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Shock Transmission through Cross-Border Bank Lending: Credit and Real Effects*

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Abstract

We study the transmission of financial shocks across borders through international bank connections. Using data on cross-border interbank loans among 6,000 banks during 1997–2012, we estimate the effect of asset-side exposures to banks in countries experiencing systemic banking crises on profitability, credit, and the performance of borrower firms. Crisis exposures reduce bank returns and tighten credit conditions for borrowers, constraining investment and growth. The effects are larger for foreign borrowers, including in countries not experiencing banking crises. Our results document the extent of cross-border crisis transmission, but also highlight the resilience of financial networks to idiosyncratic shocks.

JEL Codes: F34, F36, F6, G01, G21

Keywords: cross-border interbank exposures, banking crises, shock transmission, bank loans, real economy

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1 Introduction

The interconnectedness of global banks played a major role in the 2007–2009 financial crisis. As remarked by Ben Bernanke, former Chairman of the Board of Governors of the Federal Reserve System, interconnectedness "has the potential to magnify shocks to the financial system" (Bernanke, 2013), with significant consequences for the broader economy.[1] The financial crisis prompted many calls for research on the linkages that transmit distress from one bank to another and the "interactions of interbank exposures with the real economy" (Tumpel-Gugerell, 2009). Yet, despite a burgeoning literature on financial stability and systemic risk, little is known about the real effects of interbank connections, especially in an international context. In this paper, we provide new evidence on the international propagation of shocks through asset-side interbank exposures by exploiting detailed data from the cross-border loan market.

Our goal is to analyze how financial shocks in foreign markets are transmitted through the global web of bank connections to affect banks' profitability and lending decisions, as well as the real economy. To this end, we compute asset-side interbank exposures spanning 16 years for more than 6,000 banks that engage in cross-border lending to other banks. To construct these measures, we exploit loan-level data from the market for large corporate loans (to banks, firms, and sovereigns), most of which are syndicated. While syndicated loans have been extensively studied in finance, the interbank segment of this market remains underexplored. In fact, syndicated loans, an important source of funding for corporations and sovereigns (Ivashina and Scharfstein, 2010; Sufi, 2007), account for close to 30% of all cross-border loans to banks. They are also a sizable funding source for banks, with both advanced economy and emerging market banks tapping this market to diversify their funding sources and support balance sheet growth.[2]

Our data come from Dealogic's Loan Analytics database, which comprises more than 170,000 loans extended during 1990–2012 to bank, corporate, and sovereign borrowers in approximately 200 countries. Of these, almost 10% of loans are granted by banks to banks for a total of 6,083 banks. We start by computing exposures for each bank to individual foreign banks. We then combine these exposures with dates of systemic banking crises to calculate exposures to banks in countries that

[1] See also Mitchener and Richardson (2019) for evidence on the amplification of shocks through interbank networks and the impact on business lending during the Great Depression.

[2] Syndicated loans represent a sizable share of cross-border wholesale funding, especially for banks from emerging markets. Interbank loans account for about 10% of global syndicated loan volume, which reached a pre-crisis peak of 4.8 trillion U.S. dollars in 2007. They have an average volume of 175 million U.S. dollars and tenor of 3 years.

are experiencing (or not) a systemic banking crisis. Specifically, we calculate direct (first-order or one step away) and indirect (second-order or two steps away) exposures to banks in countries that are experiencing a crisis ("crisis exposures") as well as exposures to banks in countries that are not experiencing a crisis ("non-crisis exposures").[3] Finally, we combine these data with bank and firm balance sheet information from Bankscope and Worldscope, respectively.

This novel dataset enables us to document, for the first time, the real effects of shock propagation through the network of cross-border interbank exposures—the key contribution of our paper. We document a significant link from banks' crisis exposures to their profitability, lending decisions, and the performance of borrower firms. First, we focus on the impact of crisis exposures on bank profitability, an important outcome variable since low profits can distort financial risk-taking incentives (Demsetz, Saidenberg and Strahan, 1996; Keeley, 1990) and are associated with bank failures, impaired financial intermediation, and sluggish growth (IMF, 2016). Second, we assess the impact of crisis exposures on banks' fundamental function of financial intermediation. The link between financial system conditions and economic activity was formalized in the financial accelerator framework developed by Bernanke, Gertler and Gilchrist (1999), who emphasized that the price of external financing is a function of firms' financial position. Weak firms have to pay a higher "external finance premium" to raise funds than strong firms. The 2007–2009 financial crisis showed that a similar "external finance premium" exists for banks, generating a link between their financial strength and their ability to raise market funding (Bernanke, 2018, 2007). As a consequence, shocks that reduce bank profitability also hinder their ability to raise external funds to lend, with potential adverse effects for financially-constrained firms and the real economy. Third, we ask whether cross-border crisis exposures ultimately impact the real economy by examining the investment and growth of individual firms that borrow from the banks in our sample.

We present three sets of results. First, we show that a larger number of crisis exposures is associated with lower bank profitability, measured by return on assets (ROA), return on equity (ROE), and net interest margins (NIM) during 1997–2012. We use granular fixed effects to compare

[3]The asset-side exposures studied here are closely related to the credit risk associated with lending to foreign banks. While outright bank defaults are rare, it is common for the debt of distressed banks to be restructured, which leads to direct losses for the creditor. Additionally, interbank exposures may reflect risks that go beyond idiosyncratic borrower risk and are associated with lending to foreign markets in general. Our crisis exposure measures are constructed using an indicator of country-level systemic banking crises in a foreign market, capturing system-wide risks rather than individual counterparty risks. Even in the absence of bankruptcies and outright defaults of individual counterparties, a bank's financial strength can be affected adversely by the emergence of bad economic, financial, or political news about the foreign markets to which it is exposed. Because of such news, the bank may experience a loss of business from the affected market and from similar markets, a higher cost of funds, and even a creditor run.

the performance of banks within a given country and year and identify effects that are on top of general declines in bank profitability that might be triggered by crises in foreign countries in that year. We find that an additional direct crisis exposure reduces bank ROA and ROE by 2.9 and about 31 basis points (bps), respectively, in the same year (direct effect). This base effect goes up by approximately one third for an additional indirect crisis exposure through banks in a crisis country (indirect effect). NIMs are lower by nearly 3 bps for each additional direct crisis exposure. These results are obtained while controlling for banks' cross-border exposures to non-banks (firms and sovereigns) and other characteristics, and they are robust to potential endogeneity concerns related to banks' ability to manage their risk exposures and to the presence of real sector linkages.

While the estimated coefficients for the impact of crisis exposures on bank profitability are robust and statistically significant, the economic effect of an individual exposure is modest. This modest effect is not surprising given that syndicated loans to banks represent only a small portion of the average bank's balance sheet and banks tend to diversify idiosyncratic risks (Kashyap, Rajan and Stein, 2002). Thus, our results suggest that the financial network underpinned by cross-border interbank exposures is resilient to isolated episodes of financial instability. That said, banking crises often occur simultaneously in several countries and are clustered in one geographical region.[4] As a result, banks that are active in the cross-border syndicated loan market can experience sizable cumulative effects on their profitability during regional or global financial crises.

Our second set of results relate to bank lending behavior. We examine the effect of cross-border crisis exposures on banks' lending decisions and find that banks with a larger number of crisis exposures grant new corporate loans with smaller volumes and higher spreads. Once again, the marginal effects of individual exposures are modest, but statistically significant and robust. These effects become economically significant for banks with large numbers of exposures during regional or global financial crises. For example, banks with as few as 3 exposures to banks in each of the 7 countries hit by the 1997–1998 Asian financial crisis reduced their shares in loans to non-financial firms in other countries by 150 bps. We also find a statistically significant but modest increase in loan spreads. In addition, the adverse impact of direct crisis exposures on loan volumes and especially spreads is relatively more pronounced for loans to foreign, small, and non-core borrowers. These findings are consistent with studies that highlight heterogeneous effects across firms and show

[4] Laeven and Valencia (2008) show that in the early 1990s on average 10 countries per year were affected by systemic banking crises. During 1997–1998 Asian crisis, 7 countries in the region were in crisis in each of these years. In the midst of the 2007–2009 financial crisis, 23 countries were in crisis during 2008 alone.

that banks tend to protect borrowers that are more important to them.[5]

Finally, our third set of results refer to the impact on the real economy. We measure real outcomes using firm-level investment rate and asset growth. We estimate real effects regressions in a firm-year panel and include firm characteristics as well as country×industry×year fixed effects to control for shifts in demand. We find that crisis exposures on lender balance sheets constrain growth and investment of borrowing firms. In particular, firms that borrow from banks with more direct crisis exposures perform worse than other firms. Consistent with the differential lending effects by firm size, this effect, too, is more pronounced for smaller firms. A back-of-the-envelope calculation suggests that in the absence of lender banks' crisis exposures, the average investment ratio of the borrowing firms in our sample would have been higher by 1.7% during 1997–2012 period and 3.9% during the financial crisis of 2007–2009. The corresponding numbers for firm asset growth are 4.2% and 9.8%, respectively.

Our paper fits into the broad literature on financial contagion (see, e.g., Karolyi (2003) and Claessens and Forbes (2001)). Most closely related to our paper are studies that emphasize the role of banks in transmitting financial sector shocks to the real economy (see, e.g., Amiti and Weinstein (2018), Chodorow-Reich (2014), Iyer, Peydró, da Rocha-Lopes and Schoar (2014), de Haas and van Horen (2013), Cetorelli and Goldberg (2011), Cornett, McNutt, Strahan and Tehranian (2011), Ivashina and Scharfstein (2010), Khwaja and Mian (2008), and Peek and Rosengren (2000)). Some studies examine liability-side shocks stemming from stress in credit markets that hinder banks' ability to secure wholesale funding and grant businesses loans. Other papers analyze negative shocks to the asset side of banks' balance sheets, which is similar to the approach of our study. For example, Ongena, Tumer-Alkan and von Westernhagen (2018) and Puri, Rocholl and Steffen (2011) show that German banks with higher exposure to U.S. subprime assets retrenched lending operations when U.S. real estate prices started to fall, while de Haas and van Horen (2012) find that global banks responded to losses on subprime assets by curtailing foreign lending.[6] We contribute to this literature by studying, to our knowledge for the first time, shocks to global banks' assets that arise from their lending activities *to banks in foreign markets*. In addition, we examine not only the

[5]For example, Berlin and Mester (1999) show that banks protect their relationship borrowers from fluctuations in core funding, while Hale and Santos (2014) document that banks partly protect their relationship borrowers from debt market shocks. de Haas and van Horen (2013) and Giannetti and Laeven (2012) show that banks respond to shocks by cutting down lending to borrowers in distant markets before doing so to borrowers in home markets.

[6]In the context of the European sovereign debt crisis, Popov and van Horen (2015) find that greater exposures to risky sovereigns lead to lower bank credit.

direct effects of such exposures, but also their indirect effects. Our approach thus emphasizes the role of financial interconnectedness in the propagation of financial stress from countries in crisis to the real sector in countries that are ex-ante financially healthy.

Our paper also adds to a related literature on shock transmission *among* financial firms, which emphasizes the effect of exposures to failed firms on creditors' stock market performance. Jorion and Zhang (2009) document "credit contagion," a causal link from announcements of bank bankruptcies to negative equity returns and higher credit default swap spreads for their creditors. Helwege and Zhang (2016) show that distress of a financial firm reduces the market valuations of financial firms with similar characteristics. Both a "counterparty contagion" channel, reflecting direct losses caused by bankruptcy filings, and an "information contagion" channel, reflecting negative externalities from bad news about a particular institution or type of asset, account for these negative valuation effects. Similar to our results, in their paper the counterparty channel is empirically small and there is no evidence of a cascade of failures, because banks hold diversified portfolios, limiting their exposures to individual counterparties. We bring to this literature an analysis of credit risk exposures among financial institutions in a *global* context, covering a large sample of banks in 115 countries. The richer diversity of banks and crises enhances the generality of our results. Although our coefficient estimates imply economically modest effects of individual crisis exposures, consistent with financial networks being resilient to idiosyncratic shocks, we show that the negative externality from contagion goes beyond banks' financial returns and impacts the real economy.

Finally, the real effects of bank lending have been studied in the literature on the transmission of shocks through interbank connections, especially in a domestic context. Cingano, Manaresi and Sette (2016) document that the crunch in the Italian interbank market during the 2007–2009 financial crisis led banks with large exposures to this market to curtail credit, with negative effects on firm investment, especially for younger and smaller firms. Iyer and Peydró (2011) find contagion effects in the Indian interbank market, showing that after the failure of a large bank, banks exposed to it experience large deposit withdrawals, suffer a loss of profitability and cut back loans, propagating the shock to the real sector. The mechanism by which we expect cross-border crisis exposures to impact bank credit and firm activity is a standard bank lending channel of shock transmission as highlighted in these contributions. However, our paper emphasizes the *international* dimension of this channel by considering the global market for cross-border (long-term) interbank loans rather than the domestic overnight interbank market. Although our narrative focuses on

crisis exposures as a negative shock, our setup flexibly allows us to explore the impact of non-crisis exposures as well. For non-crisis exposures we generally find positive but insignificant effects.

