more muted than the decline in cross-border interbank loan supply elasticity.

5.2 Changes in Insurance and Transmission Over Time

To understand the implications of the changes in supply and demand elasticities for international risk sharing and shock propagation, we conduct counterfactual analysis and study the changes in insurance provision over time. Overall, our results indicate a weakening of insurance provision but also a decline in shock transmission through the global financial network.

The top two panels of Figure 9 summarize the changes in insurance provision in the banking and corporate sectors over time. Panel (a) plots the amount of global interbank insurance received by each country's bank sector under the 2010 (x-axis) and 2016 (y-axis) loan supply and demand curves, as well as a 45-degree line. Points below the 45-degree line indicate that the country's bank sector received less global interbank insurance in 2016, whereas points above the 45-degree line indicate the country received more global insurance. The figure shows that all countries received less interbank insurance in 2016. Columns (3)–(4) of Table 6 present corresponding values in insurance provision as measured by the share of global interbank rebalancing relative to the shock effect. This result is consistent with the fact that the elasticity of cross-border interbank loan supply declined substantially over the sample period, which greatly weakened the risk-sharing mechanism in the global interbank network. Panel (b) of Figure 9 highlight a similar decline in insurance provision to the corporate sector through both cross-border and domestic lending.

The bottom two panels of Figure 9 show that the decline in insurance provision over time is coupled with an analogous decline in shock transmission in the banking and corporate sectors over time. Panel (c) plots the transmission of the U.S. local funding shock to foreign banking sectors in 2010 and 2016. Panel (d) plots transmission to foreign corporate sectors.

Both figures highlight a general decline in shock transmission over time. Altogether, Figure 9 reveals a decrease in risk sharing and shock propagation since the Global financial Crisis.

5.3 The Role of Regulation

In this section, we explore one potential explanation for the change in loan supply elasticity and risk sharing in the global financial network over time. Prompted by the GFC, a number of countries heightened regulatory oversight of their financial sector by introducing new or more stringent regulatory standard and macroprudential policy. From a theoretical perspective, stricter bank regulation could reduce the likelihood of banks' distress. At the same time, regulations like higher capital requirements can reduce liquidity in a financial network and prevent 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, with each tightening event coded as +1 and each loosening event coded as -1. For each lender country, we compute a regulatory strictness index using the cumulative sum of policy instruments implemented by the country up to each quarter starting from 2000Q1. On average, we observe significant tightening in different policy instruments. The average liquidity coverage ratio index across the lender countries increased from 0.1 in 2010 to 3.9 by the end of the sample period. The average capital requirement index increased from 0.1 to 2.6.

Panel (a) of Figure 10 plots the changes in the elasticities of cross-border interbank loan supply as a function of the changes in the liquidity coverage ratio index, which captures the component of the bank regulation that is most relevant for interbank lending. Panel (a) shows that more stringent liquidity requirements are associated with less elastic loan supply in the interbank network. Similarly, in Panel (b) of Figure 10, we plot the changes in the elasticities of corporate loan supply as a function of the changes in the capital requirement index—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 credit network. Therefore, it is plausible that regulatory changes have contributed to less insurance provision in the global financial network.

Understanding the drivers of the changes in loan supply curves is crucial for policymakers when determining the optimal level of regulation, given their link to insurance in the global financial network. Although the results in this section cannot provide conclusive evidence on whether increases in regulatory strictness caused the decline in loan supply elasticities, we provide suggestive evidence that changes in regulation could explain the changes in loan supply curves on multiple dimensions in recent years. At the same time, more stringent regulation (at least by our measure) cannot fully explain the decline in insurance provision in the interbank network, which highlights the need for additional explanatory factors.

6 Conclusion

This paper provides a systematic analysis of international risk sharing and shock propagation through the global financial network over the past decade. We develop a structural model of the global financial network that incorporates both the global interbank network and the global bank-firm credit network as well as endogenous cross-border loan supply, loan demand, and lending prices. Using the model, we estimate time-varying supply and demand curves for cross-border interbank and firm lending. We uncover significant variations in the estimates of cross-border supply and demand elasticities across countries, which reveals significant heterogeneity in the willingness and capacity of global financial intermediaries to provide intermediary services. We show that this heterogeneity governs the extent of risk sharing across countries: countries with lower supply elasticities receive less insurance in response to idiosyncratic shocks. We further show that the elasticities of cross-border loan supply have declined since the GFC, resulting in less insurance provision and greater shock amplification in both interbank and credit networks. We provide suggestive evidence that tightening of macroprudential policy instruments has contributed to the decline in insurance. Our results shed new light on the role of the global financial network in supporting risk sharing and shaping global systemic risk over time.

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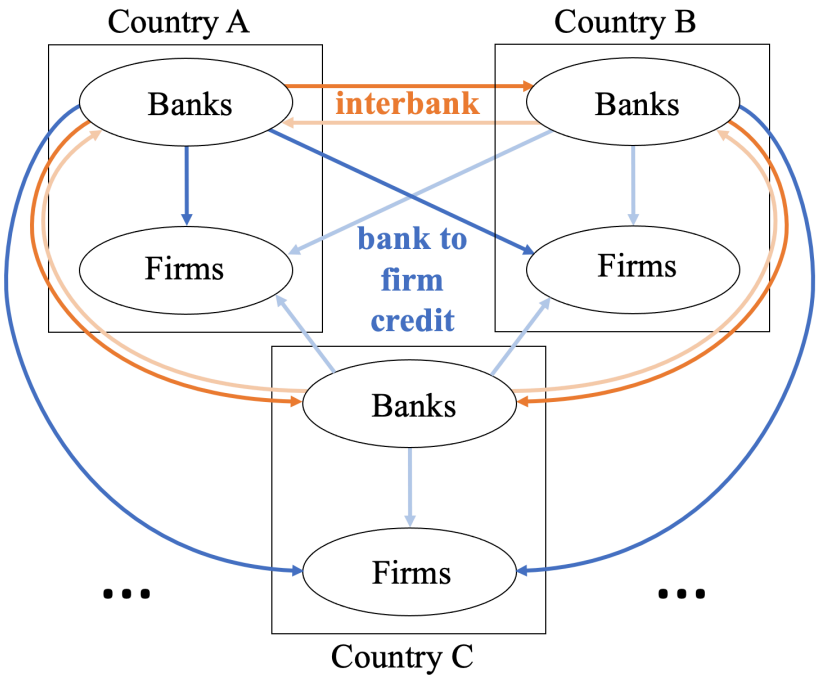
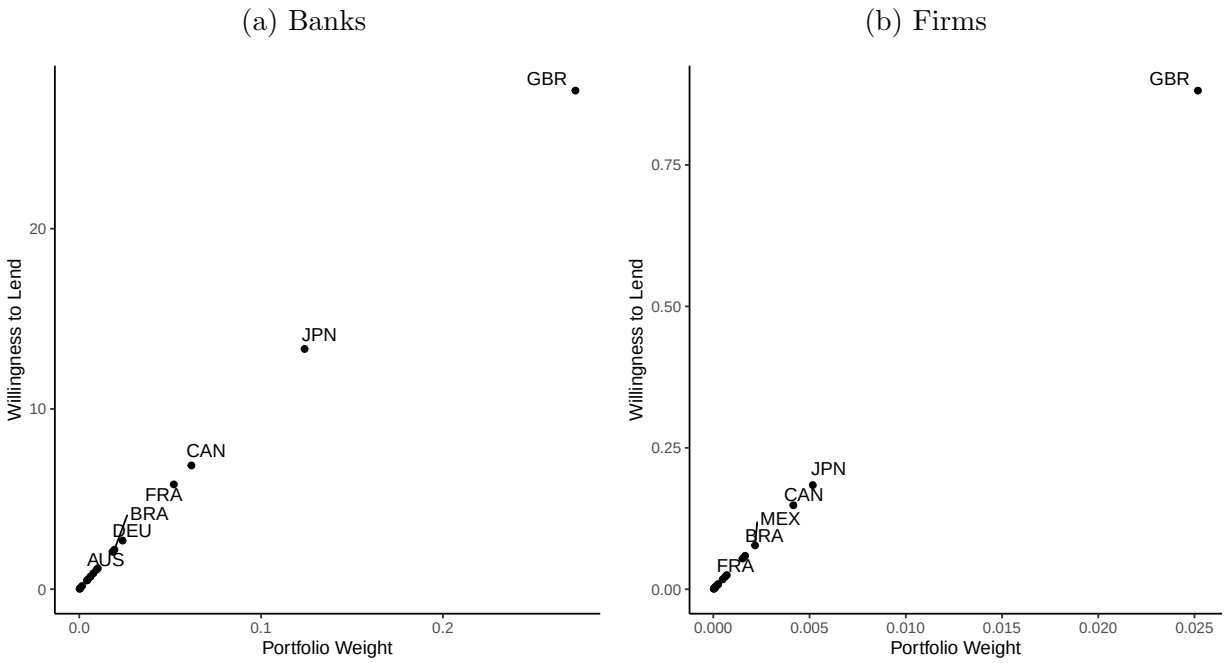
7 Figures and Tables

Figure 1: **Global Financial Network**



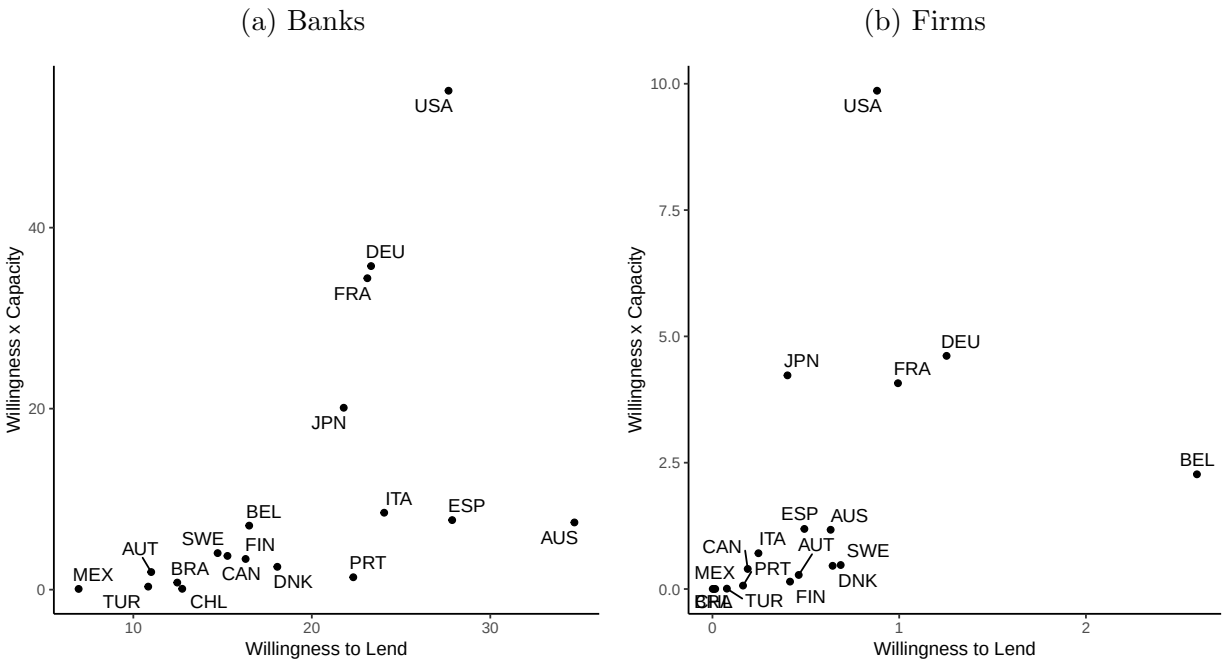
Notes: This plot provides a conceptual overview of the global financial network, which is comprised of the global interbank network and the global credit network.