2 The Cross-Border Interbank Market

We begin by briefly describing the market for cross-border interbank loans and reviewing some estimates of its size. Interbank lending represents about 10% of total deal number and volume in the global syndicated loan market (see Figure 1).[7] The largest lenders in the last two decades were banks in the U.S., U.K., Japan, France, and Germany. Confidential data from the Bank of International Settlements (BIS) gives us an indication of how large cross-border claims created through this particular market are relative to total cross-border interbank claims. Using BIS data on bilateral cross-border positions reported by internationally-active banks, we estimate these exposures to account for almost 30% of total interbank claims during 1997–2012 (see Figure 2).[8]

To gauge the importance of cross-border interbank exposures on bank balance sheets, in Panel A in Table 1 we list the top 25 lender countries by size of foreign interbank asset exposures relative to total gross loans. In our sample they represent on average 3.2% of total loans during 1997–2012. This average, however, conceals a high degree of variation across countries. For instance, cross-border interbank asset exposures are almost 10% of U.K. banks' loan portfolios. During 1997–2012, the largest borrower countries in the cross-border interbank market were the U.S., U.K., Australia, and France, and among emerging markets, Brazil, India, the Russian Federation, South Korea, and Turkey. In our matched sample, interbank loans represent 5% of total liabilities and 8% of total liabilities less deposits (Panels B-C in Table 1). We can see that these loans are a more significant source of funding for banks from emerging markets than for banks from advanced economies, representing 12.3% of non-deposit liabilities for banks in Turkey and as much as 41.2% for banks in Latvia.

[7] Syndicated loans are extended by financial institutions organized in syndicates and take the form of credit lines and term loans. They are originated by one or more "lead banks" who sell portions of the loan to other lenders. Most loans are issued in U.S. dollars and have floating interest rate based on the LIBOR. Syndicated loans are generally extended to creditworthy borrowers and are held to maturity, but there is an active secondary market for loans extended to leveraged borrowers (see, for instance, Irani and Meisenzahl (2017)). The syndication process allows banks to diversify their portfolios while meeting counterparty exposure limits. Syndicated loan flows are a strong predictor of total loan flows (Gadanecz and von Kleist, 2002).

[8] This estimate is obtained by comparing interbank loan exposures, from which we remove undrawn portions of credit lines following the methodology of Cerutti, Hale and Minoiu (2015), as well as intra-group transfers, with total cross-border loan exposures from the BIS. The remaining exposures are created through single-lender loans.

3 Hypotheses and Empirical Approach

3.1 Hypothesis Construction

Baseline Analysis. We with to examine the effects of loan exposures to foreign banks on bank profitability, lending decisions, and the real economy. We focus on two types of direct exposures to foreign banks, crisis and non-crisis exposures, labeled C and NC, respectively. Crisis exposures refer to claims on banks in countries experiencing a banking crisis, and non-crisis exposures are claims on banks in countries not experiencing a crisis. There are four types of indirect second-degree exposures: CC, CNC, NCC, and $NCNC$. For example, NCC represents a second-degree crisis exposure through a first-degree non-crisis exposure. Figure 3 provides a visualization of all direct and indirect interbank exposures.

We expect negative balance sheet shocks that occur due to cross-border crisis exposures to have a negative impact on bank earnings, reducing net income and returns. This effect may occur directly through valuation effects and write-downs on non-performing exposures, or indirectly, through a loss of other business. We review each potential mechanism in detail below.

Valuation effects and write-downs on non-performing loans (NPLs) are two direct ways by which a bank's returns would be affected negatively by crisis exposures. The syndicated loan market notably exhibits lower default rates and higher loan recovery rates than other credit markets.[9] Financial borrowers in particular have low default probabilities partially because they can benefit from a public backstop aimed at reducing the risk of contagion from financial shocks. Although bank defaults are rare, they do occur, as illustrated in Figure 4 which plots the number of banks rated by Moody's that experienced defaults on at least one debt instrument during 1997–2012.[10] In addition to defaults, borrower distress in the syndicated loan market typically leads to renegotiations that result in an amendment to the terms of the loan such as a principal write-down, a lower interest rate, a grace period, or a lengthening of maturity (Standard and Poor's, 2011). All of these loan restructuring options effectively reduce the cash outlays of the borrower and the present value of the loan for the lender, resulting in lower profit margins. A bank may also experience valuation

[9]For example, in the aftermath the 2007–2009 financial crisis, loan default rates were only 2% during 2011-2012. During the past decades, the default rate for firms rated AAA was 0.38% and that for firms rated B was 21.76% (1981-2010). Loan recovery rates were 71% for syndicated loans compared to 43.5% for unsecured loans (1989-2009) (Standard and Poor's, 2011).

[10]Conditional on a banking crisis, the probability of observing at least one bank default in the countries where at least one bank is rated by Moody's is 84%.

losses on its securities due to crisis exposures. This would occur if banks placed their syndicated credits in the trading book and marked them to market using secondary market prices. This is more likely to happen for high-yield leveraged loans for which there is an active secondary market. To the extent that these loans are designated as "held for trading," marked-to-market losses and gains would directly affect bank net income and profitability.

Lending banks' profit margins may also be squeezed because of "information contagion," a mechanism through which crisis exposures may lead to a loss of business and higher funding costs for the bank. The literature highlights the negative effects of corporate borrower distress on creditors' market valuation. Dahiya, Saunders and Srinivasan (2003) show that borrower default or bankruptcy announcements lead to negative abnormal stock market returns for the borrower's main lender. Furthermore, large-scale corporate bankruptcies can affect lender banks' reputation and their ability to syndicate loans in the long run. Gopalan, Nanda and Yerramilli (2011) find that lead banks that experience borrower bankruptcies are less likely to subsequently syndicate loans and to attract participant lenders. These results are suggestive of an indirect effect of non-performing exposures on lenders through a loss of business, which in turn may put pressure on their profit margins.

Given potential direct losses on crisis exposures and indirect information-related losses discussed above, we expect crisis exposures to affect bank performance negatively. Although the directionality of the effects of crisis exposures is rather intuitive, we do not have any priors on economic magnitudes. Small idiosyncratic shocks to the financial network underpinned by cross-border interbank exposures may be absorbed with only small effects on other banks. By contrast, large shocks may lead to economically sizable effects. Such effects would be consistent with the theoretical model proposed by Acemoglu, Ozdaglar and Tahbaz-Salehi (2015), which shows that when the size of a shock to banks in a financial system is below a certain threshold, then a densely-connected network is able to absorb the shock; however, if the shock exceeds the threshold, then "dense interconnections serve as a mechanism for the propagation of shocks."

If losses erode capital and raise the bank's cost of funds sufficiently, we also expect crisis exposures to negatively impact the bank's lending decisions. Finally, bank lending shocks should affect the real investment and growth performance of firms that borrow from affected banks, to the extent that those firms are bank-dependent and cannot perfectly substitute to alternative financing sources.

We are also interested in examining the impact of higher-degree ("network") exposures on bank and firm outcomes. In financial systems modeled as networks, shocks to a particular financial

firm affect not only directly-linked firms, but also indirectly linked firms, through higher-order exposures. In other words, negative shocks can have "cascading" effects through the chain of lending relationships (Allen and Gale, 2000). Therefore, in addition to a bank's direct exposures, there may be spillovers and externalities from downstream financial stress. Our specifications will allow for this possibility by including all exposure terms that capture direct and indirect exposures as shown in Figure 3. As for direct and indirect *non-crisis* exposures, we are largely agnostic about their effects. These effects could be positive, but small, given that the syndicated lending business is highly competitive and has small profit margins (Gadanecz, 2004; Allen, 1990).

Heterogeneous Effects. We examine differential effects of crisis exposures on bank credit to financial firms compared to non-financial firms, a common distinction in the literature. This distinction hinges on the observation that the relationship between a lender and its financial borrowers is potentially a two-way relationship, whereas that between the lender and a non-financial borrower is one-way. For example, Cocco, Gomes and Martins (2009) show that banks provide insurance to one another on the basis of relationships formed in the interbank lending market. During crises, banks tend to continue lending to their financial counterparties, an effect referred to as "flight to friends" (Hale, 2012; Degryse, Karas and Schoors, 2019). In addition, financial sector borrowers are more likely to benefit from implicit government guarantees (Ahmed, Anderson and Zarutskie, 2015) and therefore less likely to default even during times of stress. Corbae and Gofman (2019) argue that banks participate in the interbank market not only for liquidity management purposes, but also to collude and reduce competition with their financial counterparties in the market for corporate loans. They also provide empirical evidence supporting the collusion motive for the formation of interbank relationships in the syndicated loan market we analyze here. These arguments suggest that interbank relationships are valuable for banks and banks experiencing negative financial shocks may protect their financial borrowers to a greater extent than their non-financial borrowers.

We also explore heterogeneous effects of crisis exposures on bank credit and the performance of non-financial firms, allowing for differential effects by firm location (domestic/foreign), size, and relationship intensity with the bank. Numerous studies have analyzed this type of heterogeneity in bank lending behavior. For example, Giannetti and Laeven (2012) and de Haas and van Horen (2013) document the "flight-home" tendency of global banks facing balance sheet shocks, in that they first cut credit to distant foreign markets before doing so in domestic markets. These authors show that banks find it easier to overcome borrower-related information asymmetries in countries

that are close to their home market and in countries where they have established long-term lending relationships. A similar heterogeneity channel applies for large firms compared to small firms. Informational asymmetries are likely to be less severe with large firms as they have stricter disclosure requirements and therefore are less opaque (Diamond and Verrecchia, 1991). Large firms also tend to have long-standing relationships with their banks, including through repeated loans, deposit-taking and cash management, working capital and trade credit lines, as well as underwriting services (Ongena and Smith, 2001).

Recent studies further document the protective role of relationship lending using more direct measures of bank-firm relations. Sette and Gobbi (2015) find greater volumes and lower prices during the 2007–2009 financial crisis for new loans originated by Italian banks to their closer borrowers (measured by physical distance, banking relationship length and the bank's existing credit exposure), with positive real effects for those borrowers (see also Banerjee, Gambacorta and Sette (2017)). In addition, the positive effects of relationship lending on credit standards are stronger during crises than during tranquil periods. Bolton, Freixas, Gambacorta and Mistrulli (2016) confirm the informational advantage of relationship banking with empirical evidence and a theoretical model that predicts favorable continuation-lending terms for banks in response to a crisis.

Borrowing firms also vary in their ability to absorb the effects of credit supply shocks. It is well known that smaller firms tend to be more bank-dependent and to have less diversified sources of external financing, which makes them more sensitive to financial intermediary health and credit conditions (Cingano, Manaresi and Sette, 2016; Ongena, Peydró, Van Horen and Bank, 2015; Iyer, Peydró, da Rocha-Lopes and Schoar, 2014; Gertler and Gilchrist, 1994). Based on these arguments, we expect stronger real effects for smaller firms.

3.2 Empirical Set-up

We test our hypotheses in four separate datasets.

Bank Profitability. We estimate the effects of cross-border interbank exposures on bank profitability in a *bank-year* panel. Let Cr_{jt} be a dummy variable that takes value 1 if there is a crisis in the country of bank j in year t and NCr_{jt} a dummy variable that takes value 1 if there is no crisis. Define bank i's total direct crisis exposures as $C_{it} = \sum_j E_{ijt} Cr_{jt}$ and non-crisis exposures

as $NC_{it} = \sum_j E_{ijt} NCr_{jt}$, where E_{ij} is a dummy variable taking value 1 for the presence of an exposure of bank i to bank j. We estimate the following equation:[11]

$$Y_{it} = \alpha_{ht} + X_{it}\beta_0 + \lambda_1 C_{it} + \mu_1 NC_{it} + \varepsilon_{it} \tag{1}$$

where Y_{it} is a measure of profitability, α_{ht} is a set of bank country×year fixed effects, X_{it} denotes a (1×K) matrix of bank i's K characteristics in year t, and C_{it} and NC_{it} are the total number of crisis and non-crisis exposures of bank i in year t. The matrix of bank characteristics X_{it} includes capital adequacy, balance sheet size (log-total assets), indicator variables for bank type and business model, and exposures to firms and sovereigns (collectively referred to as "non-banks"). These regressions include bank country×year fixed effects to account for time-varying country-level unobservables which may affect banking industry profits, such as changes in the macroeconomic environment, e.g., banking crises, monetary conditions, financial regulation, and crisis management policies. Given the long time-span of our dataset, comparing banks within the same country and year also allows us to rule out differences in accounting standards across countries and over time.[12]

Our coefficient of interest, representing the impact of direct crisis connections on bank profitability, is λ_1. Given that crisis exposures are expected to have a negative impact on bank returns and profit margins, our hypothesis is $\lambda_1 < 0$. We are agnostic about μ_1.

Next, we allow for the possibility of spillover effects from second-degree exposures. In light of the crisis transmission paths discussed in the previous section, the effect of indirect exposures to a crisis country may depend on the crisis state of the intermediate bank, which is one step away from the origin of the shock. Therefore, we separate indirect exposures into four possible paths as shown in Figure 3. Let CC_{it} be the number of indirect (second-degree) crisis exposures of bank i in year t that are reached through its direct (first-degree) crisis exposures. Let NCC_{it} be the number of indirect (second-degree) crisis exposures of bank i in year t that are reached through its direct (first-degree) non-crisis exposures (captured by NC_{it}). We also define CNC_{it} and $NCNC_{it}$ similarly. With this notation for indirect crisis exposures, we then estimate the following equation:

$$\begin{aligned} Y_{it} = {} & \alpha_{ht} + X_{it}\beta_0 + \lambda_1 C_{it} + \mu_1 NC_{it} \\ & + \lambda_2 CC_{it} + \lambda_3 NCC_{it} + \mu_2 CNC_{it} + \mu_3 NCNC_{it} + \varepsilon_{it} \end{aligned} \tag{2}$$

[11] See Appendix A-I for details on a shock transmission mechanism that produces this specification.

[12] For instance, several countries adopted International Financial Reporting Standards (IFRS) during the 2000s.

Here, in addition to direct effects, we are interested in the effects of indirect CC and CNC exposures (λ_2 and μ_2). Depending on their nature, second-order, downstream connections could amplify or mitigate the effect of first-order exposures. For instance, a direct crisis connection could be further weakened by direct links to other crisis banks, resulting in an amplifying effect on a CC path ($\lambda_2 < 0$). The reverse may happen if a crisis connection has direct links to non-crisis banks, resulting in a dampening effect on a CNC path ($\mu_2 > 0$). However, as discussed before, the effects of direct and indirect non-crisis exposures are likely to be positive, but small. In our regressions, the coefficients λ_3 and μ_3 turn out to be statistically insignificant, therefore in subsequent equations we will sum these indirect exposures into one term ($NCC_{it} + NCNC_{it}$).

Bank Loan Volumes and Prices. To study the effects of crisis exposures on the quantity and price of loans supplied by banks, we construct two additional datasets. Quantity effects are examined in a *loan share-bank-firm-year* dataset and pricing effects are tested in a *bank-firm-year* dataset. We use a specification similar to Equation 2, but add the individual borrower dimension to our dataset. The specification is given by:

$$\begin{aligned} L_{zimt} = \alpha_i + \alpha_{ht} + \alpha_{ct} + X_{it}\beta_0 + Z_z\beta_1 + \lambda_1 C_{it} + \mu_1 NC_{it} \\ + \lambda_2 CC_{it} + \mu_2 CNC_{it} + \lambda_4 (NCC_{it} + NCNC_{it}) + \varepsilon_{zimt}, \end{aligned} \tag{3}$$

where L_{zimt} denotes the individual share of bank i in loan deal z extended to firm m in year t. The specification includes a comprehensive set of fixed effects: α_i are bank fixed effects and α_{ht} are bank country×year fixed effects which absorb unobserved time-varying macroeconomic conditions in the bank's home country. In addition to the usual bank characteristics X_{it}, we control for several loan-level characteristics Z_z (credit line dummy, loan currency dummies, and the number of syndicate members in the loan deal). We also include a dummy variable for lead banks to account for the fact that they systematically contribute larger loan amounts than simple syndicate participants (Mora, 2015).

Furthermore, we include firm cluster×year fixed effects (α_{ct}) to control for unobserved time-varying loan demand at a granular level, following Khwaja and Mian (2008) and subsequent studies (e.g., Acharya, Eisert, Eufinger and Hirsch (2018), Auer and Ongena (2016) and de Haas and van Horen (2013)). We define clusters as groups of firm within the same country, risk category, and industry.[13] There are two risk categories: investment grade vs. speculative grade borrower. The

[13] We use the 1- or 2-digit Standard Industrial Classification (SIC) in the baseline regressions, and the 3- or 4-digit

firm cluster×year fixed effects allow firms in the same risk category, industry, and same country to receive a common demand shock each year.[14]

For loan spreads we specify a similar regression—in a *bank-firm-year* panel—with the sole difference that the dependent variable is the log-transformed weighted average loan spread across the loans extended by a given bank to a given firm in a given year. The weights reflect the relative size of each loan. We include the same set of fixed effects in these specifications as in the above loan-share regressions, with a view to controlling for bank-level heterogeneity, macroeconomic developments in the banks' home countries, and time-varying loan demand.[15]

Real Effects. We study firm performance in a fourth dataset—a *firm-year* panel. We denote firm performance as F_{mt} for firm m in year t, captured by the investment ratio (capital expenditure divided by lagged assets) and real asset growth. We estimate specifications similar to Equation 3, but we control for weighted average crisis and non-crisis exposures of all the banks i that lend to firm m in year t:

$$\begin{aligned} F_{mt} = \alpha_{lkt} + W_{mt}\beta_0 + \lambda_1 \sum_{i\in\Theta_t} s_{imt} C_{it} + \mu_1 \sum_{i\in\Theta_t} s_{imt} NC_{it} \\ + \lambda_2 \sum_{i\in\Theta_t} s_{imt} CC_{it} + \mu_2 \sum_{i\in\Theta_t} s_{imt} CNC_{it} + \lambda_4 \sum_{i\in\Theta_t} s_{imt}(NCC_{it} + NCNC_{it}) + \varepsilon_{mt} \end{aligned} \tag{4}$$

where α_{lkt} is a set of firm country×industry×year fixed effects, W_{mt} is a matrix of time-varying firm characteristics, Θ_t is the set of banks that lend to firm m in year t, and s_{imt} is the share of bank i in total loan volume granted by all banks in Θ_t to firm m. The regressors of interest are time-varying direct and indirect crisis exposures at the firm level. Here, too, we expect $\lambda_1 < 0$ and $\lambda_2 < 0$. The real effects regressions are estimated with firm country×industry×year fixed effects to

SIC classification in robustness checks.

[14]Ideally we would like to include even more granular firm ×year fixed effects to control for demand at the firm (instead of firm cluster) level, but we are constrained in doing so by two characteristics of the data that are carefully discussed in Acharya, Eisert, Eufinger and Hirsch (2018). First, the data refer to loan originations, and loans are not tracked over time (so a firm is observed repeatedly if it receives multiple loans in the same year); and second, syndicated loan have relatively long maturity. These factors reduce the likelihood of repeated occurrence of a given firm in a given year, so there is insufficient variation in the data for firm×year fixed effects. Our strategy of defining clusters based on firms' country, industry, and risk profiles closely follows Acharya, Eisert, Eufinger and Hirsch (2018) who define clusters based on firm country, industry, and S&P credit rating.

[15]Notice that the loan-share regressions, similar to Duchin and Sosyura (2014), have an identification advantage over the loan pricing regressions, namely, that the dependent variable is specified as a loan share (instead of a loan amount). In this approach, the dependent variable is arguably unaffected by shocks to a given firm's demand for loans. As the estimation exploits variation in loan shares across multiple lenders within the same syndicated loan, specifying the dependent variable as a loan share is akin to introducing loan fixed effects. Any differences in loan shares within the same loan deal can thus be attributed to differences in bank balance sheet characteristics (in our case, cross-border interbank exposures).

control for potential demand shifts within narrowly-defined clusters of firms, assuming all firms in a given country l, industry k, and year t, face the same demand shocks.[16]

All results are based on the Ordinary Least Squares (OLS) estimator. The standard errors are heteroskedasticity-robust and clustered at the bank level in the profitability and lending regressions, and at the firm level in the real effects regressions.

3.3 Threats to Identification

In this section we discuss potential sources of endogeneity and how we try to address them.

Omitted Variables. In specifications 1-3 we interpret the coefficients of interest as capturing the effect of cross-border interbank exposures on bank outcomes. Yet, a bank's performance may be affected not only through the financial channel of interbank lending, but also through its exposures to non-bank borrowers such as non-financial firms and sovereigns, as well as through the bank's exposure to other asset classes, such as securities holdings or derivatives. A bank's performance may also be affected through real channels if, for instance, there are significant commercial ties between the bank's home country and the counterparty country, or if the bank has significant presence in a counterparty country through branches and subsidiaries. Real sector and other exposures could generate a bias in our estimates insofar as they are correlated with our cross-border interbank exposures.

In the baseline specifications we address this potential issue by controlling for bank-level measures of cross-border exposure to non-financial firms and sovereigns computed from syndicated loan data. (These exposures to non-banks are computed in the same way as exposures to banks.) But even with these proxies, we cannot entirely rule out alternative explanations such as shock transmission through cross-border real linkages or the geographical footprint of banks, both of which may be correlated with cross-border interbank exposures. To further rule out these potentially confounding factors, in Section 6.1 we examine the sensitivity of our results to explicitly controlling for real linkages at the country-pair or bank level, including bilateral trade and bank presence in foreign markets.

In addition, the baseline analysis ignores the potential role of crisis exposures on the liability side—that is, borrower exposures to *creditors* in stress. While it is possible that such exposures

[16] As in the baseline lending regressions, industry is based on 1- or 2-digit SIC industry code, and we show they are robust to using the 3- or 4-digit industry SIC classifications.

translate into funding problems for borrower banks, especially when their debt rollover needs coincide with creditor stress, the impact of a crisis in a counterparty country for the bank borrowing from that country is arguably less direct (for instance, the bank may be able to substitute to other creditors). This mechanism would diminish the impact of individual crisis exposures on the liability side. That said, liability-side exposures may still be informative for bank performance and behavior, and may be correlated with asset-side exposures. In Section 6.1 we report additional analyses examining the role of liability-side interbank exposures to crisis and non-crisis countries, both in isolation and together with asset-side exposures.

Endogenous Network and Measurement Error. We address the possibility that banks recognize that being interconnected carries certain risks and try to form links in ways that mitigate these risks. The result would be an endogenous network in which the banks position themselves in a way that helps reduce the impact of shocks, for example by reducing their exposures in anticipation of foreign market turmoil. (We explore this possibility in Section 5.1.2.) It is also possible that banks hedge some of the credit risk in their interbank exposures; for instance, by buying credit default swaps. Note that both endogenous link formation and portfolio management tools would likely reduce the impact of observed crisis exposures on bank outcomes and associated real effects, attenuating our estimates of the impact of crisis exposures.

4 Data

The empirical analysis uses the following key ingredients: bank-level estimates of cross-border (asset-side) interbank exposures, bank and firm balance sheet data, data on origination of corporate loans, and financial crisis dates. We link loan-, bank- and firm-level datasets in order to analyze the lending behavior of banks with differential exposures to the cross-border interbank market and the real outcomes of their borrowers. We describe each data source and the main variables below. Summary statistics for all variables used in the regression analysis are reported in Table 2.

Cross-border Interbank Exposures. Bank-level exposures to banks in foreign markets are constructed from data on individual loan deals. These data come from Dealogic's Loan Analytics, a database with extensive international coverage of syndicated loans.[17] To construct interbank exposures for the 1997–2012 period, we obtain information for 170,274 loan deals signed between

[17]To be precise, in our dataset three quarters of all loans are syndicated and remaining loans are single-lender loans. For simplicity, in the paper we refer to all loans as "syndicated loans."

1990 and 2012. For each loan we observe the identities of the borrower and lenders, the loan amount in U.S. dollars (which we express at 2005 prices using the U.S. consumer price index), and loan origination and maturity dates. From these data we retain 16,526 interbank loans and construct bank-level foreign exposures among 6,083 banks with cross-border lending and/or borrowing operations.[18] An important caveat of this approach is that we only observe loans at origination and do not have information on credit line drawdowns, liquidation, prepayments, side-arrangements, or potential loan sales made by lenders to reduce these exposures or remove them from their balance sheets. Therefore, to limit the well-known problem of measurement error in estimated dollar exposures (de Haas and van Horen, 2013; Bord and Santos, 2012; Ivashina, 2009), we conduct the empirical analysis using the *number* of exposures rather than their dollar value.[19]

Direct and indirect exposures are defined as follows. Direct exposures of bank i in year t represent the number of banks to which bank i has direct exposures in that year. Direct exposures are calculated based on all the loans that were extended by bank i starting in 1990 until and including year t and that are outstanding at the end of year t.[20] The sum of these exposures is simply a bank's number of direct counterparties. Indirect exposures of bank i in year t are the direct exposures of those banks to which bank i has direct exposures in year t. These are two-step away exposures because they represent the number of direct counterparties of a bank's direct counterparties. From the same data source, we use individual loans to non-financial sector borrowers (firms and sovereigns) to construct exposures to non-banks. Since non-bank borrowers are rarely involved in lending themselves, we only compute *direct* exposures to non-banks and use them as control variables in all our regressions.

The total number of crisis exposures across the banks in our sample (C, CC, and CNC) is shown in Figure 5. We can see that there were relatively more direct crisis exposures in the earlier part of the period, notably the 1997–1998 Asian financial crisis, and there were relatively more indirect crisis exposures in the latter part of the period, notably the 2007–2009 financial crisis. These figures reflect the growing internationalization of cross-border interbank lending operations.

Bank Balance Sheets. Data on bank balance sheets comes from Bankscope. Due to the lack of

[18] See Appendix A-II.1 for details on data construction.

[19] Another reason to prefer the number of exposures over their dollar value is that while direct dollar exposures reflect the maximum size of losses for a creditor bank, indirect dollar exposures (defined in Section 3.1) do not have a similar interpretation. That said, in Section 6.2 we explore specifications where we use an alternative exposure variable, namely total dollar amount of exposures divided by total bank assets.

[20] We start in 1990 to make sure we have a good measure of exposure in 1997, the first year of our sample period, given that the average and standard deviation of loan maturity in the sample is about 3 years.

common identifiers in Dealogic Loan Analytics and Bankscope, we hand-match banks in Dealogic with financial information from Bankscope by bank name and country (on a locational basis). Prior to the match we carefully process the lender names in Dealogic to account for name changes, mergers, and acquisitions over the sample period. (See Appendix A-II.1 for details.) While we use the full network of 6,083 banks to compute crisis and non-crisis exposures, our final regression sample of matched banks includes 1,869 banks due to the availability of balance sheet information in Bankscope.[21]

For the profitability analysis we use return on assets (ROA), return on equity (ROE), and net interest margins (NIM) as general indicators of bank performance and financial health.[22] Other bank variables include bank capital (equity/assets), size (log-total assets), dummy variables for bank type (controlled subsidiary, global ultimate owner, and other), and dummy variables for bank business model (commercial banks, investment banks, and other).

Bank Loans. We examine the impact of financial stress in foreign markets on banks' lending decisions using detailed data on corporate loans from Dealogic Loan Analytics. For this purpose, we use 161,270 loans extended by the banks in our sample to financial and non-financial firms over the 1997–2012 period (about 9,000 loans to sovereigns are excluded). The loan pricing variable ("all-in-spread-drawn") refers to the sum of the spread over the reference rate (mostly the LIBOR) plus the facility fee associated with the granting of the loan (Berg, Saunders and Steffen, 2016).[23]

Firm Performance. Data on firm financials comes from Thomson Reuters Worldscope, a database with balance sheet and income statement information for publicly listed firms around the world. Market capitalization coverage in Worldscope exceeds 90% for advanced economies and 70% for emerging markets. Given that Worldscope does not share a common identifier with Dealogic Loan Analytics, we match firms across the two datasets using an approximate string match algorithm based on firm name and country, which we double-check for any erroneous or ambiguous

[21] Note that our analysis is subject to survival bias, as some of the banks experiencing large losses in a period may fail subsequently. Exits of unprofitable banks likely works against our results.