Figure 2: Willingness of the U.S. Banking Sector to Extend Loans



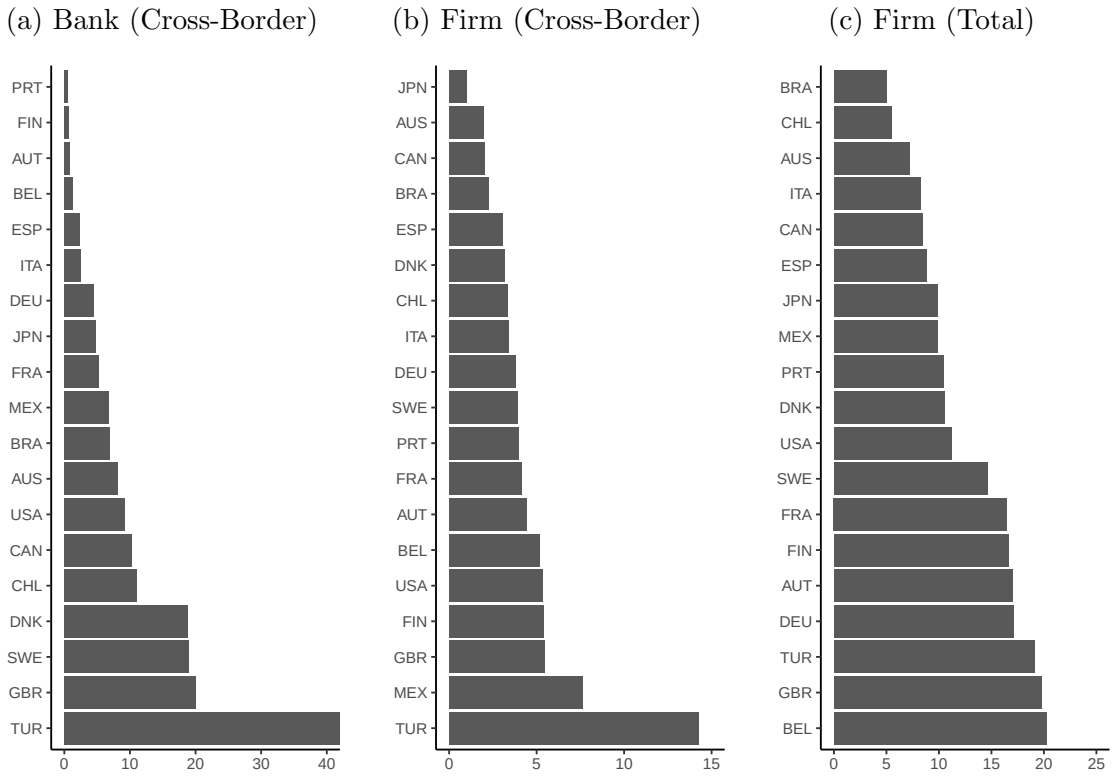
Notes: This exhibit plots the average willingness of the U.S. banking sector to lend to different borrower countries as a function of its average portfolio weights in that country in the bank (Panel a) and firm (Panel b) sectors. A lender country's willingness to lend to a borrower country in a sector 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 shown in equation (11). The bilateral elasticity is computed according to equation (A.2) in Appendix A. Averages are taken within country and over time.

Figure 3: Banks' Willingness and Capacity to Extend Loans to the United Kingdom



Notes: This exhibit plots the average willingness and capacity (willingness to lend multiplied by total AUM of the lender) of different countries to lend to the United Kingdom's bank (Panel a) and corporate (Panel b) sectors as a function of their average willingness to lend to the United Kingdom. See the notes from Figure 2 for details on calculating a country's willingness to lend.

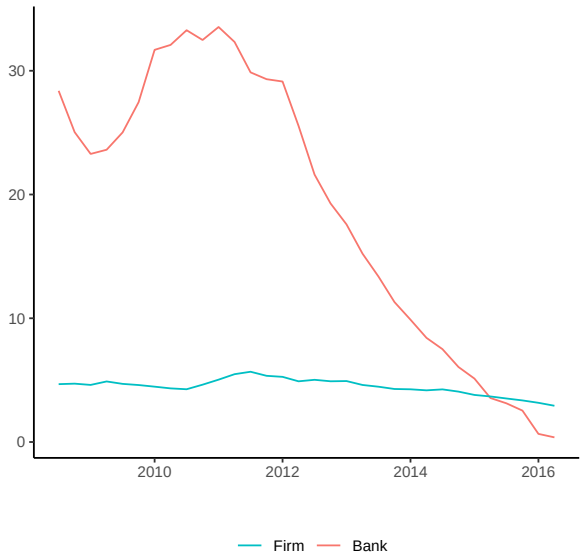
Figure 4: Loan Supply Elasticities by Borrower Country



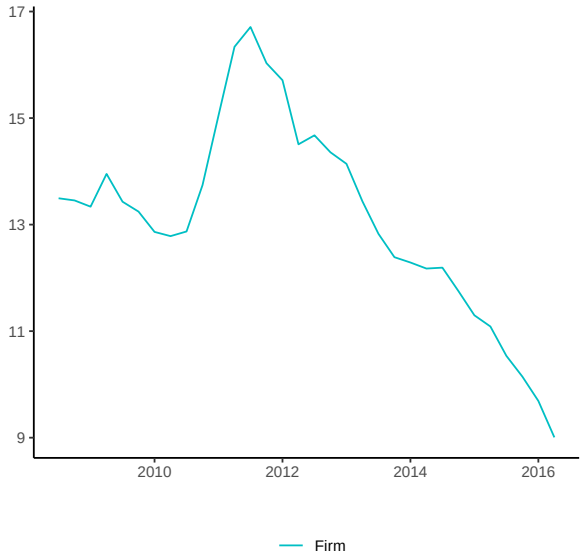
Notes: This exhibit presents the average cross-border loan supply elasticities for the bank sector (Panel a) and corporate sector (Panel b) and the total (cross-border and local) lending elasticities for the corporate sector (Panel c) of the borrower countries in the global financial network. The elasticities measure the percent change in the quantity of cross-border or total loans extended to a given sector in a given country in relation to a one percent increase in price. We compute the loan supply elasticity for each borrower country according to equation (11) using the full sample. Borrower countries are presented in ascending order from the least elastic lending supply to the most elastic.

Figure 5: Evolution of Global Banks' Loan Supply and Demand Curves

(a) Cross-Border Lending Elasticities



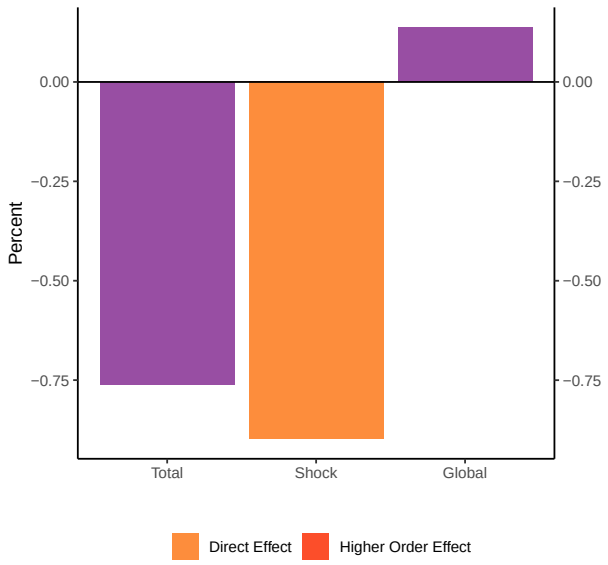
(b) Total Lending Elasticity for Firms



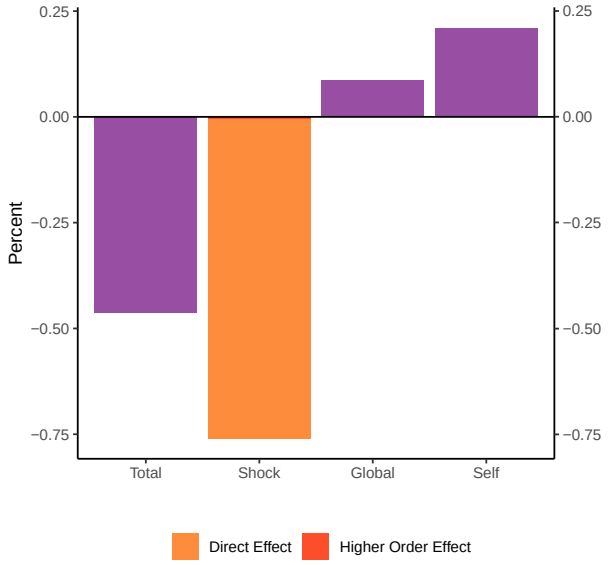
Notes: Panel (a) presents the average elasticities of cross-border interbank and firm loan supply and the average elasticities of cross-border interbank loan demand from 2005Q1 to 2019Q4. Panel (b) presents the average elasticities of total firm loan supply. The supply elasticities for each borrower country are computed based on a rolling regression using a 7-year subsample of the data, and are averaged across countries. See Figure 4 for more detailed descriptions of cross-border and total lending elasticities.

Figure 6: Effects of U.S. Funding Shock on the United States and Turkey

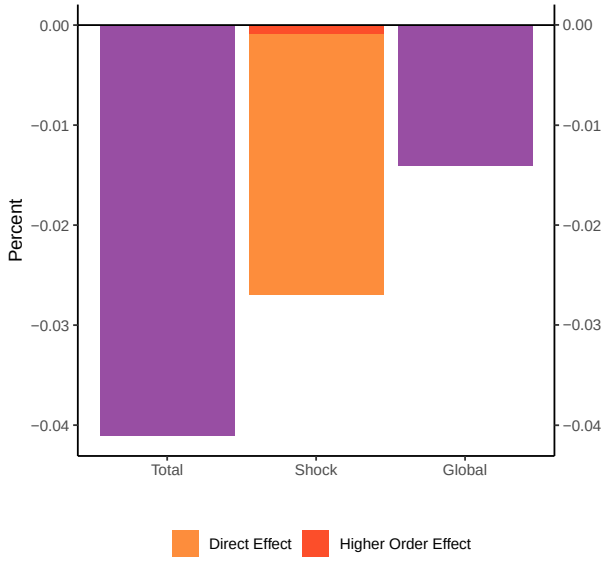
(a) U.S. Interbank Funding (2010Q4)



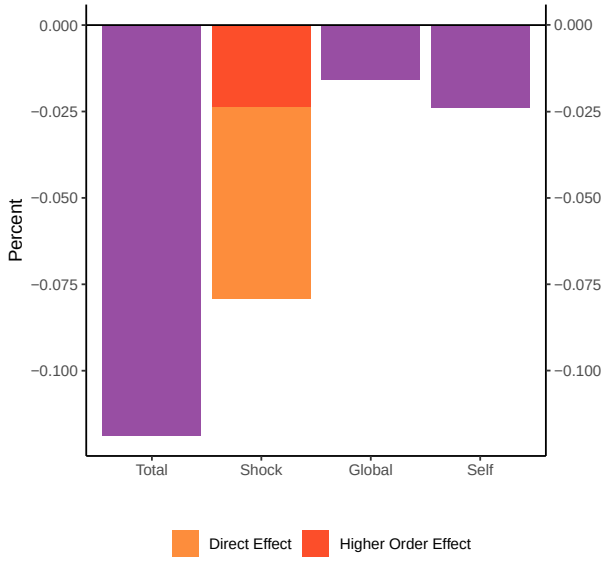
(b) U.S. Corporate Funding (2010Q4)



(c) Mexico Interbank Funding (2010Q4)



(d) Mexico Corporate Funding (2010Q4)

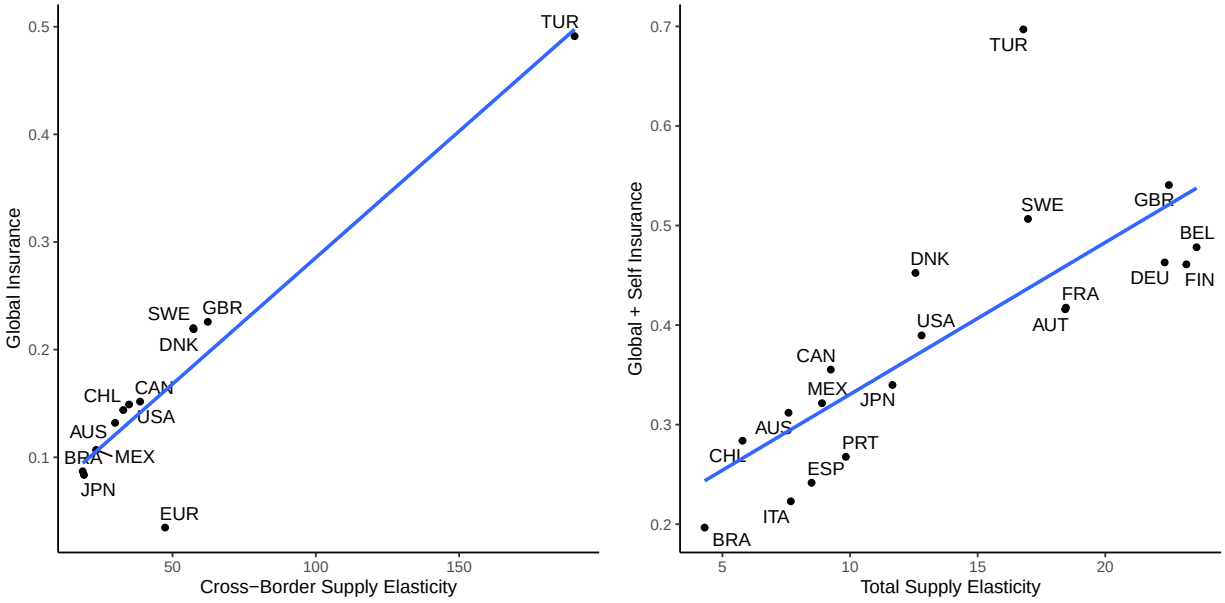


Notes: Panels (a) and (b) of this exhibit present the effect of a one percent decline in U.S. local funding on cross-border bank funding and total firm funding, respectively, in the United States based on the 2010Q4 supply and demand curves. The "shock" effect captures the change in lending that is directly attributable to the decline in U.S. local funding in a static network. "Global" interbank and credit rebalancing captures the change in lending resulting from endogenous reallocations of non-U.S. banks' loan portfolios to the corresponding sector. "Self" rebalancing captures endogenous reallocation of U.S. banks' loan portfolios to the corporate sector. The shock effect and the rebalancing effect(s) sum up to the "total" effect. Panels (c) and (d) of this exhibit present the effect of a one percent decline in U.S. local funding on cross-border bank funding and total firm funding, respectively, in Mexico.

Figure 7: Global Insurance and Elasticity of Loan Supply

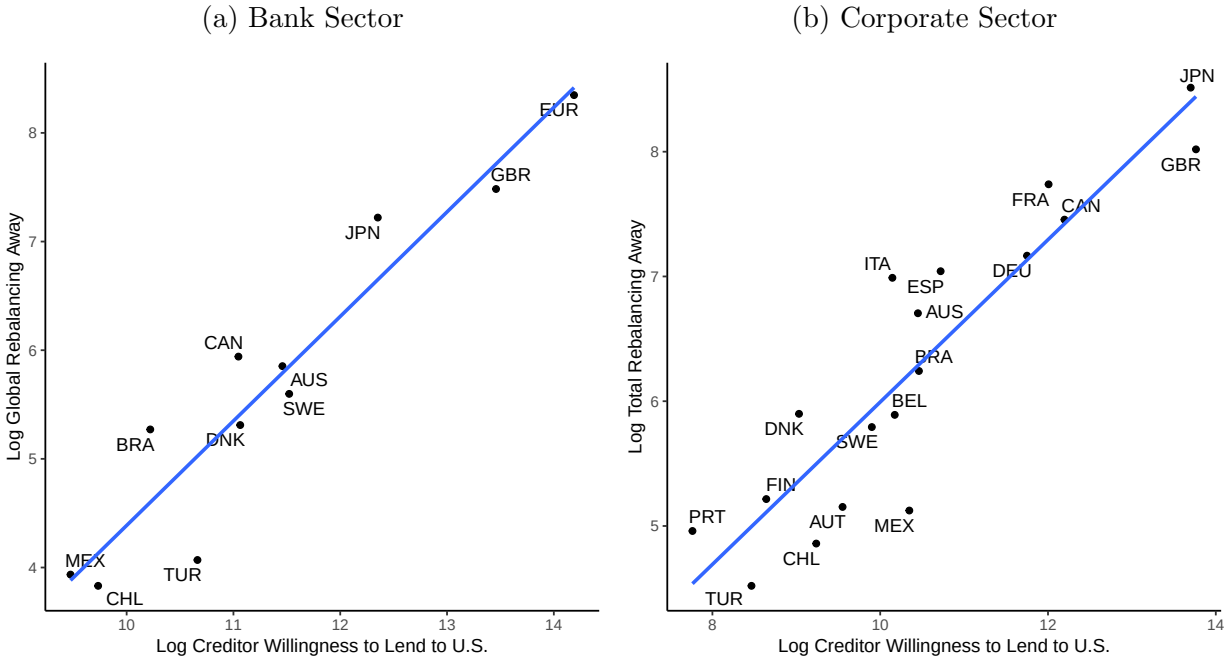
(a) Cross-border Funding (Banks)

(b) Total Funding (Firms)



Notes: This exhibit presents the amount of insurance banking sectors receive through global interbank rebalancing (Panel a), the amount of insurance corporate sectors receive through global credit and self rebalancing (Panel b) as a function of loan supply elasticities in response to a one percent local funding shock in each country. The estimates are based on the 2010Q4 supply and demand curves. See Figure 4 for additional details on the calculation of aggregate loan supply elasticities of each borrower country, and see Figure 6 for more detailed descriptions of the different margins of rebalancing. We include a fitted line in each panel.

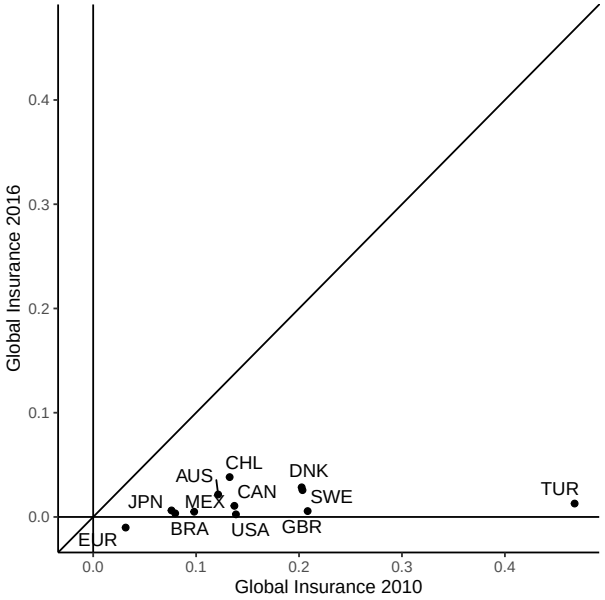
Figure 8: U.S. Local Funding Shock Transmission



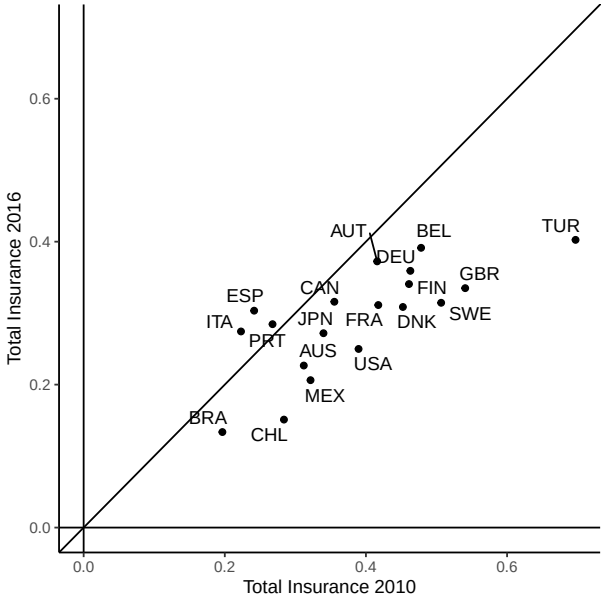
Notes: This exhibit illustrates the transmission of the U.S. local funding shock to other economies. For the bank sector (panel a) and the corporate sector (panel b), the exhibits plot the log change in lending to each destination country (y-axis) against the log exposure of the corresponding country's creditors to the U.S. local funding shock (x-axis). For each destination country, the exposure is computed by multiplying the amount of its creditor country's loans to the United States and the creditor's portfolio weight on the sector, weighted by the 1 percent shock and summed across all creditor countries. The estimates are based on the 2010Q4 supply and demand curves.

Figure 9: Insurance and Shock Transmission: 2010Q4 v 2016Q2

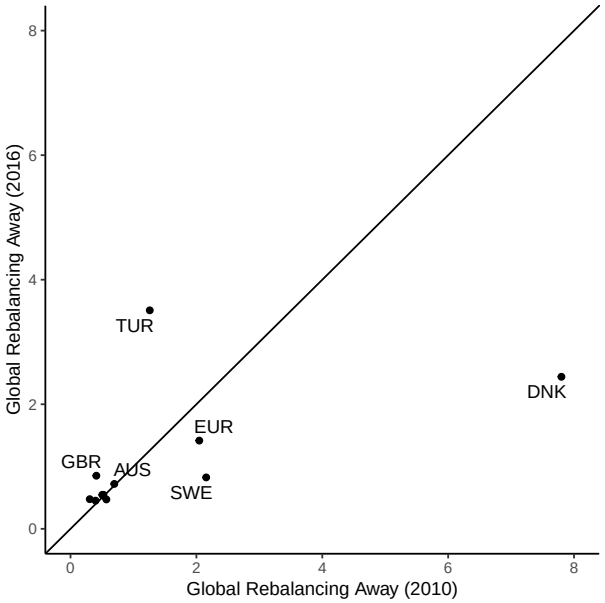
(a) Global Insurance (Banks)



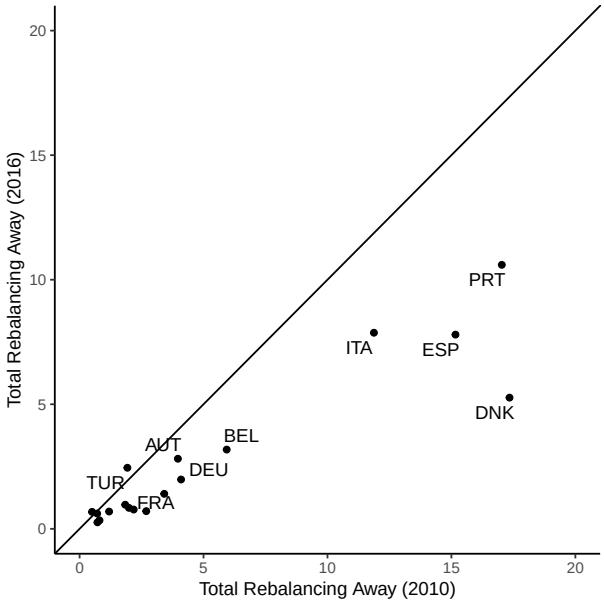
(b) Total Insurance (Firms)



(c) U.S. Shock Transmission (Banks)



(d) U.S. Shock Transmission (Firms)

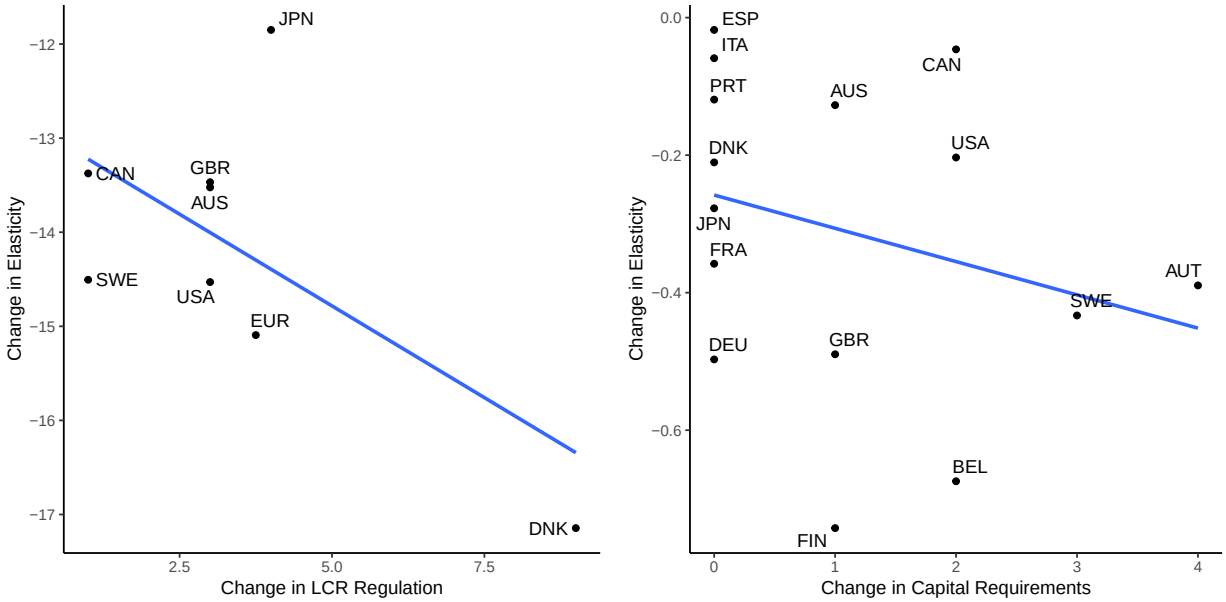


Notes: This exhibit compares the magnitude of insurance provision and shock transmission between 2010Q4 and 2016Q2. Panels (c) and (d) present the amount of insurance received in each country's bank and corporate sector in response to a 1 percent local funding shock. All margins of rebalancing are normalized by the shock effect. See Figure 6 for more detailed descriptions of the different margins of rebalancing. Panels (c) and (d) present the magnitude of the U.S. local funding shock transmission to foreign bank and corporate sectors. We include a 45-degree line in each panel. Points lying below the 45-degree line indicate a lower magnitude of transmission / insurance.