[22] An alternative indicator of bank performance is bank stock market returns. Analyzing market valuations would require setting up the analysis at the bank holding company level. Unfortunately, we are unable to carry out such an analysis largely due to data limitations, as reliable information on the historical composition and ownership of international banking groups is not available.

[23] Two notes are in order about sample sizes in lending and real effects regressions. First, the number of banks in loan-share regressions is less than in the profitability regressions because singletons drop out due to the inclusion of bank fixed effects, as do several banks that only lend to sovereigns. Second, sample sizes in loan spreads regressions are smaller than in loan-share regressions due to limited availability of the "all-in-spread-drawn" pricing variable. In robustness tests we check that our main loan-share results hold up in the significantly smaller sample of loans with non-missing pricing information (see column 3 of Table A4).

matches. The regression dataset comprises about 4,300 firms.

Systemic Banking Crises. Data on the incidence of banking crises comes from Laeven and Valencia (2013). The authors define systemic banking crises as periods during which the domestic banking system experiences significant stress and at least three of the following six interventions are implemented by public authorities: guarantees on bank liabilities, extensive liquidity support, significant asset purchases, public takeovers of financial institutions, large restructurings, and deposit freezes or bank holidays. Systemic banking crises occurred in 47 out of 203 countries during 1997–2012 for a total of 165 crisis-years. The average length of a crisis is 3.5 years for countries that experience at least one crisis during the period and 0.8 years for the full sample of countries.

5 Main Results

We begin with a regression model for bank profitability based on Equation 2, which relates bank accounting returns to cross-border interbank exposures and bank characteristics. We also estimate a modified specification to account for the potential endogeneity of crisis exposures. Then, we examine the real effects of cross-border crisis exposures with a series of bank lending and firm performance specifications, corresponding to Equations 3 and 4.

5.1 Crisis Exposures and Bank Profitability

5.1.1 Main Findings

In Table 3 we report the regression results for bank profitability, where the dependent variables are ROA, ROE, and NIMs and the regressors of interest are crisis exposures. We first examine the impact of direct crisis exposures (columns 1-3). Across specifications, the coefficient estimates are statistically significant at conventional levels and indicate that a higher number of direct exposures to banks in countries experiencing banking crises is associated with lower bank profitability.[24] In column 1, the estimate -0.0288 indicates that adding a new crisis exposures reduces ROA by close to 2.9 bps in the same year or by 3.5% of mean ROA. Put differently, for a bank with total assets of one trillion U.S. dollars—and there were 29 banks globally with balance sheet larger than 1 trillion U.S. dollars in 2012, according to data from Bankscope—an additional crisis connection translates

[24]These results are robust to controlling for the characteristics of counterparty banks in specifications that derive directly from Equation 2 (see Table A1).

into a reduction in annual returns of close to 300 million U.S. dollars. The results are similar when we use ROE or NIMs as measures of bank profitability. The estimated coefficients in columns 2-3 indicate an additional crisis exposure reduces bank ROE by about 31 bps and NIMs by 2.7 bps for the average bank in the sample.

While the reported coefficients are statistically significant and show that individual shocks propagate through the financial network of cross-border interbank exposures, they point to individual crisis exposures' having *modest* economic impact on bank profitability. This is not surprising given that syndicated interbank loans are a small fraction of the average bank's total balance sheet and that banks attempt to diversify idiosyncratic risks. At the same time, the reported coefficients are likely underestimating the true extent of crisis transmission through the interbank network. First, cross-border syndicated interbank loans are only about 30% of total cross-border interbank claims, so we are not capturing the full extent of cross-border exposures to banks in foreign markets. Second, the financial network may have formed endogenously, with banks deciding to create and sever links over time in a way that generated as resilient a network as possible given past financial shocks. (We turn to the possibility of crisis anticipation in the next section.)

Despite being small, the effects of individual shocks on bank profits margins are important because large aggregate shocks hit the financial network occasionally, taking the form of regional or global crises, and causing a large number of interbank links to turn from non-crisis to crisis exposures within a short period. Take, for example, the case of Standard Chartered bank, which in 1998 had 21 direct exposures to banks in countries hit by the Asian financial crisis. Our estimates (in column 1 of Table 3) imply that direct crisis exposures alone reduced Standard Chartered's ROA that year by 60 bps, or 41% of its ROA in 1998. Thus, systemic banking crises that affect multiple countries at the same time can have a sizable economic effect on exposed banks' balance sheets through the financial network. This result is consistent with the theoretical work of Acemoglu, Ozdaglar and Tahbaz-Salehi (2015), who argue that interconnected banking systems facilitate the propagation of shocks when these shocks exceed a certain threshold.

Next we add indirect exposures, that is, crisis and non-crisis exposures of first-degree counterparty banks (columns 4-6). The coefficients on these second-degree exposures are statistically insignificant. However, these measures ignore the network structure of bank connections, where the path of a connection can influence the transmission of shocks along a chain of lending relationships. In Section 3.2 we conjectured that a second-degree crisis exposure could have a significant effect on

bank returns if the first-degree exposure is also a crisis exposure (a CC path). To explore this possibility, in columns 7-9 we condition on the nature of first-degree exposures and include separately all the paths shown in Figure 3. The estimated coefficients confirm that second-degree crisis exposures (CC) are negatively correlated with bank profitability. An additional indirect exposure to a crisis country bank through a crisis-country bank (CC) reduces ROA by close to 0.8 bps in addition to the effect of a crisis exposure (C) (or 33% of the base effect of C). By contrast, an additional indirect exposure to a non-crisis country bank (CNC) through a crisis-country bank reduces the negative effect on ROA by 0.4 bps (18% of the base effect of C). Notice also that the coefficients on indirect non-crisis exposures (NCC and $NCNC$) are largely statistically insignificant.

The comprehensive regressions in columns 7-9 of Table 3 are our preferred specifications and are used in the subsequent analysis unless specified otherwise.[25]

5.1.2 Potential Shock Anticipation

As discussed in Section 3.3, the estimates of crisis exposures' impacts could suffer from endogeneity bias if banks anticipated adverse shocks from counterparts and adjusted their balance sheets ex-ante. If banks reduced their exposures to foreign markets in anticipation of negative shocks, our main estimates would suffer from attenuation bias. To obtain more precise estimates, we disaggregate interbank exposures into two exposure components that differ in terms of the ease with which they can be adjusted by the bank.

Specifically, we decompose a cross-border interbank exposure in year t into a "stock" exposure that was in place as of the end of year $t-1$ and a "flow" exposure based on loans originated during year t. Banks should have a harder time adjusting their stock exposures than their flow exposures because unwinding existing positions through loan sales requires appropriate market conditions, the availability of willing buyers, and even when these conditions are met, loan sales may entail large haircuts. By contrast, adjusting the loan flow is possible by simply not granting new loans. For this reason, stock exposures should be less contaminated by endogeneity concerns than are flow

[25] In Tables A2-A3 we refine these profitability results. The specifications in Table A2 allow for persistent negative effects of cross-border crisis exposures on bank profitability, possibly due to the lags involved in banks recognizing loan impairments on the balance sheet. The specifications in Table A3 allow the baseline profitability effects of direct crisis exposures to differ based on bank capital and size, two important determinants of banks' ability to withstand shocks. On balance, the results show that (a) the baseline effects persist in outer years; and (b) ROA and ROE of relatively smaller and thinly-capitalized banks are most responsive to foreign shocks while NIMs are more uniformly impacted across bank types.

exposures.

In Table 4 we estimate our preferred profitability specification after replacing the direct crisis exposures with these two components—the "stock" exposures S, based on loans originated until the end of year $t-1$, and the "flow" exposure F based on loans originated during year t. This approach yields statistically significant results only for stock exposures, as well as quantitatively similar estimates across all specifications. This finding supports the idea that financial shocks are transmitted mainly through the portion of exposures that is predetermined and hence hardest to adjust endogenously.

5.2 Crisis Exposures and Bank Lending: Quantity and Price

Next, we examine the lending effects of exposures to banks in crisis countries. While bank profitability is important in its own right, we take advantage of our detailed loan origination data to go one step further and estimate the effects of crisis exposures on loan supply. We examine both loan *quantity* and *pricing* effects. We use data on individual loans extended by the banks in our sample to financial and non-financial borrowers during 1997–2012. For loan volume regressions, we employ data at the loan share-bank-borrower level, representing loan shares contributed by each bank in a syndicated loan deal, extended to an individual firm. For loan pricing regressions, we use the same data on individual loans and construct a panel at the bank-borrower-year level where loan spreads are averaged across multiple loans for any given bank-firm pair (and log-transformed). The data structure for our lending regressions is advantageous because it allows us to control, among others, for time-varying shifts in demand at the firm-cluster level, where firm clusters are granularly defined as all firms in the same country, industry, and risk category. We run regressions specified in Equation 3 in the full sample and then explore heterogeneous effects.

The main lending results are reported in Table 5. Consistent with our findings for bank profitability, the estimates indicate that a greater number of direct crisis exposures is associated with lower loan shares and higher loan spreads in the full sample of borrowing firms.[26] The coefficient estimate on crisis exposures (-0.046 in column 2) indicates that one additional direct crisis exposure reduces the average loan share by 0.046 percentage points, or almost 5 bps (across all firms). In addition, the effect of indirect CC exposures is negative, but imprecisely estimated, while that of

[26] In these baseline results, firm clusters use 1- and 2-digit industry SIC classifications. In Table A4 we show that the results hold up for more granular 3- or 4-digit SIC classifications (columns 1-2 and 4-5).

indirect non-crisis exposures is both positive and statistically significant (columns 2-3).

Turning to pricing effects, columns 4-6 of Table 5 show that a greater number of direct crisis exposures is associated with higher spreads on new loans for the average borrower in the sample. Using the coefficient estimates in column 5, an additional direct crisis exposure increases the spread by 0.26%. This effect, although small, is amplified by second-degree crisis exposures: one indirect crisis exposure (CC) on top of existing direct exposures further increases the spread by 8% of the base effect. Loan pricing decisions thus respond not only to banks' direct crisis exposures, but also to their indirect exposures. The pricing regressions further show that a larger number of (direct or indirect) non-crisis exposures (NC and CNC) are associated with lower loan spreads, and these effects are statistically significant (columns 5-6).

Next, we explore differential effects by firm type. In Table 6 we examine financial versus non-financial firms. Columns 1 and 5 show that the baseline effects of crisis exposures on loan shares and spreads are driven by loans extended to non-financial firms. The insignificant effects for financial firms are consistent with the economic value of interbank relationships highlighted in the literature (and discussed in Section 3). The coefficient estimates on crisis exposures (-0.056 in column 1 and 0.0035 in column 5) indicate that an additional direct crisis exposure reduces the average loan share to a non-financial firm by 5.6 bps and raises the average loan spread to a non-financial firm by 0.35%.

In the remaining specifications of Table 6 we focus on non-financial firms, and investigate differential effects by several attributes, including location (domestic/foreign), size (small/large), and bank-firm relationship intensity (core/peripheral borrower). For this purpose, we break up the main coefficient of interest on direct crisis exposures along these dimensions. In columns 2 and 6 we see that the adverse effects of direct crisis exposures on lending apply primarily to foreign firms. In columns 3 and 7 the same adverse effects are present only for small firms (defined as those firms with average loan size below the sample median).[27] In columns 4 and 8 we allow the coefficient on direct crisis exposures to vary with bank-firm relationship intensity. We distinguish between a bank's "core" and "periphery" borrowers based on the intensity of their relationship with that

[27]To preserve sample size, these regressions are run for *all* firms (not only firms that are matched with financial information from Worldscope), and firm size is proxied by average loan amount to a given firm over the full sample period. In the matched sample, this firm size proxy and firm total assets have a correlation of 0.40. In Table A5 we show that our main lending results, both for loan shares and spreads, are also present in the subsample of loans to borrowers that are matched to Worldscope despite the significant drop in sample size and statistical power. This Worldscope-matched subsample is about five times smaller than the full sample.

bank. A firm is a core borrower if the bank-firm pair has a number of loans that is above the sample mean (periphery borrowers are defined accordingly).[28] The estimates show that bank-firm relationship intensity is inconsequential for loan volumes, but not for loan spreads: banks with more exposures to crisis countries are more likely to raise loan spreads to peripheral borrowers, while there is no spread impact on core borrowers. These results provide partial support to the relationship banking literature: when banks experience the adverse impact of their crisis exposures, they increase lending spreads relatively more to their peripheral borrowers while protecting their core borrowers. Overall, the heterogeneity results are broadly consistent with our hypotheses, deriving from the large literature on financial shocks and firm heterogeneity.

Notice also that, across specifications, the coefficients on direct non-crisis exposures (NC) have intuitive signs and are statistically significant for both loan shares and spreads. In addition, the coefficients on indirect crisis exposures (CC) and non-crisis exposures (CNC and $NCC + NCNC$) take the expected signs and, for loan spreads, they are also statistically significant. The economic effects of an additional crisis exposure on loan volume and pricing are modest, but add up when banks have concentrated exposures across a given region that experiences a systemic banking crisis, or when crises afflict many countries worldwide. To gauge magnitudes, we can consider the case of the Hong Kong subsidiary of Long-Term Credit Bank of Japan (LTCB), which had significant interbank exposures to Asian banks in the late 1990s (53 direct C exposures and 204 indirect CC exposures in 1998) and compare this case to a bank with no such exposures. Using the estimates in columns 1 and 5 of Table 6, we find that direct C exposures alone account for a 295 bps difference in the average loan share to non-financial firms and a 18.6% difference in loan spreads between LTCB and the non-exposed bank. Indirect CC exposures add a further 4 percentage points to the difference in loan spreads between LTCB and the non-exposed bank.

Transmission to Third Countries. So far we have shown that crisis exposures are associated with worse credit terms for all firms that borrow from crisis-exposed banks. This effect could be further decomposed into a credit crunch for the firms in the country that is the origin of the shock (A), the firms in the country of the exposed banks ("domestic firms," in B), and the firms that are located in other, ex-ante healthy, countries ("foreign firms," in C). To investigate the extent to which exposed banks transmit shocks from a crisis origin country (A) to third countries (C), we re-estimate the regressions in Table 6 after dropping bank-firm pairs for which firms are located in

[28] The average number of loans at the bank-firm level is 4 over the sample period. The results are robust to using the median number of 6 loans to identifying core and peripheral borrowers.

crisis origin countries (A). The results in Table 7 show that direct crisis exposures are associated with tighter credit—lower loan volume and higher spreads—on loans to foreign firms in countries other than the country where the shock originated. Put differently, banks in country B that are exposed to banks in crisis country A curtail their credit to firms in all other foreign countries C, including those that do not have any direct exposure to country A. In addition, these effects are heterogeneous across firms, with foreign, small, and peripheral borrowers being relatively more affected. Overall, these results highlight the transmission of financial sector shocks across borders through interbank exposures even to countries themselves not experiencing banking crises.

5.3 Crisis Exposures and Firm Performance

Here we document the real effects of systemic banking crisis transmission through international bank connections. Specifically, we quantify the impact of crises in foreign countries on the performance of non-financial firms that borrow from the banks with exposures to those countries. We estimate reduced-form regressions in a firm-year panel for 1997–2012 and two outcome variables: the investment ratio and total asset growth. We control for firm-level Tobin's q (total market capitalization divided by total asset book value) to capture firms' investment opportunities, firm size (log-total book assets), and cash flow (in % of assets). For each firm, bank characteristics (including all types of cross-border exposures) are computed as weighted averages of the firm's lenders' characteristics, with weights computed as the share of lending granted by each lender. All regressors are lagged one year. To control for time-varying demand for firm services and products as precisely as possible, in addition to Tobin's q we include firm country×industry×year fixed effects, where industry is defined as 1- or 2-digit SIC industry codes.[29]

The results for investment and asset growth are reported in Table 8. Among firm level controls, Tobin's q and firm size have intuitive and statistically significant coefficients in all specifications. In column 1, we can see that firms that borrow from banks with a greater number of crisis exposures have lower investment ratios. Columns 2-4 show that this effect is stronger for small firms (with below-median total assets) (at least at the 20% level) and columns 3-4 show that it is robust to controlling for indirect exposures and to different levels of granularity for our demand controls. Notice also that the coefficients on other types of exposures are imprecisely estimated. The results

[29] As with our lending results, the real effects results are robust to defining industries using 3- or 4-digit SIC codes (see Table A6).

are similar for asset growth (columns 5-8).

These results echo the findings of previous studies that balance sheet shocks to financial intermediaries have binding effects on firm performance, especially for smaller firms that arguably have less diversified sources of external funding (see, among others, Chava and Purnanandam (2011)). This literature also suggests that even relatively large firms with access to the syndicated loan market are not able to completely make up for a deterioration in bank credit terms by substituting with alternative funding sources (see, e.g., Acharya, Eisert, Eufinger and Hirsch (2018) and Chodorow-Reich (2014)).

Similar to our results on bank profitability and lending, coefficient magnitudes in Table 8 are modest. Note, however, that they only measure the effect of one additional crisis exposure of the firm's average lender. Based on the coefficients in columns 1 and 5, we find that a firm whose average lender acquires one additional direct crisis exposure has an investment ratio that is lower by 2.2 bps and an average asset growth rate that is lower by 11 bps points. A direct way to gauge the economic magnitude of our financial channel of interbank crisis connections is to compare our estimates to a counterfactual in which lenders have no such connections. A back-of-the-envelope calculation can tell us the yearly investment and asset growth that are foregone due to transmission of systemic banking crises across borders. Using the estimates in columns 1 and 5 of Table 8, we find that in the absence of lender banks' crisis exposures, the investment ratio for the firms in our sample would have been higher by 1.7%, and firm balance sheet growth would have been higher by 4.2% during 1997–2012.[30] The corresponding numbers for the 2007–2009 financial crisis are 3.9% and 9.8%, respectively.

6 Additional Results

6.1 Ruling Out Alternative Explanations

Cross-Border Real Linkages. An important question raised by our baseline analysis is whether our results might be confounded by real linkages across countries. For instance, if financial linkages in general, and interbank lending in particular, are highly correlated with bilateral trade flows

[30] We obtain 1.7% for the investment ratio using the following figures—coefficient estimate of 0.0216 from column 1 of Table 8, average direct crisis exposure of 5.38 in the firm-year dataset, and average investment ratio of 6.816 (over the full sample). Specifically, $(-0.0216 \times 5.38)/6.816 = -0.017$.

(Caballero, Candelaria and Hale, 2018), then crises may transmit across borders through a real (rather than financial) channel. In addition, many global banks have extensive subsidiary and branch networks around the world (Claessens and van Horen, 2014), which makes them susceptible to a loss of franchise value when foreign markets experience crises. Studies have also shown that global banks facing balance sheet constraints are more likely to sustain their cross-border lending to those countries in which they have a real presence on the ground via subsidiaries (de Haas and van Horen, 2012). These mechanisms could generate biases in our main coefficients of interest insofar as a bank's presence in foreign markets is correlated with its lending to other banks in those markets, and it also affects its overall lending decisions.

To address these possibilities, we explore specifications that include three sets of control variables for real linkages. First, in our lending regressions we control for real linkages using data on bilateral trade flows (from the U.N. Comtrade International Trade Statistics). Specifically, we use log-transformed total bilateral trade flows between a bank's home country and all crisis and non-crisis countries. Second, we saturate our lending specifications with interacted country-pair×year fixed effects, which absorb all unobserved time-varying real linkages between a bank's home country and the countries of its borrowers. Third, we use microdata on financial sector mergers and acquisitions (M&A deals from the Orbis Zephyr database) to construct bank-level proxies for bank presence—the location of bank branches and subsidiaries in foreign markets—and include those proxies in both profitability and lending regressions.[31] For each bank in our sample, we measure its presence in crisis and non-crisis countries as the cumulative log-dollar value of M&A deals starting in 1995 (that is, predating our sample period, and the first year for which data are available) in which the bank acquired or merged with financial sector firms.[32]

We report the estimation results for lending and profitability regressions with these additional controls in Tables 9 and 10, respectively. In columns 1-4 of Table 9, where we control for total bilateral trade flows, or alternatively for country-pair×year fixed effects, we find that the main coefficients of interest, on direct crisis exposures, remain negative and statistically significant (at the 1% level) across specifications, and the coefficients on bilateral trade are statistically insignificant. In columns 5-8 we deploy our bank presence controls, which leave the key estimated coefficients on direct crisis exposures largely unchanged, suggesting that unobserved real linkages do not play a

[31] See Appendix A-II.2 for details.

[32] Out of the 1,200 banks in our largest lending regression sample, we are able to trace 564 banks in the Orbis Zephyr database. We make two distinct assumptions about the geographical presence in foreign markets of *unmatched* banks, setting the variable to either 0 (no presence) or missing (no information).

significant confounding role for our main results. Similarly, in Table 10 we add our controls for bank presence in the main profitability regressions and find that they not only leave the main results unchanged, but also yield intuitive signs: bank presence through subsidiaries in crisis countries has a negative association with bank profitability, and bank presence through subsidiaries in non-crisis countries has a positive association or is insignificant.

Prior Trends and Spurious Shocks. To alleviate concerns that our results are driven by unobserved trends, shocks, or linkages, we conduct two additional tests. To test whether our results are confounded by pre-existing trends in bank performance, we replace the bank profitability outcome variables with their 2, 4, and 6-year lags prior to the crisis date. We find that none of the estimates of the effect of direct and indirect exposures on these lagged profitability measures are statistically significant. That is, there is no evidence that prior trends in bank profitability spuriously produce our results. To test whether our results are due to spurious correlations due to unobserved shocks or linkages, we conduct a set of falsification tests in which we randomize crisis years across time, bank linkages across countries, or both. As seen in Table A7, the regression results do not show any significant effects of false crises or linkages on bank profitability.

Shocks through Liability-Side Exposures. In Section 3.3 we discussed the possibility that cross-border *liability-side* exposures also affect bank performance, albeit less directly then asset-side exposures. To explore their impact on our results, we create an alternative financial network based on liability-side exposures and construct direct exposures to banks in crisis and non-crisis countries from this network. Then we include these variables in our baseline profitability and lending regressions, first in isolation and then together with our baseline asset-side exposures. As shown in Panel A of Table 11, including direct C and NC liability-side exposures alone shows that these exposures do not systematically affect bank profitability and lending behavior. Furthermore, in regressions that include both asset- and liability-side exposures, as shown in Panel B, our main coefficient estimates for the impact of direct and indirect asset-side crisis exposures remain unchanged, while the coefficients on liability-side exposures are statistically insignificant. In sum, interbank crisis exposures on the liability side of bank balance sheets do not seem to be significant channels of financial shock transmission across borders. While cross-border funding shocks to banks may affect their performance, it appears that simply having liability-side exposures to banks in crisis countries does not systematically affect bank performance and lending decisions.

6.2 Heterogeneity

In this section we explore variations in our baseline results depending on the size of cross-border interbank exposures, the severity of systemic banking crises, and bank business model.

Size of Interbank Exposures. Do our results differ by size of exposures? To answer this question, we run our baseline regressions with an alternative measure of cross-border interbank exposures that captures their dollar value (rather than the *number* of such exposures) as a share of total bank assets. These estimates should be interpreted with some caution as they may be prone to measurement error due to, for instance, banks removing a portion of credit exposures from their balance sheets through secondary market sales or by hedging them via credit risk management techniques. As seen in Table 12, the estimates for direct crisis exposures are consistent with the baseline findings, both in terms of sign and statistical significance, however, those for indirect exposures have coefficients that are less precisely estimated. In column 1, the estimate -0.0924 indicates that increasing the ratio of crisis interbank exposures to total assets by 1 percentage point reduces bank ROA by 9.2 bps. While this estimate is more sizable than the corresponding estimate in our baseline specification in response to a one unit increase in the number of direct crisis exposures (2.9 bps), it measures the response to a shock where a significant portion (1%) of the bank's total assets turn to a crisis exposure.[33] We obtain similar results for other outcome variables, where the key estimates are also larger than those in the baseline specifications.

Systemic Banking Crisis Severity. We also explore heterogeneity in our results depending on the economic cost and severity of systemic banking crises. One might imagine that exposures to banks in a country that experiences a deep and protracted financial crisis might be more impactful than exposures to a less severe crisis. For each crisis Laeven and Valencia (2013) provide additional information that can serve as proxies for the severity of the crisis. This information includes detailed estimates of the costs of fiscal, monetary, and structural public interventions and other crisis characteristics such as an estimate of the output loss (compared to pre-crisis trend), the maximum banking system NPL ratio attained during the crisis, and an indicator for crises preceded by a credit boom.[34]

[33]This coefficient implies that a one-standard deviation increase in the ratio of crisis interbank exposures to total assets (0.51%) leads to a 4.7 bps decline in bank ROA. This effect is just over half of the ROA decline in response to a one-standard deviation increase in the NPL ratio reported by Xu, Hu and Das (2019) in a similar profitability regression. Given that in our case crisis exposures are not necessarily non-performing and hence the effect on the balance sheet is less direct, it is not surprising that we find a smaller economic magnitude.

[34]As common in the crisis dating literature, systemic banking crises are identified by the presence of significant

We measure the severity of systemic banking crises with the first principal component extracted from the nine crisis-specific variables in the Laeven and Valencia (2013) database.[35] Then we identify high-severity crises as those with above-median values of this proxy. Finally, we calculate for each bank the number of direct exposures to banks in high-severity and low-severity crises and include these two terms in our main specifications. As seen in Table 13, the results indicate that exposures to high-severity crises consistently have stronger negative effects on bank profitability and lending decisions.[36]

Bank Business Model. Finally, we explore heterogeneous effects in the transmission of systemic banking crises across borders depending on banks' degree of involvement in the cross-border interbank market. Bank engagement in the syndicated interbank market—either as an asset class or a funding source—is an indication of the bank's business model, and most banks participate in interbank markets as both borrowers and lenders (as documented, for instance, by Bluhm, Georg and Krahnen (2016), Bräuning and Fecht (2016), and Craig and von Peter (2014)). We split banks in our sample depending on how involved they are in the lending or borrowing part of the global interbank market, as follows. Banks that are major lenders in this market have above-median cross-border asset-side interbank exposures (as a share of total assets); banks that are major borrowers have above-median cross-border liability-side interbank exposures (as a share of non-deposit liabilities). As Table 14 shows, the spline coefficients on direct crisis exposures for major lender banks are systematically and negatively associated with bank profitability and loan outcomes, and statistically significant across all outcome variables, while there is no significant effect for major borrowers.[37] These results are intuitive and in line with the lack of evidence of cross-border crisis transmission through the financial network of liability-side interbank exposures.

stress in the domestic banking sector and the implementation of public responses to resolve the crisis (Laeven and Valencia, 2008, 2013). As discussed in Section 4, Laeven and Valencia (2013) require that at least three significant events or public interventions occur for a financial shock to qualify as a crisis. Therefore, our results should be interpreted bearing in mind that the data encompass potentially mitigating effects of public interventions to resolve the crisis.