Figure 10: Regulatory Stringency and Insurance Provision in the Global Financial Network

(a) Interbank Network

(b) Bank-Firm Credit Network



Notes: This exhibit presents the correlation between changes in the regulatory stringency measures after the Global Financial Crisis, and changes in loan supply elasticities between 2010 and 2016 in the interbank network (Panel a) and the bank-firm credit network (Panel b). In panel (a), the regulatory stringency measure is based on the stringency of the liquidity coverage ratio. The slope of the fitted line is -0.08 (s.e. = 0.04) with R-squared = 0.40. In panel (b), the regulatory stringency measure is based on the stringency of the capital ratio. The slope of the fitted line is -0.05 (s.e. = 0.05) with R-squared = 0.24. We restrict the sample to advanced economies. Data source: Integrated Macroprudential Policy (iMaPP) Database.

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

	2007Q2–2014Q2						2012Q4–2019Q4					
	CB Bank		CB Firms		Total Firms		CB Bank		CB Firms		Total Firms	
	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	112	38	85	23	1298	353	152	16	99	11	2051	247
Austria	156	34	59	6	532	65	89	31	76	7	546	39
Belgium	254	56	88	16	768	104	164	14	106	8	712	69
Brazil	42	20	60	29	595	449	76	8	92	14	1432	191
Canada	179	41	90	22	1814	274	230	24	145	24	2163	137
Chile	12	6	14	2	164	36	19	2	18	1	254	20
Denmark	154	32	56	19	634	97	140	24	70	8	713	40
Finland	89	37	37	5	296	37	141	17	49	5	329	17
France	955	175	371	56	3286	433	872	91	447	27	3739	241
Germany	811	121	391	83	4128	615	720	89	355	75	2807	1215
Italy	512	120	329	62	3143	384	296	51	249	60	3188	263
Japan	356	86	175	36	8736	1821	624	50	308	62	8701	1239
Mexico	10	6	57	12	330	38	21	1	79	4	416	26
Portugal	107	22	57	8	446	61	45	19	38	2	406	56
Spain	529	124	238	48	2773	365	240	75	190	16	2361	431
Sweden	147	24	74	9	635	79	182	14	80	5	766	38
Switzerland	397	97	120	24	772	141	325	22	127	6	1030	44
Turkey	28	10	49	11	147	34	58	8	62	5	211	14
United Kingdom	2478	389	746	123	5537	544	1735	367	1007	162	5659	328
United States	1088	224	1848	234	10771	901	1207	71	2186	236	13356	1581

Notes: This table reports the quarterly means and standard deviations of total cross-border lending to the bank sector (columns 2–3, columns 7–8) and corporate sector (columns 4–5, columns 9–10), and of total (cross-border and domestic) funding to the corporate sector (columns 6–7, columns 11–12) of the 19 countries in the global financial network over the sample period of 2007Q2–2014Q2 (left panel) and 2012Q4–2019Q4 (right panel).

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

	(1) Banks	(2) Firms
Log Price	-91.85	-35.04^{**}
	(66.06)	(14.65)
Exchange Rate	0.01	0.04
	(0.06)	(0.05)
Policy Rate Differential	9.33	3.14
	(10.60)	(2.87)
Log GDP (Lagged)	1.41^{***}	0.99^{***}
	(0.10)	(0.11)
Log GDP per capita (Lagged)	0.56^{*}	0.19
	(0.32)	(0.24)
Distance	-1.70^{***}	-1.31^{***}
	(0.20)	(0.17)
Trade Exposure	0.06	0.18^{*}
	(0.11)	(0.09)
Volatility	-0.39^{***}	-0.38^{***}
	(0.10)	(0.06)
Regulation (Borrower)	-0.38^{**}	-0.25^{***}
	(0.13)	(0.08)
Indicator: Own Country		3.42^{***}
		(0.89)
Obs.	18,435	18,601

Notes: This table presents the estimation results from equation (8) for the bank (column 1) and corporate (column 2) sectors using the full sample period from 2005Q1 to 2019Q4. The estimation is based on an instrumental variable approach. All specifications include lender country, time, and borrower country MSCI market fixed effects. Standard errors (in parentheses) are clustered by lender and time period. $^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$

Table 3: Within-sector Loan Supply Estimation (2010Q4 and 2016Q2)

	2010Q2		2016Q2	
	(1) Banks	(2) Firms	(3) Banks	(4) Firms
Log Price	-367.09^{***}	-41.31^{***}	-20.62	-24.51
	(119.94)	(13.62)	(75.88)	(15.62)
Exchange Rate	-0.04	0.17^{***}	0.05	0.05
	(0.09)	(0.06)	(0.07)	(0.07)
Policy Rate Differential	51.90^{**}	13.07^{**}	-2.05	-0.68
	(18.73)	(6.03)	(11.69)	(1.77)
Log GDP (Lagged)	1.32^{***}	0.96^{***}	1.63^{***}	1.12^{***}
	(0.09)	(0.12)	(0.13)	(0.12)
Log GDP per capita (Lagged)	0.09	0.42^{*}	0.94^{**}	0.27
	(0.36)	(0.24)	(0.37)	(0.27)
Distance	-1.64^{***}	-1.28^{***}	-1.88^{***}	-1.43^{***}
	(0.20)	(0.17)	(0.23)	(0.21)
Trade Exposure	0.09	0.13	-0.02	0.17
	(0.10)	(0.09)	(0.12)	(0.10)
Volatility	-0.33^{***}	-0.37^{***}	-0.33^{**}	-0.36^{***}
	(0.10)	(0.05)	(0.13)	(0.09)
Regulation (Borrower)	-1.68^{***}	-0.77^{***}	-0.23^{*}	-0.21^{**}
	(0.37)	(0.18)	(0.12)	(0.09)
Indicator: Own Country		3.07^{***}		3.67^{***}
		(0.93)		(0.91)
Observations	8,993	9,138	9,163	9,237

Notes: This table presents the estimation results from equation (8) for the bank (columns 1 and 3) and corporate (columns 2 and 4) sectors using 7-year subsamples with midpoints at 2010Q4 and 2016Q2. The estimation is based on an instrumental variable approach. All specifications include lender country, time, and borrower country MSCI market fixed effects. Standard errors (in parentheses) are clustered by lender and time period. $^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$

Table 4: Effects of U.S. Local Funding Shock on Cross-border Interbank Lending

	2010Q4		2016Q2	
	(1) Shock Amt (Mil.USD)	(2) Interbank Reb. (%)	(3) Shock Amt (Mil.USD)	(4) Interbank Reb. (%)
Australia	-501.1	-0.72	-798.2	-0.66
Brazil	-489.3	-0.43	-158.7	-0.41
Canada	-1,245.3	-0.34	-764.7	-0.43
Chile	-81.0	-0.60	-253.0	-0.40
Denmark	-26.0	-7.72	-153.8	-2.30
Euro-Area	-2,062.9	-2.06	-7697.8	-1.31
Japan	-2,708.5	-0.53	-5,918.3	-0.49
Mexico	-97.7	-0.55	-31.0	-0.51
Sweden	-125.2	-2.16	-804.9	-0.72
Turkey	-46.5	-1.33	-1.9	-3.50
United Kingdom	-4,338.2	-0.45	-5,575.3	-0.76
United States	-112,689.1	0.14	-112,689.1	0.00

Notes: This table presents the change in funding in each country's bank sector as a result of a one percent decline in U.S. local funding in 2010Q4 based on the 2010Q4 supply and demand curves (columns 1 and 2) and the 2016Q2 supply and demand curves (columns 3 and 4). The shock effect captures the change in cross-border funding directly attributable to the U.S. local funding shock in a static network. Global interbank rebalancing captures the endogenous reallocation of cross-border funding to each borrower country normalized by the magnitude of the shock effect.

Table 5: Effects of U.S. Funding Shock on Cross-border and Local Firm Lending

	2010Q4			2016Q2		
	(1) Shock Effect (Mil.USD)	(2) Credit Reb. (%)	(3) Self Reb. (%)	(4) Shock Effect (Mil.USD)	(5) Credit Reb. (%)	(6) Self Reb. (%)
Australia	-443.6	-0.21	-1.58	-649.7	-0.24	-0.70
Austria	-43.6	-1.97	-1.91	-41.4	-1.93	-0.82
Belgium	-60.9	-1.79	-3.94	-85.5	-1.53	-1.59
Brazil	-723.9	-0.23	-0.48	-194.8	-0.25	-0.42
Canada	-1452.5	-0.07	-1.09	-1285.4	-0.16	-0.46
Chile	-160.3	-0.18	-0.62	-284.5	-0.04	-0.28
Denmark	-21.0	-2.67	-13.93	-68.2	-1.34	-3.80
Finland	-84.4	-0.33	-1.74	-203.1	-0.11	-0.66
France	-671.9	-0.49	-2.79	-1465.7	-0.25	-1.19
Germany	-316.4	-1.13	-2.85	-614.0	-0.33	-1.64
Italy	-91.4	-2.89	-8.65	-125.8	-2.86	-4.79
Japan	-2504.3	-0.15	-1.83	-4716.7	-0.11	-0.66
Mexico	-334.4	-0.21	-0.30	-177.0	-0.32	-0.32
Portugal	-8.4	-4.01	-12.47	-10.9	-3.54	-6.34
Spain	-75.4	-2.42	-12.27	-120.0	-1.54	-5.97
Sweden	-122.0	-0.75	-1.83	-318.8	-0.17	-0.52
Turkey	-47.6	-0.34	-1.56	-8.3	-2.28	-0.40
U.K.	-4209.0	-0.08	-0.62	-6019.4	-0.11	-0.11
U.S.	-89935.6	0.12	0.27	-81206.4	0.15	0.11

Notes: This table presents the change in funding in each country's corporate sector as a result of a one percent decline in U.S. local funding in 2010Q4 based on the 2010Q4 (columns 1–3) and 2016Q2 (columns 4–6) supply and demand curves. The shock effect captures the change in funding directly attributable to the U.S. local funding shock in a static network. Global credit rebalancing captures the endogenous reallocation of cross-border funding by non-U.S. banks normalized by the magnitude of the shock effect, and self-rebalancing captures the endogenous reallocation of funding by U.S. banks normalized by the magnitude of the shock effect.

Table 6: Global Interbank Rebalancing

	2010Q4		2016Q2	
Country	(1) Shock Effect (Mil.USD)	(2) Interbank Reb. (%)	(3) Shock Effect (Mil.USD)	(4) Interbank Reb. (%)
Australia	-20,953.0	0.12	-20,953.0	0.02
Brazil	-16,891.6	0.08	-16,891.6	0.00
Canada	-22,948.1	0.14	-22,948.1	0.01
Chile	-2,128.6	0.13	-2,128.6	0.04
Denmark	-8,396.7	0.20	-8,396.7	0.03
Euro-Area	-188,552.3	0.03	-188,552.3	-0.01
Japan	-114,285.4	0.08	-114,285.4	0.01
Mexico	-3,418.6	0.10	-3,418.6	0.00
Sweden	-10,424.0	0.20	-10,424.0	0.03
Turkey	-764.6	0.47	-764.6	0.01
United Kingdom	-82,697.1	0.21	-82,697.1	0.01
United States	-112,689.1	0.14	-112,689.1	0.00

Notes: This table presents the change in cross-border funding in each country's bank sector as a result of a one percent decline in *each country's* local funding in 2010Q4 based on the 2010Q4 and 2016Q2 supply and demand curves. See Table 4 for a description of each column.

Table 7: Global Credit and Self Rebalancing in the Corporate Sector

	2010Q4			2016Q2		
	(1) Shock Effect (Mil.USD)	(2) Credit Reb. (%)	(3) Self Reb. (%)	(4) Shock Effect (Mil.USD)	(5) Credit Reb. (%)	(6) Self Reb. (%)
Australia	-17729.8	0.05	0.26	-15121.0	0.06	0.18
Austria	-4643.2	0.12	0.30	-3372.3	0.12	0.25
Belgium	-5542.9	0.14	0.34	-3999.4	0.14	0.25
Brazil	-16081.1	0.07	0.13	-13865.9	0.02	0.12
Canada	-18613.7	0.05	0.30	-12455.3	0.09	0.23
Chile	-2023.8	0.10	0.17	-1864.1	0.07	0.11
Denmark	-6174.4	0.06	0.38	-4556.4	0.10	0.23
Finland	-2289.1	0.14	0.33	-1700.5	0.10	0.24
France	-30714.5	0.11	0.31	-20196.1	0.10	0.21
Germany	-21664.3	0.11	0.35	-13425.8	0.09	0.27
Italy	-31038.8	0.09	0.14	-22657.8	0.10	0.18
Japan	-84408.3	0.03	0.31	-64180.1	0.04	0.24
Mexico	-3299.7	0.19	0.12	-3030.0	0.14	0.07
Portugal	-3890.9	0.09	0.18	-3072.1	0.09	0.20
Spain	-24646.3	0.08	0.16	-16132.0	0.09	0.21
Sweden	-6317.0	0.07	0.43	-4394.0	0.08	0.26
Turkey	-643.0	0.17	0.52	-381.1	0.25	0.15
U.K.	-42035.7	0.09	0.45	-25038.8	0.14	0.21
U.S.	-89935.6	0.12	0.27	-81206.4	0.15	0.11

Notes: This table presents the change in funding in each country's corporate sector as a result of a one percent decline in *each country's* local funding in 2010Q4 based on the 2010Q4 and 2016Q2 supply and demand curves. See Table 5 for a description of each column.