[35]These variables are: output loss (% GDP), three measures of fiscal cost (the costs associated with restructuring in % of GDP and in % of financial sector assets, and the increase in public debt during the crisis), two measures of liquidity support (the ratio of central bank claims on deposit money banks and direct liquidity support from the Treasury) and monetary expansion (the change in monetary base between the start and the peak of the crisis), peak NPL ratio (% of gross loans), and a dummy variable for credit boom preceding the crisis. The first principle component explains almost one third of the total variation in the data.

[36]The results are robust to using different thresholds for separating high from low-severity crises, for instance the 75th or 90th percentile of the cost distribution.

[37]One-side t-tests of the null that the adverse effects of direct crisis exposures are greater for major lender banks than they are for major borrower banks indicate that the null cannot be rejected at conventional levels.

7 Conclusions

The real effects of interbank networks remain understudied, especially in an international context. In this paper we assemble a novel dataset to study the international transmission of financial sector shocks through cross-border interbank lending activities. We construct cross-border asset-side interbank exposures for more than 6,000 banks during 1997–2012, which allows us to map global interbank connections as a financial network. Then we examine the effects of direct and indirect bank exposures to foreign markets in turmoil. Specifically, we trace the cross-border transmission of financial shocks to bank profitability, bank lending decisions (volumes and prices), and the performance of borrower firms.

We find robust and statistically significant negative effects of direct crisis exposures on bank profitability. The effects are economically modest, suggesting that the global network of interbank connections is resilient to isolated banking crises. However, when banks have cross-border exposures that are concentrated regionally and a regional crisis arises, or are geographically diversified but a global financial shock arises, these negative effects translate into sizable profitability losses and affect bank lending behavior. Crisis exposures lead banks to cut back the volume of new business loans and to charge higher spreads on these loans, especially to foreign, small, and peripheral firms with which they have low-intensity banking relationships. This retrenchment of bank credit applies not only to borrower firms in crisis-hit countries, but also to firms in third markets, indicating that shocks propagate through the financial network to affect even ex-ante healthy countries. In addition, this retrenchment of bank credit tightens financial constraints for bank-dependent borrowers and leads to lower investment ratios and asset growth, especially for small firms. We also show that indirect (second-degree) crisis exposures have an additional negative impact on bank profitability and lending decisions, but this indirect impact is substantially smaller than the direct impact.

Our results suggest that globally-active banks are unable to fully shield their balance sheets from turmoil in foreign markets. Furthermore, the results illustrate how interactions in the cross-border interbank market affect bank profitability and the flow of credit in the global economy. Our findings support the notion that interconnected financial systems enable shock transmission across borders through banks, with negative consequences for the real economy. These costs should be weighed against the benefits of risk-sharing and the greater efficiency of capital allocation associated with financial globalization.

Additionally, our results have implications for regulators and policy-makers by showing that the international syndicated interbank market poses little short-term risk to the balance sheet of the average bank. That said, regulators should pay attention to banks with foreign exposures that are concentrated in specific countries or regions. They should also monitor the dynamics of such exposures for the banks in their jurisdictions and the health of foreign banking systems to which domestic banks have significant exposures.

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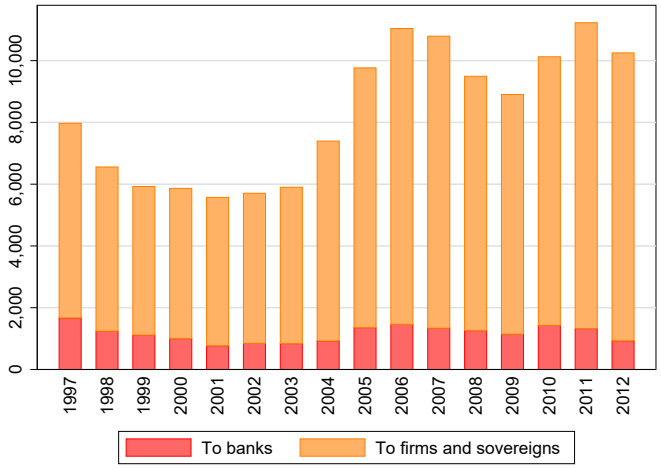
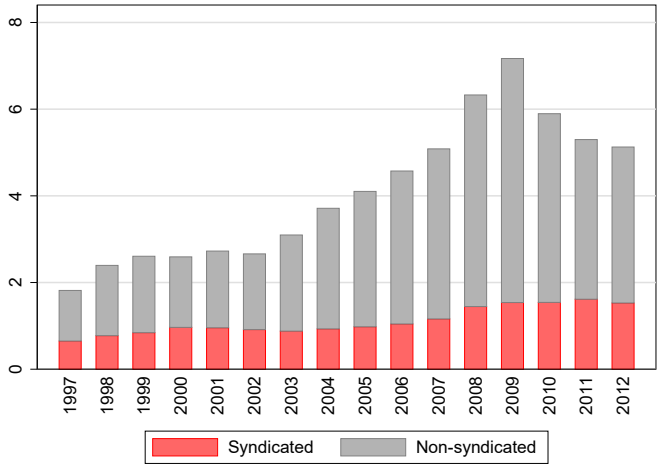
Figures and tables

Figure 1: Size of the Cross-border Interbank Market, 1997–2012



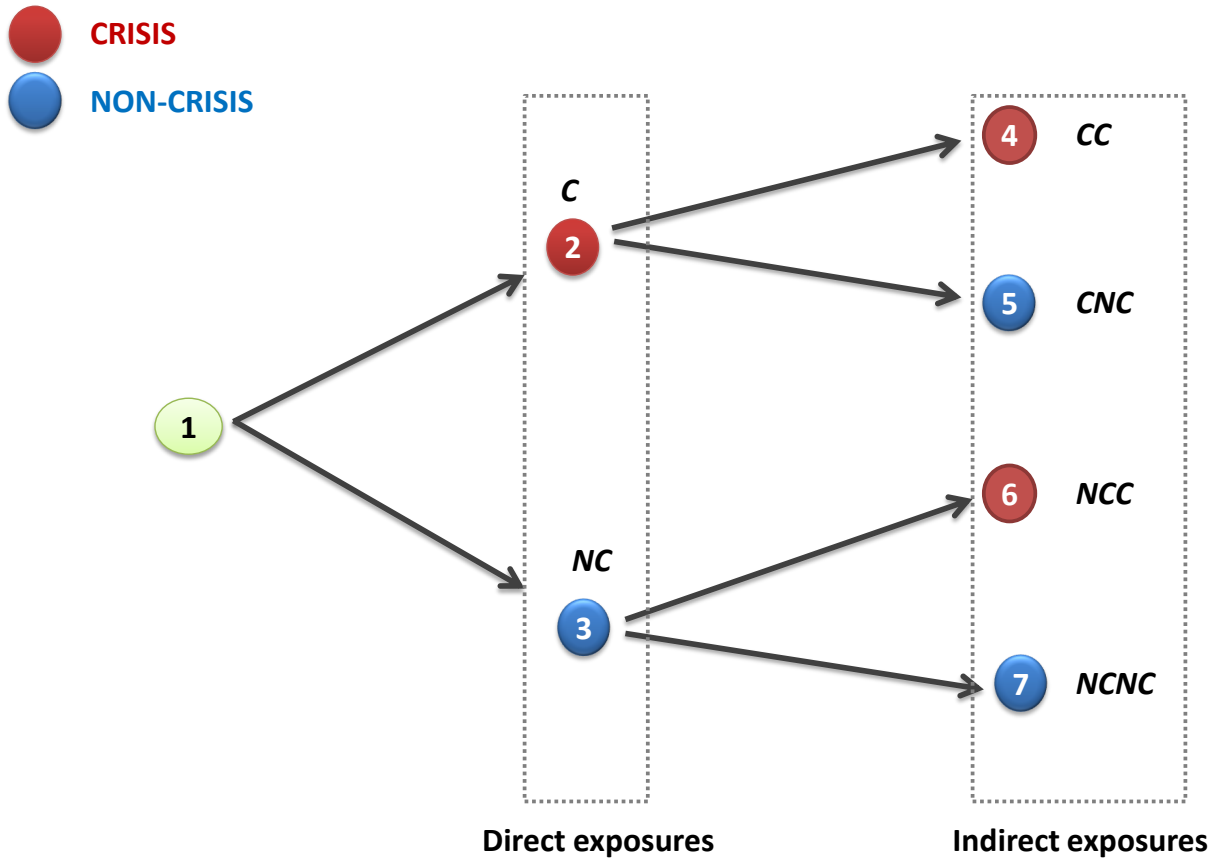
Notes: The figure plots the number of syndicated loans issued to bank and non-bank (corporate and sovereign) borrowers during 1997–2012. *Data sources*: Dealogic Loan Analytics.

Figure 2: Size of cross-border interbank loan claims, 1997–2012



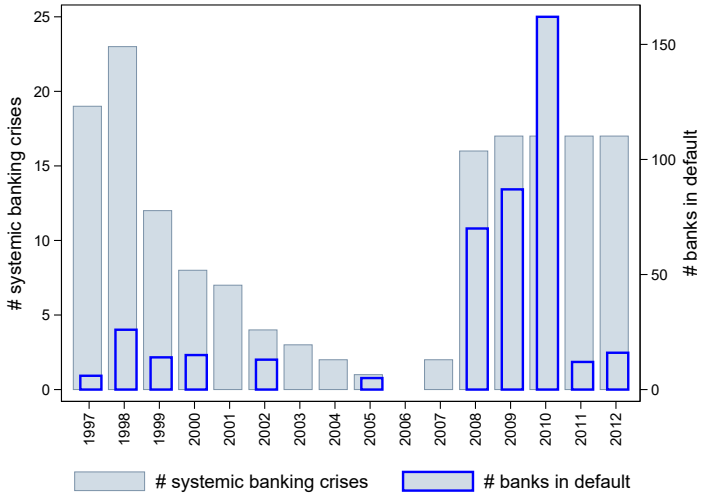
Notes: The figure shows the composition of cross-border interbank exposures (in trillions of U.S. dollars at 2005 prices), distinguishing between claims formed through syndicated loans and claims formed through non-syndicated (single-lender) loans. Claims that are formed through transactions *within the same banking group* are excluded. The figure is constructed using data on cross-border claims of 35 BIS reporting banking systems vis-a-vis 197 banking systems. Syndicated loan claims are estimated using the methodology in Cerutti, Hale and Minoiu (2015). *Data sources*: BIS locational banking statistics and Dealogic Loan Analytics.

Figure 3: Visualization of Direct and Indirect Exposures



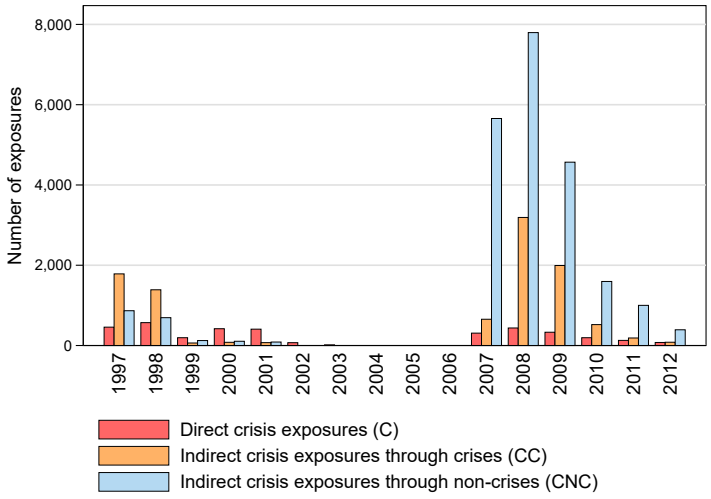
Notes: The figure illustrates direct (first-order or one step away) and indirect (second-order or two steps away) exposures. Throughout the paper and in regression tables, direct exposures are labeled as C (crisis exposures) or NC (non-crisis exposures). Indirect exposures are labeled as CC (crisis exposures through crises), CNC (non-crisis exposures through crises), NCC (crisis exposures through non-crises), and $NCNC$ (non-crisis exposures through non-crises).

Figure 4: Systemic banking crises and defaulting banks, 1997–2012



Notes: The figure plots the number of systemic banking crises and the number of defaulting banks (among the population of banks rated by Moody's) on at least one debt instrument during 1997–2012. *Data sources*: Laeven and Valencia (2013), Moody's Default and Recovery (DRD) database.

Figure 5: Direct and indirect crisis exposures, 1997–2012



Notes: The figure depicts the number of direct crisis exposures (C), indirect crisis exposures through crises (CC), and indirect non-crisis exposures through crises (CNC) in the regression sample. *Data sources*: Bankscope, Dealogic Loan Analytics, Laeven and Valencia (2013).

Table 1: Cross-border Interbank Exposures on Bank Balance Sheets

For lender banks		For borrower banks			
A. % gross loans		**B.** % total liabilities		**C.** % (total liabilities - deposits)	
Malta	15.4	Iceland	12.2	Latvia	41.2
Luxembourg	9.9	Kazakhstan	9.5	Azerbaijan	25.2
United Kingdom	8.6	Azerbaijan	9.2	Slovenia	22.5
Netherlands	5.9	Slovenia	7.9	Iceland	20.4
Singapore	5.3	Georgia	7.3	Malta	18.7
Belgium	5.3	Latvia	6.6	Kazakhstan	15.3
Ireland	5.0	Turkey	6.3	Turkey	12.3
France	4.0	Algeria	5.9	Croatia	11.7
Hong Kong	3.7	El Salvador	5.1	Algeria	10.2
Germany	3.6	Norway	5.0	Oman	10.2
Libya	3.1	Denmark	5.0	Mauritius	10.0
Switzerland	3.1	Croatia	4.4	Denmark	9.5
Bahrain	2.9	Ukraine	4.0	Hungary	9.4
Australia	2.5	Bahrain	4.0	Bulgaria	9.3
Kuwait	2.2	Hungary	3.9	Norway	8.6
Egypt	2.2	Oman	3.3	Sri Lanka	8.2
Cyprus	1.9	Ireland	3.2	Australia	7.5
Portugal	1.8	South Korea	3.2	Bahrain	7.3
Canada	1.8	Estonia	2.9	Romania	7.2
Qatar	1.8	Argentina	2.8	Estonia	7.1
United Arab Emirates	1.5	Russia	2.6	Hong Kong	7.1
Saudi Arabia	1.4	Hong Kong	2.5	Argentina	6.7
Argentina	1.1	Romania	2.5	United Arab Emirates	6.6
Oman	1.1	Australia	2.4	Ukraine	6.5
Italy	1.0	Bulgaria	2.3	Namibia	6.4
Top 25 average	3.8	Top 25 average	5.0	Top 25 average	12.2
Full sample average	3.2	Full sample average	3.2	Full sample average	8.0

Notes: The table reports the top 25 countries by average share of cross-border interbank exposures in total gross loans (Panel A), share of cross-border interbank liabilities in total liabilities (Panel B), and share of cross-border interbank liabilities in total liabilities less deposits (Panel C), during 1997–2012. The full sample average refers to the 50 countries for which bank-level data on cross-border interbank liabilities and total liabilities are available for at least 5 observations. *Data sources*: Dealogic Loan Analytics, Bankscope.

Table 2: Descriptive Statistics for Selected Regression Variables

	N	Mean	St. Dev.	Min	Max
A. BANK VARIABLES					
Return on assets (ROA)	14,448	0.809	1.560	-6.850	8.850
Return on equity (ROE)	14,445	8.398	16.44	-78.09	53.17
Net interest margins (NIM)	14,315	2.759	2.238	-0.910	15.87
Equity/Assets	14,448	8.753	9.333	0.320	81.51
Assets (USD bn)	14,448	72.34	236.4	0.450	3,808
# direct crisis exp. to non-banks	14,448	1.968	19.32	0	582
# direct non-crisis exp. to non-banks	14,448	5.308	29.89	0	828
Systemic banking crisis (in bank's own country)	14,448	0.209	0.407	0	1
B. CROSS-BORDER INTERBANK EXPOSURES					
# direct exp.	14,448	4.339	13.84	0	191
# direct crisis exp. (C)	14,448	0.251	1.553	0	53
# direct non-crisis exp. (NC)	14,448	4.083	13.20	0	190
# indirect exp.	14,448	15.62	68.19	0	1,981
# indirect crisis exp.	14,448	1.611	10.64	0	500
# indirect non-crisis exp.	14,448	14.01	61.37	0	1,481
# indirect crisis exp. through crises (CC)	14,448	0.694	7.237	0	415
# indirect non-crisis exp. through crises (CNC)	14,448	1.585	17.25	0	938
# indirect crisis exp. through non-crises (NCC)	14,448	0.917	5.285	0	126
# indirect non-crisis exp. through non-crises ($NCNC$)	14,448	12.43	52.49	0	1,249
C. FIRM VARIABLES					
Investment rate (capex/lagged assets)	10,151	6.816	6.831	0.00	28.39
Asset growth rate	10,149	14.33	30.25	-77.43	128.74
Tobin's Q	10,151	128.8	88.2	18.13	590.23
Cash flow-to-assets	10,151	8.440	9.187	0.00	99.93
Assets (USD billion)	10,149	8.909	24.506	0.02	751.20
D. LOAN-LEVEL VARIABLES					
Loan share	319,267	17.31	19.42	0	100
Loan spread	134,461	170.6	125.0	12.50	750
Log(loan spread)	134,461	4.836	0.845	2.53	6.62
1: Credit line	319,267	0.614	0.487	0	1
# lenders in syndicate	319,267	12.08	10.35	1	118
1: Domestic firm	319,267	0.60	0.49	0	1

Notes: The table reports descriptive statistics for selected variables in our regression datasets. Bank variables (panels A and B) correspond to the bank-year panel, firm variables (panel C) come from the real effects dataset, and loan-level variables (panel D) come from the lending datasets. Dummy variables for bank business model and entity type are also included in the regressions and labelled as "other bank controls." Business models are commercial banks (81%) including cooperative banks, saving banks, real estate and mortgage banks, and other credit institutions; investment banks (7%); and "other banks" (12%) including bank holding companies, finance companies, investment and trust corporations, securities firms, private banking companies, asset management companies, and group finance companies. Entity types are subsidiaries (51%), global ultimate owners (30%), and "other entities" (19%) including branches, independent companies, and single location banks. All bank and firm variables (other than cross-border interbank exposures) are winsorized at the 1st and 99th percentiles of their distributions. In lending regressions we include the following loan-level currency dummies: Australian dollar, British pound sterling, Canadian dollar, Euro, Hong Kong dollar, Japanese yen, New Taiwan dollar, and U.S. dollar. *Data sources*: Dealogic Loan Analytics, Bankscope, Worldscope, Laeven and Valencia (2013).

Table 3: Crisis Exposures and Bank Profitability

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Dependent variables:	**ROA**	**ROE**	**NIM**	**ROA**	**ROE**	**NIM**	**ROA**	**ROE**	**NIM**
# direct crisis exp. (C)	-0.0288***	-0.3093**	-0.0271***	-0.0309***	-0.2938**	-0.0306***	-0.0227**	-0.2194*	-0.0259***
	(0.009)	(0.125)	(0.008)	(0.009)	(0.126)	(0.009)	(0.009)	(0.119)	(0.009)
# direct non-crisis exp. (NC)	-0.0000	-0.0043	-0.0018	0.0002	-0.0238	-0.0019	0.0011	-0.0163	-0.0013
	(0.002)	(0.018)	(0.002)	(0.002)	(0.024)	(0.003)	(0.002)	(0.025)	(0.003)
# indirect exp. to crises (CC+NCC)				0.0009	-0.0070	0.0016			
				(0.001)	(0.016)	(0.001)			
# indirect exp. to non-crises (CNC+$NCNC$)				-0.0002	0.0062	-0.0002			
				(0.000)	(0.004)	(0.000)			
# indirect crisis exp. through crises (CC)							-0.0076***	-0.0988**	-0.0036*
							(0.003)	(0.043)	(0.002)
# indirect non-crisis exp. through crises (CNC)							0.0042***	0.0496**	0.0024***
							(0.001)	(0.019)	(0.001)
# indirect crisis exp. through non-crises (NCC)							0.0009	0.0053	0.0017
							(0.002)	(0.033)	(0.003)
# indirect non-crisis exp. through non-crises ($NCNC$)							-0.0008*	0.0003	-0.0005
							(0.000)	(0.005)	(0.000)
Bank equity/assets	0.0555***	0.0714	0.0165***	0.0555***	0.0717	0.0164***	0.0554***	0.0713	0.0164***
	(0.007)	(0.045)	(0.004)	(0.007)	(0.045)	(0.004)	(0.007)	(0.045)	(0.004)
Bank size (log-assets)	0.0709***	0.7999***	-0.0923***	0.0709***	0.8046***	-0.0924***	0.0705***	0.8012***	-0.0926***
	(0.012)	(0.150)	(0.022)	(0.012)	(0.150)	(0.022)	(0.012)	(0.149)	(0.022)
# direct crisis exp. to non-banks	-0.0012	-0.0101	0.0002	-0.0013	-0.0093	0.0002	-0.0019*	-0.0153*	-0.0002
	(0.001)	(0.008)	(0.000)	(0.001)	(0.008)	(0.000)	(0.001)	(0.008)	(0.000)
# direct non-crisis exp. to non-banks	0.0001	0.0088*	0.0004	0.0002	0.0067	0.0005	0.0005	0.0090*	0.0007
	(0.000)	(0.005)	(0.001)	(0.000)	(0.005)	(0.001)	(0.000)	(0.005)	(0.001)
Other bank controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank country×year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	14,448	14,445	14,135	14,448	14,445	14,135	14,448	14,445	14,135
R-squared	0.440	0.345	0.659	0.440	0.345	0.659	0.441	0.346	0.659

Notes: In these bank profitability regressions, the dependent variables are bank ROA, ROE, and NIM and the data are at the bank-year level during 1997–2012. Other bank controls refer to indicators for bank business model (commercial bank, investment bank, and other), entity type (subsidiary, global ultimate owner, and other) and a constant term (coefficients not shown). Standard errors are clustered at the bank level. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 4: Addressing Potential Shock Anticipation—Stock and Flow Exposures

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variables:	**ROA**	**ROA**	**ROE**	**ROE**	**NIM**	**NIM**
# direct crisis exp. (C) - Stock	-0.0287***	-0.0248***	-0.3279***	-0.2740**	-0.0232***	-0.0260***
	(0.009)	(0.008)	(0.125)	(0.110)	(0.008)	(0.008)
# direct non-crisis exp. (NC) - Stock	0.0018	0.0018	-0.0060	-0.0057	-0.0011	-0.0008
	(0.001)	(0.001)	(0.018)	(0.018)	(0.002)	(0.002)
# direct crisis exp. (C) - Flow	0.0233		0.3196		-0.0152	
	(0.017)		(0.234)		(0.020)	
# direct non-crisis exp. (NC) - Flow	0.0005		0.0083		0.0018	
	(0.001)		(0.015)		(0.001)	
# indirect crisis exp. through crises (CC)	-0.0061**	-0.0067**	-0.0772*	-0.0852**	-0.0028	-0.0025
	(0.003)	(0.003)	(0.041)	(0.041)	(0.002)	(0.002)
# indirect non-crisis exp. through crises (CNC)	0.0034**	0.0037***	0.0405**	0.0437**	0.0017*	0.0018**
	(0.001)	(0.001)	(0.019)	(0.019)	(0.001)	(0.001)
# indirect crisis exp. through non-crises (NCC)	0.0004	0.0011	0.0024	0.0110	0.0029	0.0024
	(0.002)	(0.002)	(0.031)	(0.031)	(0.003)	(0.003)
# indirect non-crisis exp. through non-crises ($NCNC$)	-0.0009	-0.0009	-0.0014	-0.0010	-0.0005	-0.0004
	(0.001)	(0.001)	(0.005)	(0.005)	(0.000)	(0.000)
Bank equity/assets	0.0554***	0.0554***	0.0704	0.0706	0.0190***	0.0189***
	(0.007)	(0.007)	(0.045)	(0.045)	(0.004)	(0.004)
Bank size (log-assets)	0.0703***	0.0703***	0.7948***	0.7949***	-0.0905***	-0.0908***
	(0.012)	(0.012)	(0.147)	(0.147)	(0.022)	(0.022)
# direct crisis exp. to non-banks	-0.0020*	-0.0020*	-0.0144*	-0.0146*	-0.0003	-0.0003
	(0.001)	(0.001)	(0.008)	(0.008)	(0.000)	(0.000)
# direct non-crisis exp. to non-banks	0.0003	0.0004	0.0072	0.0082	0.0003	0.0004
	(0.000)	(0.000)	(0.005)	(0.005)	(0.001)	(0.001)
Other bank controls	Yes	Yes	Yes	Yes	Yes	Yes
Bank country×year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	14,450	14,450	14,447	14,447	14,317	14,317
R^2	0.441	0.441	0.346	0.346	0.630	0.630

Notes: In these bank profitability regressions, the dependent variables are bank ROA, ROE, and NIM, and the data are at the bank-year level during 1997–2012. The table presents a decomposition of direct crisis and non-crisis exposures into their stock and flow sub-components (see Section 5.1.2). Other bank controls refer to indicators for bank business model (commercial bank, investment bank, and other), entity type (subsidiary, global ultimate owner, and other) and a constant term (coefficients not shown). Standard errors are clustered at the bank level. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 5: Crisis Exposures and Bank Lending—Loan Shares and Spreads

	(1)	(2)	(3)	(4)	(5)	(6)
	All firms	All firms	All firms	All firms	All firms	All firms
Dependent variables:	**LOAN SHARE**			**LOAN SPREAD**		
# direct crisis exp. (C)	-0.0156*	-0.0462***	-0.0458***	0.0025***	0.0026***	0.0026***
	(0.009)	(0.011)	(0.011)	(0.000)	(0.000)	(0.000)
# direct non-crisis exp. (NC)	0.0269***	0.0129	0.0127	-0.0009***	-0.0012***	-0.0011***
	(0.008)	(0.010)	(0.009)	(0.000)	(0.000)	(0.000)
# indirect crisis exp. through crises (CC)		-0.0009	-0.0007		0.0003**	0.0002*
		(0.003)	(0.003)		(0.000)	(0.000)
# indirect non-crisis exp. through crises (CNC)		0.0152**	0.0150**		-0.0001**	-0.0001*
		(0.007)	(0.006)		(0.000)	(0.000)
# indirect exp. through non-crises ($NCC + NCNC$)		0.0035**	0.0034**		-0.0005**	-0.0005**
		(0.002)	(0.002)		(0.000)	(0.000)
Bank equity/assets	0.0091	-0.0022	-0.0015	0.0005	0.0006	0.0005
	(0.021)	(0.022)	(0.021)	(0.001)	(0.001)	(0.001)
Bank size (log-assets)	-0.0909	-0.1358	-0.1622	0.0146	0.0137	0.0129
	(0.395)	(0.380)	(0.380)	(0.011)	(0.011)	(0.011)
# direct crisis exp. to non-banks	-0.0010	0.0014	0.0011	0.0001	0.0001	0.0001
	(0.002)	(0.002)	(0.002)	(0.000)	(0.000)	(0.000)
# direct non-crisis exp. to non-banks	0.0023	0.0041*	0.0041*	-0.0000	-0.0001	-0.0000
	(0.002)	(0.002)	(0.002)	(0.000)	(0.000)	(0.000)
Other bank controls	Yes	Yes	Yes	Yes	Yes	Yes
Loan-level controls	Yes	Yes	Yes			
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank country×Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Borrower firm cluster×Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry SIC classification	1-digit	1-digit	2-digit	1-digit	1-digit	2-digit
Observations	318,619	318,619	318,457	134,011	134,011	133,930
R^2	0.553	0.554	0.559	0.476	0.476	0.493