Appendix
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A Deriving Loan Supply Elasticities

In this section, we derive expressions for elasticities of lending supply with respect to price within each sector, including bilateral elasticities of loan supply for each given lender-borrower country pair and 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 supply elasticity for lending 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 market supply elasticity for lending to sector ℓ of country m is a weighted sum of the supply elasticities of each individual lender country.

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 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 0.7 for the bank sector (λ_1) and 0.7 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 relatively stronger desirability of directly lending to the corporate sector than the bank 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 indicate that both banks and firms demand more loans as interest rates decline. Between the two point estimates, the coefficient on price in the bank sector is larger in magnitude, indicating that bank demand for cross-border interbank funding is more responsive to changes in loan prices. Compared to the corresponding coefficient from the supply curve estimation 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 loan supply.[2] The coefficients on GDP are positive, indicating that loan demand tends to be procyclical across countries.

Additional estimation results. 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 (e.g., Zhang 2021).

C Global Funding Shock

While the main text analysis the case of small local funding shocks, our structural model can also help us analyze the impact of larger global shocks during which many countries could suffer from declines in funding simultaneously. We simulate a regional funding shock and then a Global Financial Crisis (GFC) funding shock using observed declines in local funding during the GFC period. The regional shock is based on funding declines in the United States and United Kingdom, and the GFC shock is based on funding declines in six advanced economies–the United States, the United Kingdom, Japan, Germany, France, and

[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.

Spain. We then quantify the effects of the global funding shock on cross-border lending and total funding in the global financial network.

Panels (a) and (b) of Figure A.12 illustrate the effects of the regional and GFC shock on the total amount of insurance provision for the countries experiencing the respective shocks, as measured by the total change in cross-border interbank funding and total corporate funding, respectively, normalized by the shock effect. The normalization is such that values greater than -100 imply mitigation or reversal of the shock effect (or positive insurance), and values less than -100 imply amplification of the shock effect. Panels (c) and (d) of Figure A.12 illustrate the rebalancing effects that drive the overall effects. Panel (c) shows the share of interbank rebalancing normalized by the shock effect, and Panel (d) shows the share of credit balancing and retrenchment normalized by the shock effect.

We focus first on the results based on the 2010 supply and demand curves. Panel (a) shows that the amount of insurance provision provided to the banking sectors of the shocked countries is notably lower in the case of the GFC shock compared to the regional shock. As illustrated in Panel (c), insurance through interbank rebalancing mitigates the shock effect in response to the regional shock to a much greater extent than in response to the GFC shock. The same pattern is seen in the corporate sectors of the shocked countries. While the global financial network provides positive insurance through credit rebalancing and retrenchment, the amount of insurance provided is smaller in the case of a GFC shock.

Thus, in contrast to the earlier result that the global financial network provides a significant amount of insurance in response to an idiosyncratic shock through a systemic rebalancing of bank loans toward the country hit by the shock, this insurance mechanism gradually breaks down as the magnitude of the funding shock and the number of countries hit directly by the shock increases. When a global funding shock hits multiple countries, global insurance provision through interbank and credit rebalancing significantly declines relative to the size of the direct shock effects.

These results are consistent with a significant decline in cross-border lending and total funding observed during the GFC period. They also echo the argument in some of the literature on networks, such as Acemoglu, Ozdaglar, and Tahbaz-Salehi (2015), that sufficiently large shocks or sufficiently many shocks to different counterparties can lead to fragility in densely connected financial networks. Nevertheless, we arrive at our results using a completely different approach that integrates endogenous interactions among multiple financial networks, whereas the network literature is mostly theory-based and focuses on a static network.

We next compare the amount of insurance provision estimated based on the 2010Q4 supply and demand curves to the those estimates based on the 2016 supply and demand curves. In both the bank and corporate sectors, insurance provision is lower under the 2016 supply and demand curves in response to both the regional and GFC shocks. In particular, the shock effect is significantly amplified for the bank sectors of the shocked countries in the case of the GFC shock, as banks from the non-shocked countries reallocate funds away from them, resulting in negative interbank rebalancing (or negative insurance). Overall, these results reveal that in the event of a global funding shock of the same magnitude as the GFC, there would be less insurance in the global financial network in the post-GFC period

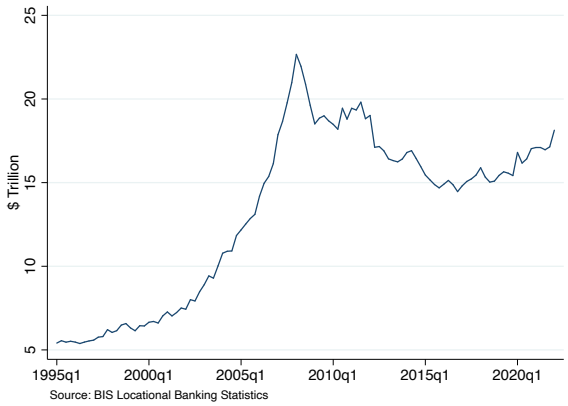
compared to the GFC period.[3]

[3]Appendix Figure A.13 illustrates the effects of the regional and GFC shocks on the total amount of insurance provision for the countries not directly experiencing the respective shocks.

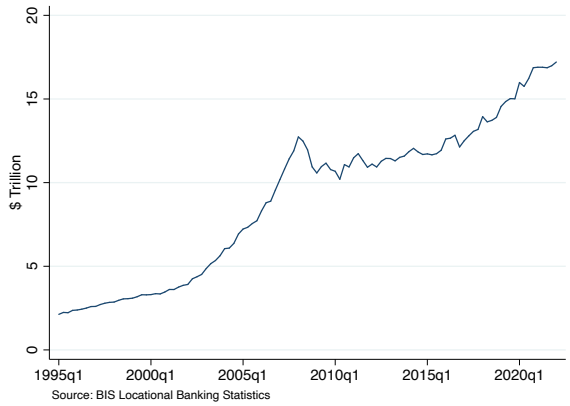
D Additional Figures and Tables

Figure A.1: **Capital Flows in the Global Financial Network**

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

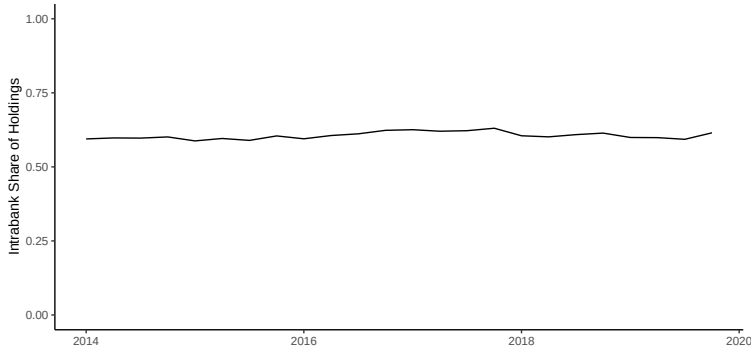


(b) Cross-border Bank-to-Firm Flows



Notes: This plot shows 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.2: **Share of Bank-to-Bank Loans Between Affiliated Banks**



Notes: This figure shows the average share of cross-border bank loans that are between affiliates of the same organizations for the countries in our sample over time. Source: BIS Locational Banking Statistics.

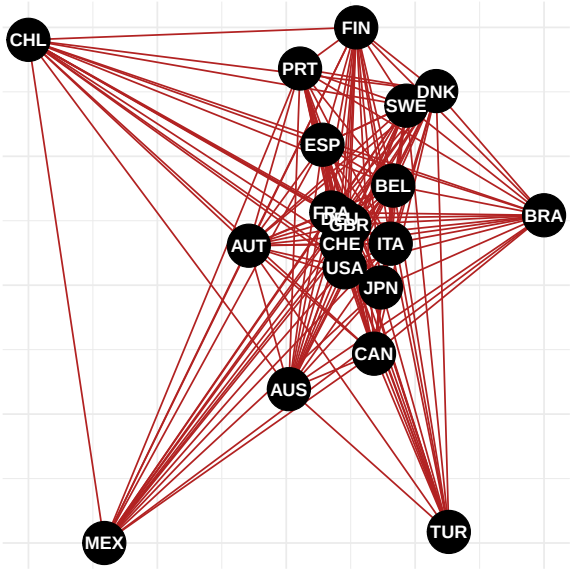
Table A.1: List of Countries

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	

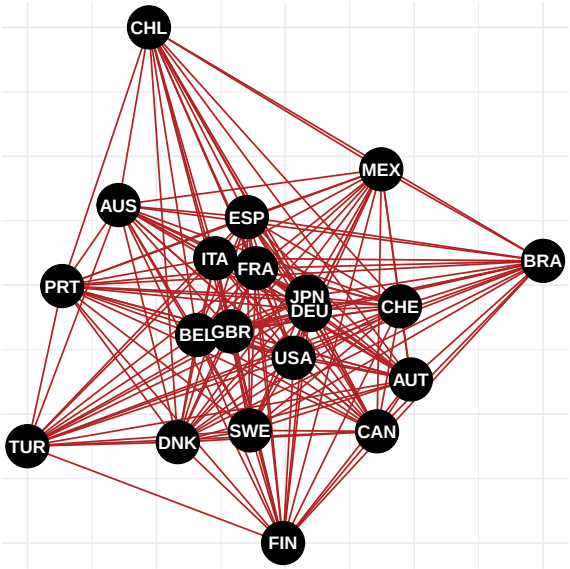
Notes: This table lists the countries in our sample, which is comprised of quarterly data from 2005Q1 to 2019Q4.

Figure A.3: **Global Financial Network**

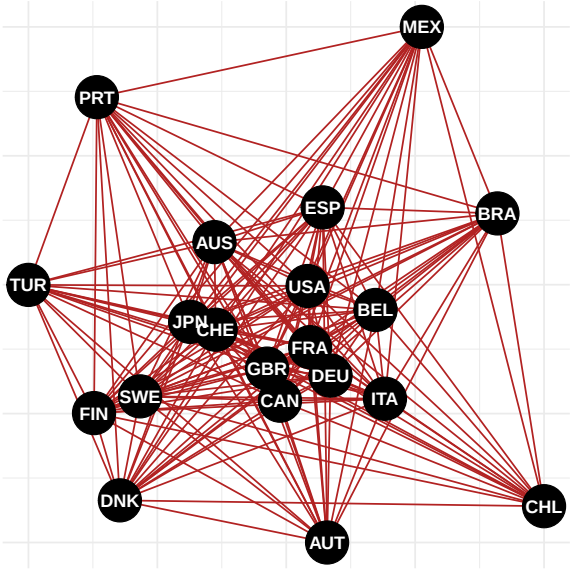
(a) Global Interbank Network, 2005Q1



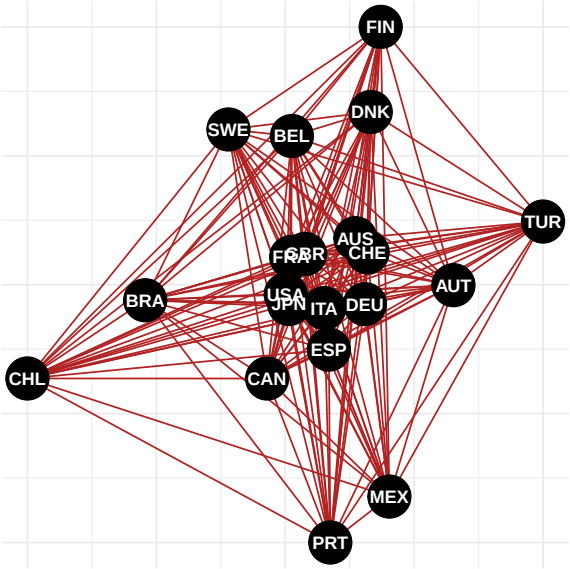
(b) Global Credit Network, 2005Q1



(c) Global Interbank Network, 2019Q4



(d) Global Credit Network, 2019Q4



Notes: This plot shows the global interbank network for 2005Q1 (Panel a) and 2019Q4 (Panel c) and the global credit network for 2005Q1 (Panel b) and 2019Q4 (Panel d) comprised of the 19 countries in our sample. Source: BIS Locational Banking Statistics.

Table A.2: Eigenvector Centrality

Global Interbank Network				Global Credit Network			
Country	2005Q1	Country	2019Q4	Country	2005Q1	Country	2019Q4
United Kingdom	1.000	United Kingdom	1.000	United States	1.000	United States	1.000
Germany	0.706	United States	0.741	United Kingdom	0.946	United Kingdom	0.917
United States	0.567	Germany	0.596	Japan	0.607	Japan	0.620
France	0.562	France	0.578	Germany	0.381	Germany	0.374
Switzerland	0.420	Japan	0.329	France	0.379	France	0.321
Japan	0.326	Italy	0.279	Belgium	0.177	Spain	0.143
Spain	0.213	Spain	0.275	Italy	0.174	Belgium	0.138
Italy	0.212	Switzerland	0.261	Spain	0.108	Italy	0.117
Belgium	0.197	Belgium	0.145	Switzerland	0.070	Canada	0.112
Canada	0.080	Canada	0.114	Canada	0.051	Switzerland	0.072
Austria	0.073	Australia	0.083	Sweden	0.045	Australia	0.071
Sweden	0.063	Austria	0.072	Australia	0.044	Sweden	0.040
Denmark	0.055	Sweden	0.058	Austria	0.033	Austria	0.038
Australia	0.051	Denmark	0.047	Denmark	0.026	Denmark	0.031
Portugal	0.044	Portugal	0.041	Portugal	0.025	Mexico	0.028
Finland	0.019	Finland	0.020	Mexico	0.021	Portugal	0.024
Brazil	0.012	Brazil	0.018	Turkey	0.012	Brazil	0.023
Turkey	0.009	Turkey	0.014	Brazil	0.012	Turkey	0.018
Mexico	0.003	Mexico	0.007	Finland	0.011	Finland	0.011
Chile	0.003	Chile	0.004	Chile	0.006	Chile	0.007

Notes: This table lists the eigenvector centrality of the sample countries in the global financial network in 2005Q1 and 2019Q4.

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	FRB
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 commercial lending rates is the IMF's International Financial Statistics database. In cases of missing observations, 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	-40.27^{**}	-13.80^{**}
	(11.93)	(4.19)
Exchange Rate	0.04	0.08
	(0.04)	(0.06)
Policy Rate Differential	1.54	0.04
	(1.75)	(1.69)
Log GDP (Lagged)	1.42^{***}	1.03^{***}
	(0.10)	(0.09)
Log GDP per capita (Lagged)	0.61	0.22
	(0.31)	(0.23)
Distance	-1.70^{***}	-1.18^{***}
	(0.20)	(0.17)
Trade Exposure	0.05	0.25^{*}
	(0.11)	(0.09)
Volatility	-0.37^{***}	-0.36^{***}
	(0.09)	(0.07)
Regulation (Borrower)	-0.32^{*}	-0.24^{**}
	(0.11)	(0.08)
Indicator: Own Country		4.54^{***}
		(0.46)
Obs.	18,435	18,601

Notes: This table presents the estimation results from equation (8) for the bank (column 1) and corporate (column 2) sectors using the full sample period from 2005Q1 to 2019Q4 using OLS. The coefficients on *Log Price* should be biased upward. All specifications include lender country, time and borrower country MSCI market fixed effects. Standard errors (in parentheses) are clustered by lender and time period. $^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$

Table A.5: Loan Supply Estimation Within Sectors (OLS, Contaminated Regression)

	2010Q4		2016Q2	
	(1) Banks	(2) Firms	(3) Banks	(4) Firms
Log Price	-47.21^{*}	-13.49^{**}	-48.51^{**}	-15.21^{*}
	(18.65)	(3.45)	(16.27)	(6.56)
Exchange Rate	0.11^{*}	0.18^{*}	(16.27)	(6.56)
	(0.05)	(0.06)	0.04	0.07
Policy Rate Differential	4.22	6.76	(0.06)	(0.07)
	(2.81)	(3.64)	2.05	-1.14
Log GDP (Lagged)	1.32^{***}	0.98^{***}	1.62^{***}	1.14^{***}
	(0.09)	(0.10)	(0.13)	(0.09)
Log GDP per capita (Lagged)	0.51	0.38	0.92^{*}	0.28
	(0.32)	(0.24)	(0.35)	(0.26)
Distance	-1.63^{***}	-1.12^{***}	-1.89^{***}	-1.38^{***}
	(0.18)	(0.17)	(0.23)	(0.21)
Trade Exposure	0.05	0.23^{*}	-0.01	0.19
	(0.11)	(0.09)	(0.12)	(0.10)
Volatility	-0.31^{**}	-0.31^{***}	-0.35^{**}	-0.38^{***}
	(0.09)	(0.06)	(0.11)	(0.09)
Regulation (Borrower)	-1.03^{***}	-0.77^{***}	-0.26^{*}	-0.20^{*}
	(0.20)	(0.18)	(0.12)	(0.07)
Indicator: Own Country		4.54^{***}		4.14^{***}
		(0.46)		(0.55)
Obs.	8,993	9,138	9,163	9,237

Notes: This table presents the OLS estimation results from equation (8) for the bank (columns 1 and 3) and corporate (columns 2 and 4) sectors using the 2010Q4 and 2016Q2 subsamples. All specifications include borrower country MSCI market fixed effects. Standard errors (in parentheses) are clustered by lender and time period. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.10$

Table A.6: Loan Supply Estimation Across Sectors

Variable	Symbol	(1) Full Sample	(2) 2010Q4	(3) 2016Q2
Log outside borrower weight:				
Banks	λ_1	0.70	0.73	0.68
		(1.49)	(1.73)	(1.08)
Firms	λ_2	0.68**	0.73**	0.62**
		(0.32)	(0.37)	(0.27)
Sector fixed effects:				
Firms	α_2	0.25	0.05	0.55
		(1.06)	(1.21)	(0.77)
Obs.		1,102	551	551

Notes: This table presents the estimation results from equation (9) using the full sample (column 1) and the 2010Q4 (column 2) and 2016Q2 (column 3) 7-year subsamples. The estimation is based on an instrumental variable approach. Standard errors (in parentheses) are clustered by lender and time period. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.10$

Table A.7: Loan Demand Estimation

	Banks		Firms
	(1) 2010Q4	(2) 2016Q2	(3) Full Sample
Log Price	195.79***	127.88***	23.44*
	(30.62)	(19.78)	(10.03)
Log GDP	0.39	0.44	1.20***
	(0.33)	(0.26)	(0.12)
Obs.	513	513	2,146

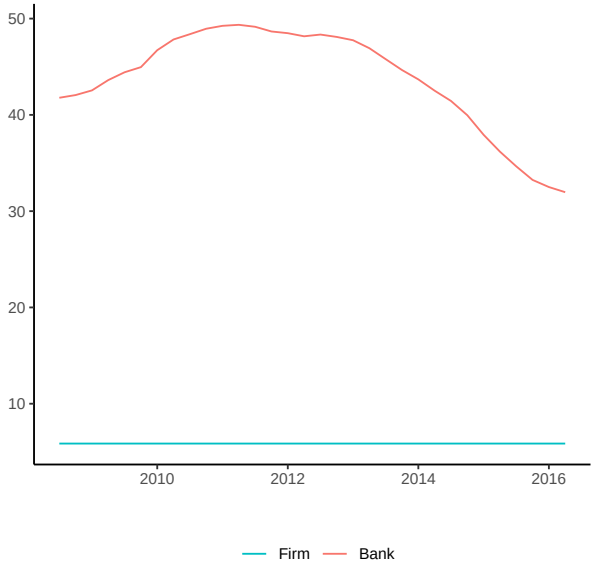
Notes: This table presents the estimation results from equation (10) for the bank (columns 1 and 2) and corporate (column 3) sectors. Loan demand elasticities are estimated in 7-year rolling windows for the bank sector and are estimated using the full sample only for the corporate sector. The estimation is based on an instrumental variable approach and includes time fixed effects. Standard errors are clustered by date. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.10$

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). ΔIRD for each country n is calculated by subtracting the U.S. interbank rate from country n's interbank rate and then taking differences over time. Estimation includes a time fixed effect. Standard errors are clustered by date. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.10$

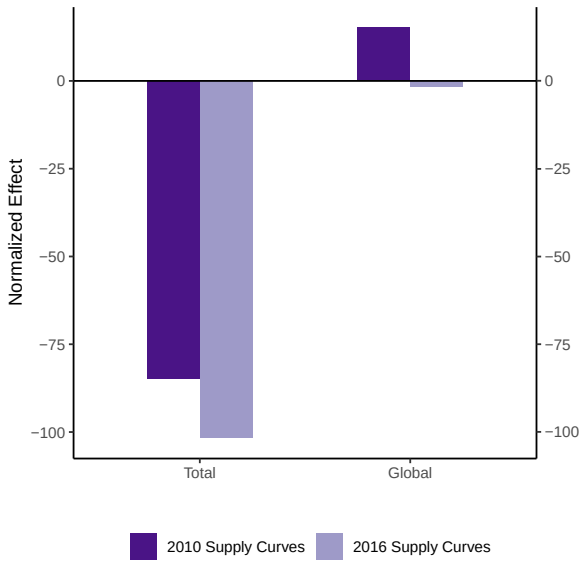
Figure A.4: Demand Elasticity Estimates Over Time



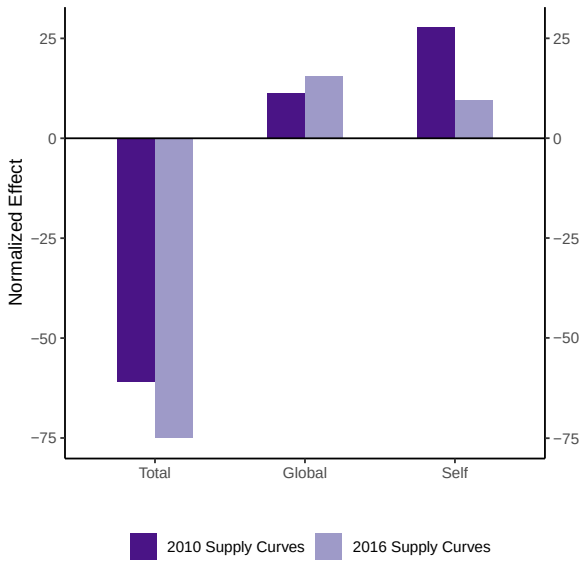
Notes: This figure shows the estimates of loan demand elasticities in the bank and corporate sectors. The demand elasticities are a function of the coefficient on *Log Price* from equation (10). The coefficient on price for the banking sector is annualized by multiplying by 1/4. We estimate a time-invariant demand elasticity for the corporate sector.

Figure A.5: Effects of U.S. Funding Shock Over Time (2010Q4 v 2016Q2)

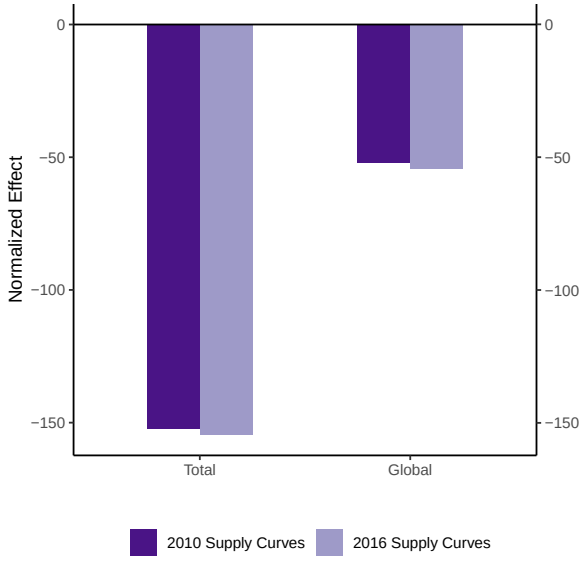
(a) U.S. Interbank Funding



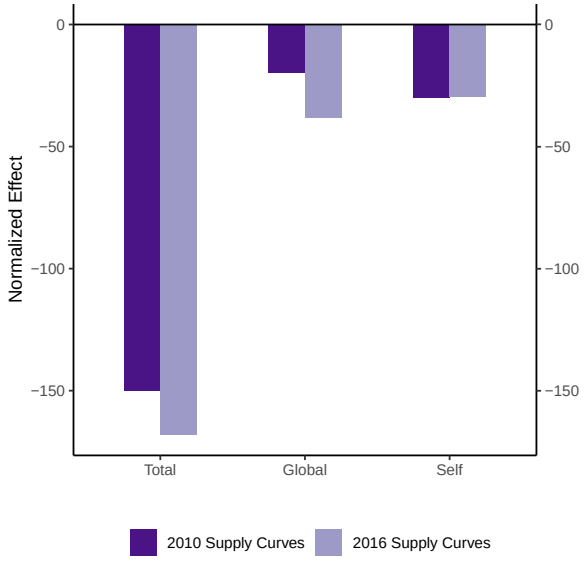
(b) U.S. Corporate Funding



(c) Mexico Interbank Funding



(d) Mexico Corporate Funding

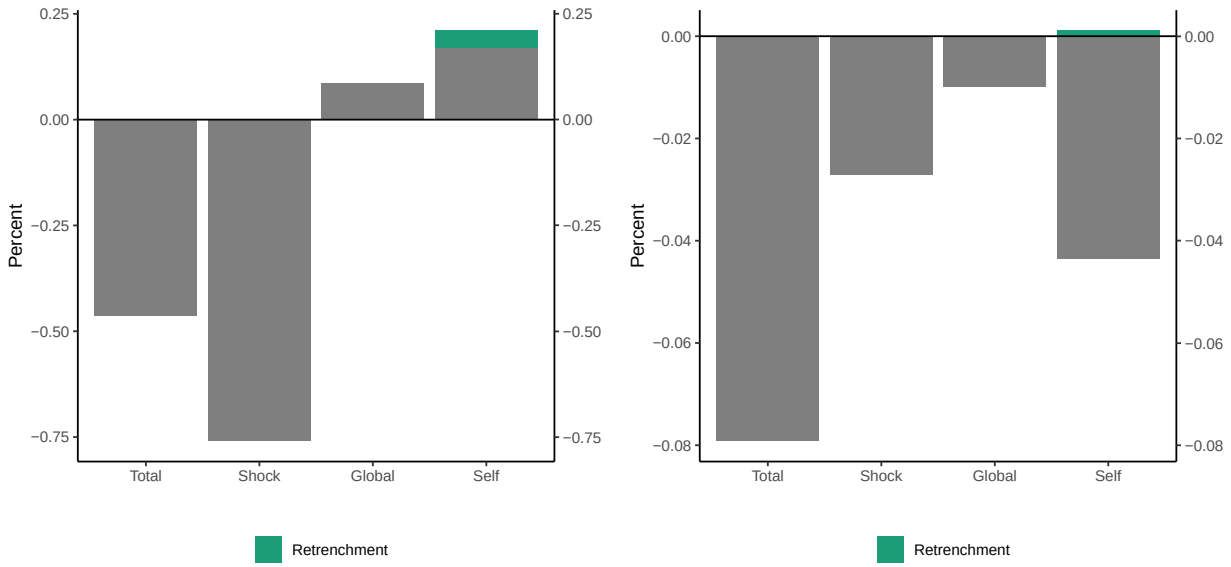


Notes: Panels (a) and (b) of the exhibit compare the effects of the one percent decline in U.S. local funding on cross-border bank funding and total corporate funding, respectively, in the U.S. in 2010Q4 based on the 2010Q4 supply and demand curves (dark purple bars) with those based on 2016Q2 supply and demand curves (light purple bars). We normalize the total, global, and self-rebalancing effects by the shock effect in order to allow for comparison across time periods. We denote supply and demand curves based on the midpoint period of the 7-year subsample (e.g., the 2010Q4 supply curves denote those estimated using the 2007Q1–2014Q2 subsample). Panels (b) and (c) compare the effects of the one percent decline in U.S. local funding on cross-border bank funding and total corporate funding in Mexico in 2010Q4 and 2016Q2.

Figure A.6: Effects of U.S. Funding Shock: Decomposing the Self-Rebalancing Effect

(a) U.S. Corporate Funding (2010Q4)

(b) Turkey Corporate Funding (2010Q4)

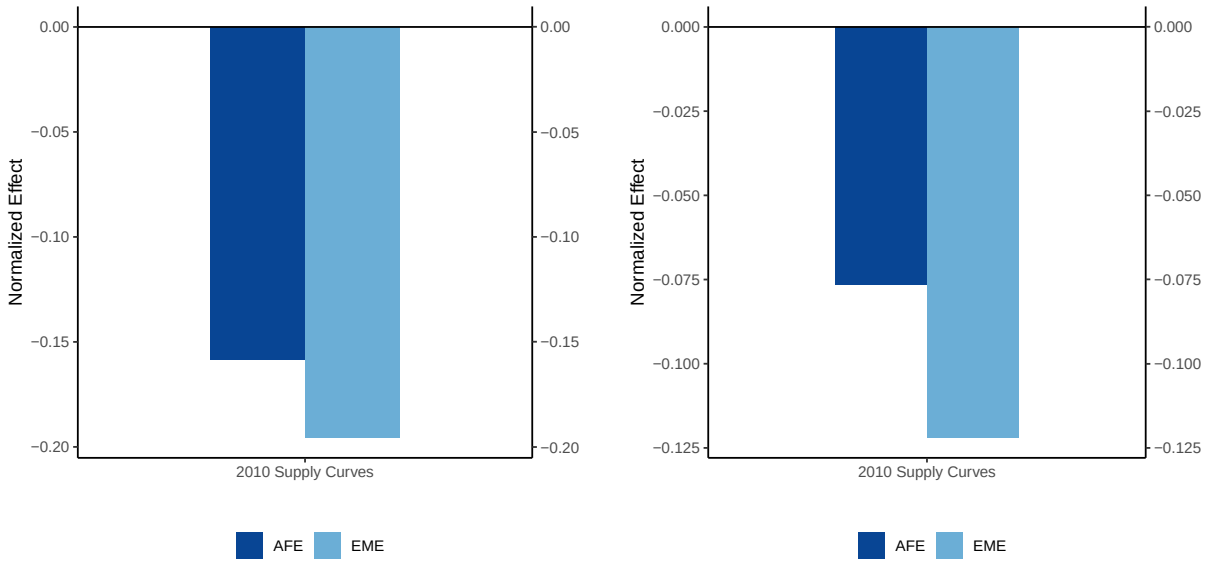


Notes: This exhibit decomposes the change in corporate funding in the United States (Panel a) and Turkey (Panel b) due to the self-rebalancing effect in response a one percent U.S. local funding shock into an "indirect interbank rebalancing" component and a "retrenchment" component. The indirect interbank rebalancing component captures U.S. or Turkish banks' intermediation of foreign funding from global interbank rebalancing. The retrenchment component captures endogenous reallocation of funding by U.S. or Turkish banks.

Figure A.7: U.S. Local Funding Shock: Cross-border Funding Change in the Bank and Corporate Sectors of Advanced Economies v Emerging Markets

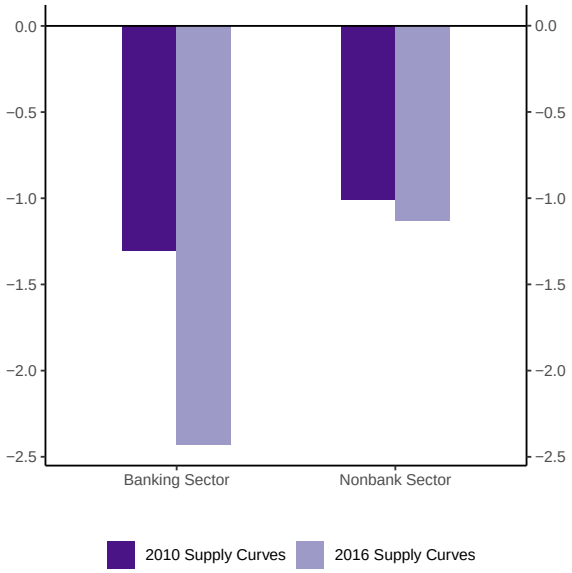
(a) Interbank Funding

(b) Corporate Funding



Notes: This figure shows the change in cross-border funding in the bank and corporate sectors of advanced (non-U.S.) foreign economies (AFE) and emerging market economies (EME) in response to a one percent U.S. local funding shock. The changes in funding are normalized by cross-border funding in each sector prior to the shock. Thus, the bars indicate the extent of funding outflows in response to the shock.

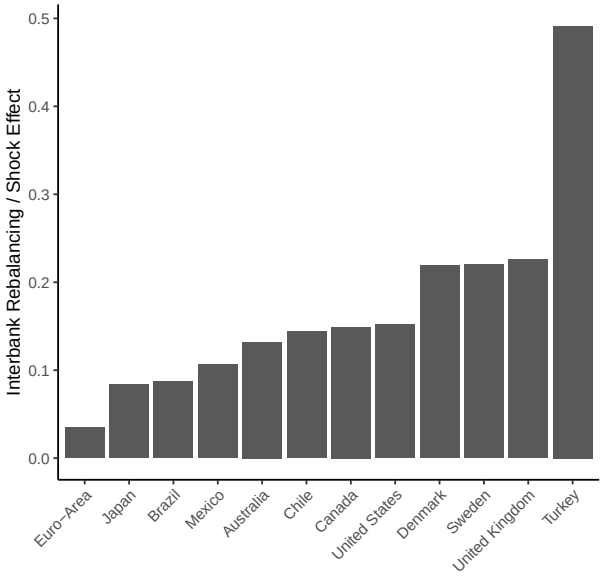
Figure A.8: U.S. Local Funding Shock: Aggregate Funding Change in the Bank and Corporate Sectors



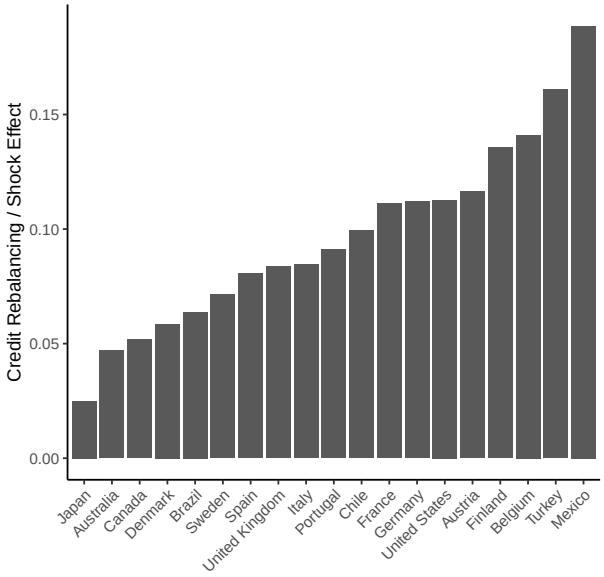
Notes: This figure shows the change in aggregate funding in the bank and corporate sectors in response to a one percent U.S. domestic funding shock. The aggregate changes in funding are normalized by the shock effect in each respective sector. Thus, bars less than -1 indicate that the funding outflows are greater than the shock effect in magnitude, and bars greater than -1 indicate funding inflows at the sector level.

Figure A.9: Heterogeneity in Global Insurance

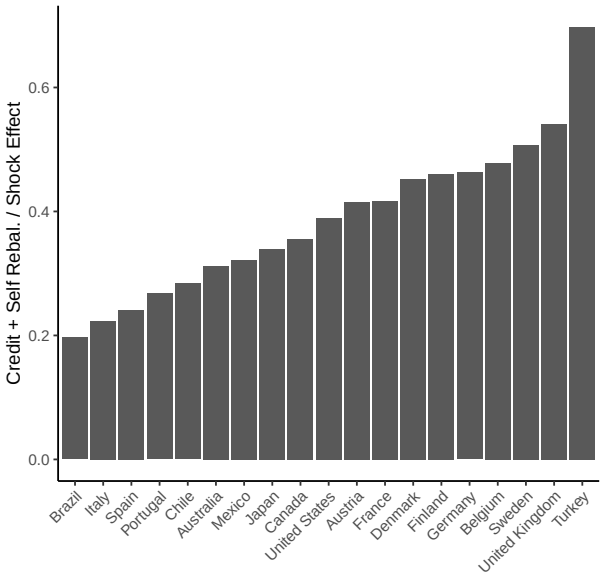
(a) Global Interbank Rebalancing



(b) Global Credit Rebalancing



(c) Global Credit and Self Rebalancing

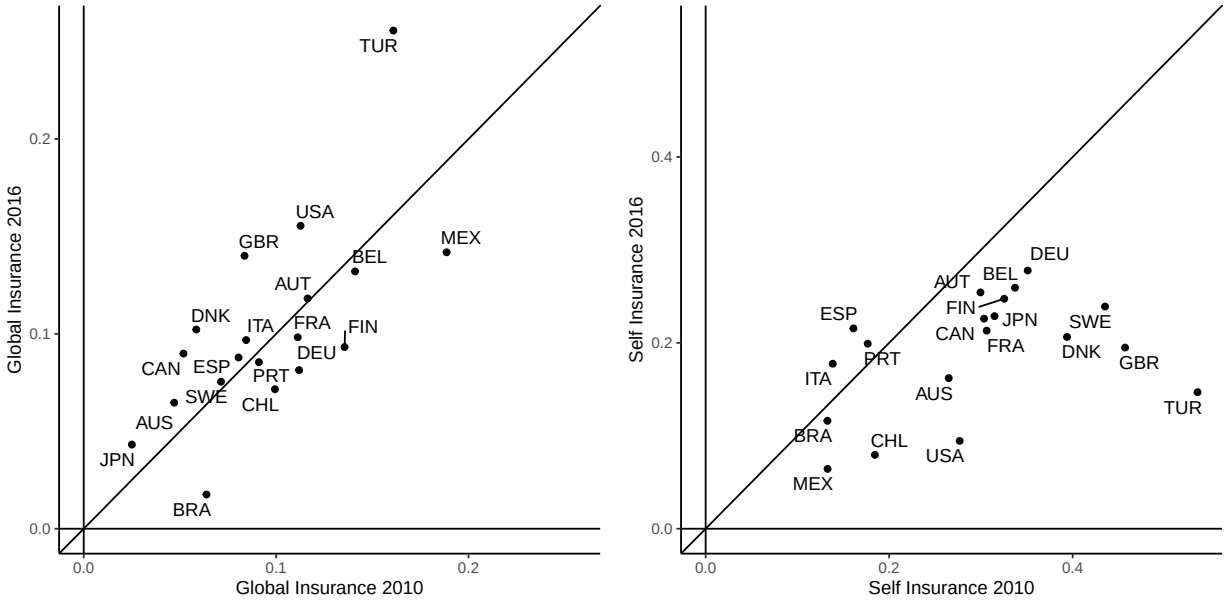


Notes: This exhibit presents the amount of insurance through global interbank rebalancing (Panel a) global credit rebalancing (Panel b) and total (global credit and self) rebalancing (Panel c) across borrower countries in response to a one percent local funding shock. Tables 6 and 7 present the corresponding magnitudes. The estimates are based on the 2010Q4 supply and demand curves.

Figure A.10: Corporate Sector Total Insurance Details: 2010Q4 v 2016Q2

(a) Global Credit Rebalancing

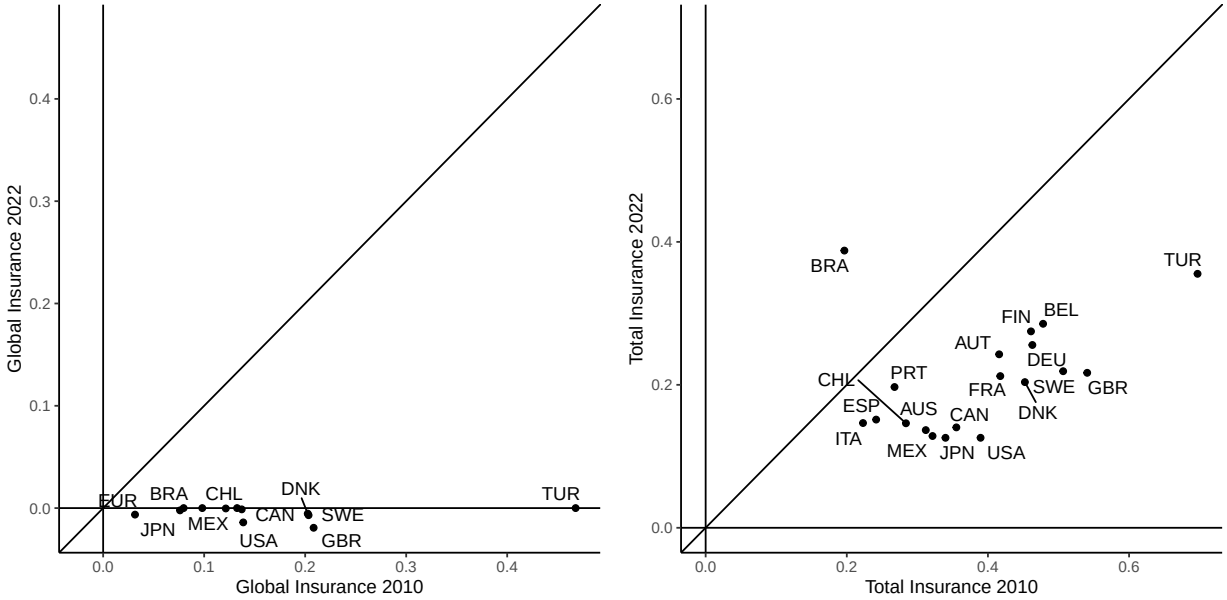
(b) Self Rebalancing



Notes: This exhibit presents the amount of insurance received by each country's corporate sector through global credit rebalancing (Panel a), and self-rebalancing (Panel b) in response to a one percent local funding shock based on the 2010Q4 supply and demand curves (x-axis) and the 2016Q2 supply and demand curves (y-axis). All margins of rebalancing are normalized by the shock effect. See Figure 6 for more detailed descriptions of the different margins of rebalancing. We include a 45-degree line in each panel.

Figure A.11: Global Insurance through Rebalancing: 2010Q4 v Extrapolated 2022Q4

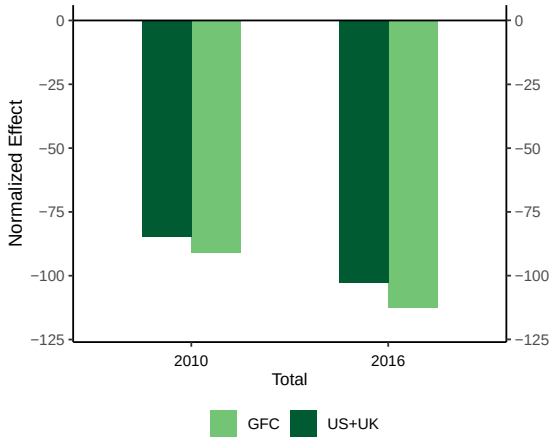
(a) Global Interbank Rebalancing (b) Total (Global and Self) Rebalancing



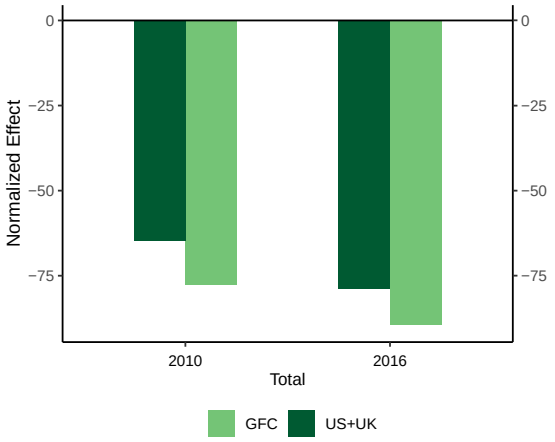
Notes: This exhibit presents the amounts of insurance received by each country's bank and corporate sectors through global interbank rebalancing (Panel a) and total (global credit and self) balancing (Panel b) in response to a one percent local funding shock based on the 2010Q4 supply and demand curves (x-axis) and the extrapolated 2022Q4 supply and demand curves (y-axis). All margins of rebalancing are normalized by the shock effect. See Figure 6 for more detailed descriptions of different margins of rebalancing. Each plot includes a 45-degree line.

Figure A.12: Insurance During the Global Financial Crisis (Shocked Countries)

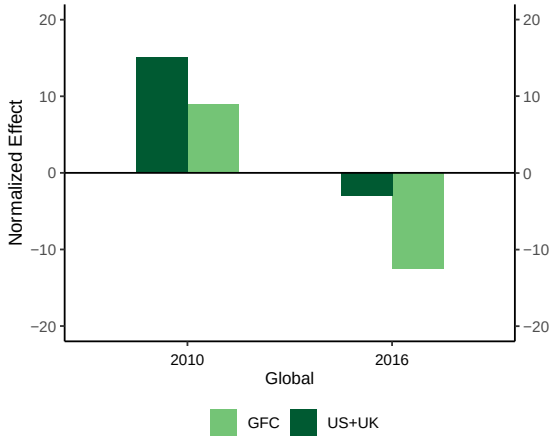
(a) Total Insurance (Bank)



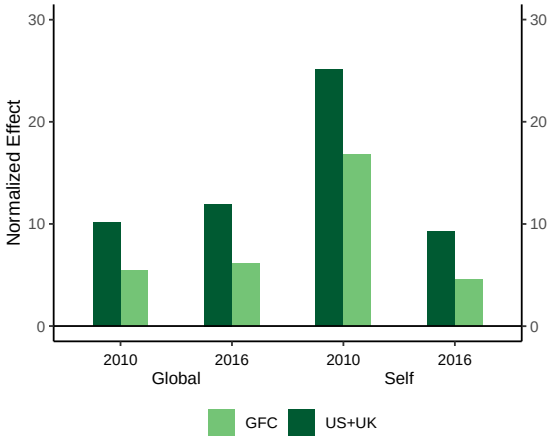
(b) Total Insurance (Firm)



(c) Decomposition (Bank)



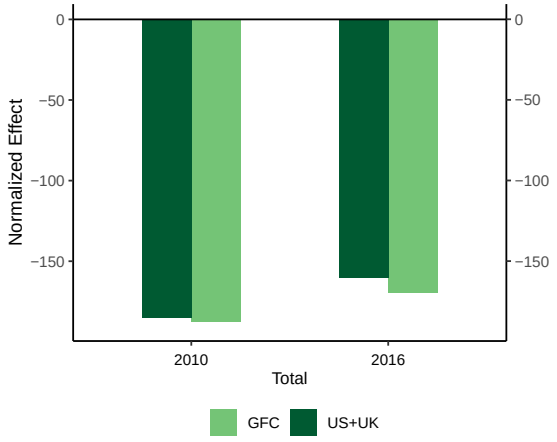
(d) Decomposition (Firm)



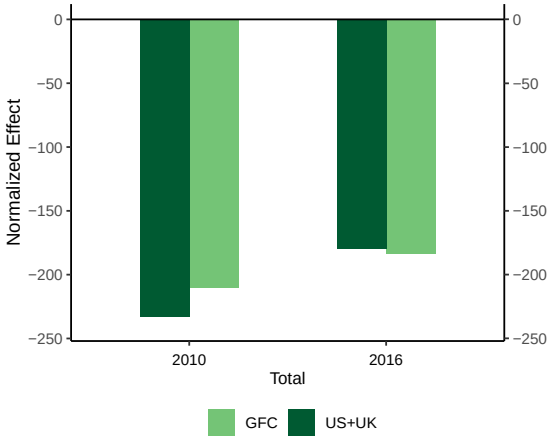
Notes: This exhibit presents insurance provision in response to a regional funding shock and a global funding shock. The regional funding shock is based on the observed decline in funding in the United States and United Kingdom during the Global Financial Crisis period. The global funding shock is based on the observed decline in funding in the United States, the United Kingdom, Japan, Germany, France, and Spain during the Global Financial Crisis period. We show insurance provision for the *shocked countries* based on the 2010Q4 and 2016Q2 supply and demand curves. In each panel, we normalize the total, global interbank rebalancing, global credit rebalancing, and self-rebalancing effects by the shock effect in order to allow for comparison across different supply and demand curves. See Figure 6 for additional details about the different margins of rebalancing.

Figure A.13: Insurance During the Global Financial Crisis (Non-Shocked Countries)

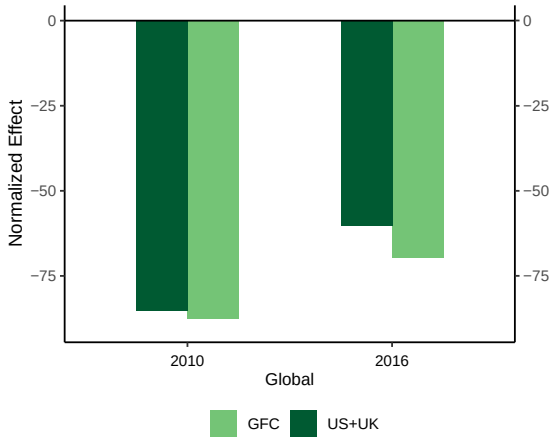
(a) Total Insurance (Bank)



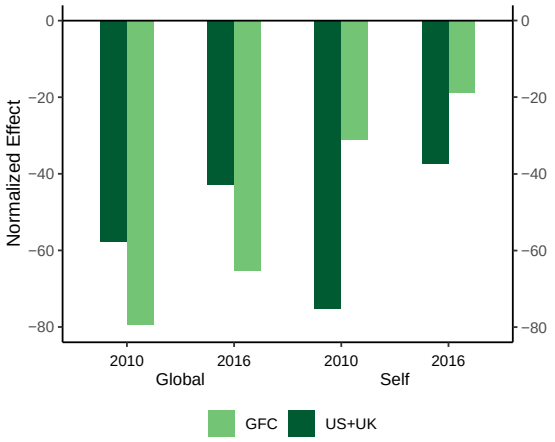
(b) Total Insurance (Firm)



(c) Decomposition (Bank)



(d) Decomposition (Firm)



Notes: This exhibit presents insurance provision in 2008Q2 in response to a regional funding shock and a global funding shock. The regional funding shock is based on the observed decline in funding in the U.S. and U.K. during the Global Financial Crisis period. The global funding shock is based on the observed decline in funding in the United States, the United Kingdom, Japan, Germany, France, and Spain during the Global Financial Crisis period. We show insurance provision for the *non-shocked countries* based on the 2010Q4 and 2016Q2 supply and demand curves. In each figure, we normalize total, global interbank rebalancing, global credit rebalancing, and self-rebalancing effects by the shock effect in order to allow for comparison across different supply and demand curves. See Figure 6 for additional details about each effect.