Notes: This table presents bank lending regressions. In columns 1-3, the dependent variable is the loan share extended by a given bank to a given borrower in a given loan deal; and the data are at the loan share-bank-firm level during 1997–2012. Loan-level controls include the number of banks in the loan deal syndicate, and indicators for lead banks in the deal, credit lines, and deal currencies. In columns 4-6 the dependent variable is the (log) average loan spread on the loans extended by a given bank to a given borrower in a given year (weighted by loan volume); and the data are at the bank-firm-year level during 1997–2012. Other bank controls refer to indicators for bank business model (commercial bank, investment bank, other), entity type (subsidiary, global ultimate owner, other). Borrower firm clusters refer to all firms in the same country, industry (at the 1- or 2-digit SIC classification level), and risk category (investment grade or speculative grade). All regressions include a constant term (coefficients not shown). Standard errors are clustered at the bank level. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 6: Crisis Exposures and Lending—Heterogeneity by Firm Type, Location, Size, and Bank-Firm Relationship Intensity

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	All firms	Non-financial firms	Non-financial firms	Non-financial firms	All firms	Non-financial firms	Non-financial firms	Non-financial firms
Dependent variables:	**LOAN SHARE**				**LOAN SPREAD**			
# direct crisis exp. (C) × Non-financial firm [1]	-0.0556***				0.0035***			
	(0.011)				(0.000)			
# direct crisis exp. (C) × Financial firm [2]	0.0646				0.0033			
	(0.079)				(0.031)			
# direct crisis exp. (C) × Domestic firm [1]		-0.0127				0.0011**		
		(0.012)				(0.001)		
# direct crisis exp. (C) × Foreign firm [2]		-0.0469***				0.0029***		
		(0.011)				(0.001)		
# direct crisis exp. (C) × Small firm [1]			-0.0412***				0.0043***	
			(0.009)				(0.001)	
# direct crisis exp. (C) × Large firm [2]			-0.0107				0.0008	
			(0.012)				(0.001)	
# direct crisis exp. (C) × Peripheral borrower [1]				-0.0279**				0.0029***
				(0.011)				(0.001)
# direct crisis exp. (C) × Core borrower [2]				-0.0333***				0.0005
				(0.012)				(0.001)
# direct non-crisis exp. (NC)	0.0147**	0.0081*	0.0078*	0.0074	-0.0010***	-0.0013***	-0.0014***	-0.0015***
	(0.007)	(0.005)	(0.005)	(0.005)	(0.000)	(0.000)	(0.000)	(0.000)
# indirect crisis exp. through crises (CC)	-0.0009	-0.0008	-0.0009	-0.0009	0.0002*	0.0003**	0.0003**	0.0003**
	(0.003)	(0.003)	(0.002)	(0.003)	(0.000)	(0.000)	(0.000)	(0.000)
# indirect non-crisis exp. through crises (CNC)	0.0149	0.0127	0.0141	0.0148	-0.0001	-0.0001*	-0.0001**	-0.0001**
	(0.010)	(0.010)	(0.010)	(0.010)	(0.000)	(0.000)	(0.000)	(0.000)
# indirect exp. through non-crises ($NCC + NCNC$)	0.0032**	0.0022	0.0023	0.0024	-0.0005**	-0.0004*	-0.0005**	-0.0004*
	(0.002)	(0.002)	(0.001)	(0.002)	(0.000)	(0.000)	(0.000)	(0.000)
p-value test Ho: coeff [1]=coeff [2]	0.0382	0.0024	0.0001	0.7433	0.0000	0.0000	0.0000	0.0000
Bank size and capital	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Other bank controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank exposures to non-banks	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Loan-level controls	Yes	Yes	Yes	Yes				
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank country×Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Borrower firm cluster×Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	318,619	294,604	294,604	294,604	134,011	120,361	120,361	120,361

Notes: This table explores heterogeneity in bank lending regression results by firm type and bank-firm relationship type. All definitions and controls as in Table 5. Borrower firm clusters use 1-digit industry SIC codes. All regressions include a constant term (coefficients not shown). Standard errors are clustered at the bank level. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 7: Crisis Exposures and Lending—Shock Transmission to Third Countries

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	All firms	Non-financial firms	Non-financial firms	Non-financial firms	All firms	Non-financial firms	Non-financial firms	Non-financial firms
Dependent variables:	**LOAN SHARE**				**LOAN SPREAD**			
# direct crisis exp. (C) × Non-financial firm [1]	-0.0713***				0.0028***			
	(0.015)				(0.001)			
# direct crisis exp. (C) × Financial firm [2]	-0.0096				0.0042			
	(0.050)				(0.041)			
# direct crisis exp. (C) × Domestic firm [1]		-0.0191*				0.0009		
		(0.011)				(0.001)		
# direct crisis exp. (C) × Foreign firm [2]		-0.0647***				0.0025***		
		(0.012)				(0.001)		
# direct crisis exp. (C) × Small firm [1]			-0.0524***				0.0049***	
			(0.010)				(0.001)	
# direct crisis exp. (C) × Large firm [2]			-0.0245**				-0.0003	
			(0.012)				(0.001)	
# direct crisis exp. (C) × Peripheral borrower [1]				-1.2670***				0.0029***
				(0.316)				(0.001)
# direct crisis exp. (C) × Core borrower [2]				-0.8514***				0.0013*
				(0.037)				(0.001)
# direct non-crisis exp. (NC)	0.0284***	0.0219***	0.0202***	0.0404***	-0.0008***	-0.0013***	-0.0012***	-0.0013***
	(0.009)	(0.007)	(0.007)	(0.014)	(0.000)	(0.000)	(0.000)	(0.000)
# indirect crisis exp. through crises (CC)	0.0059	0.0048	0.0044	-0.0418***	0.0003**	0.0006***	0.0006***	0.0006***
	(0.005)	(0.004)	(0.004)	(0.011)	(0.000)	(0.000)	(0.000)	(0.000)
# indirect non-crisis exp. through crises (CNC)	0.0030	0.0012	0.0015	0.0047	0.0000	-0.0000	-0.0000	-0.0001
	(0.002)	(0.002)	(0.002)	(0.004)	(0.000)	(0.000)	(0.000)	(0.000)
# indirect exp. through non-crises ($NCC + NCNC$)	0.0191*	0.0191*	0.0204*	0.0193***	-0.0009***	-0.0011***	-0.0012***	-0.0011***
	(0.012)	(0.012)	(0.012)	(0.007)	(0.000)	(0.000)	(0.000)	(0.000)
p-value test Ho: coeff [1]=coeff [2]	0.0000	0.0002	0.0093	0.9373	0.0000	0.0062	0.0000	0.0000
Bank size and capital	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Other bank controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank exposures to non-banks	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Loan-level controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes				
Bank country×Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Borrower firm cluster×Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	263,155	240,970	240,970	240,970	101,710	89,031	89,031	89,031
R^2	0.580	0.556	0.556	0.556	0.452	0.433	0.434	0.434

Notes: This table explores crisis transmission through cross-border interbank exposures to third countries, by dropping bank-firm pairs for which firms are located in crisis origin countries. All variables and definitions as in Table 5. Borrower firm clusters use 1-digit industry SIC codes. All regressions include a constant term (coefficients not shown). Standard errors are clustered at the bank level. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 8: Banks' Crisis Exposures and Firms' Real Outcomes

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent variables:	**INVESTMENT RATIO**				**ASSET GROWTH**			
# direct crisis exp. (C)	-0.0216**				-0.1129**			
	(0.008)				(0.034)			
# direct crisis exp. (C)×Small firm [1]		-0.0349*	-0.0431**	-0.0341***		-0.1278**	-0.1498**	-0.1123*
		(0.016)	(0.018)	(0.007)		(0.053)	(0.053)	(0.052)
# direct crisis exp. (C)×Large firm [2]		-0.0117	-0.0228*	-0.0298***		-0.1018**	-0.1124*	-0.0905
		(0.010)	(0.011)	(0.007)		(0.041)	(0.054)	(0.052)
# direct non-crisis exp. (NC)	-0.0089	-0.0096	-0.0056	-0.0051	-0.0469	-0.0476	-0.0031	-0.0036
	(0.007)	(0.007)	(0.005)	(0.005)	(0.040)	(0.041)	(0.032)	(0.024)
# indirect crisis exp. through crises (CC)			-0.0133	-0.0071			0.0357	0.0493
			(0.017)	(0.013)			(0.063)	(0.055)
# indirect non-crisis exp. through crises (CNC)			0.0093	0.0075			-0.0022	-0.0065
			(0.008)	(0.007)			(0.028)	(0.029)
# indirect exp. through non-crises ($NCC + NCNC$)			-0.0016	-0.0012			-0.0123	-0.0127
			(0.002)	(0.002)			(0.009)	(0.010)
Bank equity/assets	-0.0025	-0.0023	0.0011	0.0018	-0.0145	-0.0143	-0.0147	0.0016
	(0.011)	(0.010)	(0.009)	(0.005)	(0.025)	(0.028)	(0.034)	(0.044)
Bank size (log-assets)	0.1297*	0.1314*	0.1422*	0.0986	0.1065	0.1085	0.0246	-0.1686
	(0.066)	(0.065)	(0.067)	(0.083)	(0.658)	(0.656)	(0.654)	(0.415)
# direct crisis exp. to non-banks	0.0012	0.0011	0.0004	-0.0001	0.0117	0.0116*	0.0093	0.0093
	(0.002)	(0.002)	(0.001)	(0.001)	(0.007)	(0.006)	(0.007)	(0.008)
# direct non-crisis exp. to non-banks	0.0005	0.0007	0.0010	0.0007	0.0066	0.0068	0.0100	0.0127*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.007)	(0.007)	(0.007)	(0.005)
Firm's Tobin's q	0.0177***	0.0176***	0.0177***	0.0177***	0.1109***	0.1108***	0.1106***	0.1110***
	(0.003)	(0.002)	(0.002)	(0.002)	(0.009)	(0.010)	(0.011)	(0.009)
Firm's cash flow-to-assets	0.0093	0.0088	0.0085	0.0115	0.1888**	0.1883**	0.1873**	0.2146***
	(0.008)	(0.008)	(0.008)	(0.014)	(0.060)	(0.062)	(0.067)	(0.047)
Firm's size (log-assets)	-1.4364***	-1.4622***	-1.4500***	-1.6246***	-25.1019***	-25.1307***	-25.1485***	-26.3104***
	(0.093)	(0.096)	(0.097)	(0.165)	(0.992)	(1.030)	(1.029)	(1.109)
p-value t-test coeff. [1]> coeff. [2] (in abs. value)		0.090	0.104	0.176		0.000	0.000	0.000
Lender banks' other controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm country×Industry×Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry SIC classification	1-digit	1-digit	1-digit	2-digit	1-digit	1-digit	1-digit	2-digit
Observations	10,151	10,151	10,151	9,389	10,148	10,148	10,148	9,386
R^2	0.827	0.827	0.827	0.843	0.583	0.583	0.584	0.609

Notes: This table explores the real effects of crisis transmission through cross-border asset-side interbank exposures using data at the firm-year level during 1997–2012. In columns 1-4 the dependent variable is the firm-level investment ratio (capex/lagged assets) and in columns 5-8 it is firm-level asset growth. "Lender banks' other controls' include lender banks' business model (commercial bank, investment bank, and other) and entity type (subsidiary, global ultimate owner, other). All regressions include a constant term (coefficients not shown). Standard errors are clustered at the firm level. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 9: Robustness—Control for Real Linkages in Bank Lending Regressions

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	All firms	All firms	All firms	All firms	All firms	All firms	All firms	All firms
Dependent variables:	**LOAN SHARE**		**LOAN SPREAD**		**LOAN SHARE**		**LOAN SPREAD**	
					All banks	Matched banks	All banks	Matched banks
# direct crisis exp. (C)	-0.0459***	-0.0346***	0.0021***	0.0022***	-0.0458***	-0.0371**	0.0026***	0.0035***
	(0.013)	(0.010)	(0.000)	(0.001)	(0.013)	(0.017)	(0.000)	(0.001)
# direct non-crisis exp. (NC)	0.0082*	0.0093	-0.0001	-0.0001*	0.0096**	-0.0018	-0.0011***	-0.0022***
	(0.004)	(0.006)	(0.000)	(0.000)	(0.005)	(0.005)	(0.000)	(0.000)
# indirect crisis exp. through crises (CC)	0.0025	-0.0017	0.0003***	0.0002	0.0030	-0.0026	0.0002*	-0.0002
	(0.003)	(0.003)	(0.000)	(0.000)	(0.003)	(0.004)	(0.000)	(0.000)
# indirect non-crisis exp. through crises (CNC)	0.0096	0.0156	-0.0007***	-0.0012***	0.0091	0.0177	-0.0001*	-0.0001
	(0.008)	(0.010)	(0.000)	(0.000)	(0.008)	(0.017)	(0.000)	(0.000)
# indirect exp. through non-crises ($NCC + NCNC$)	0.0027*	0.0028*	-0.0007***	-0.0005**	0.0028**	0.0052**	-0.0005**	0.0003
	(0.001)	(0.002)	(0.000)	(0.000)	(0.001)	(0.003)	(0.000)	(0.000)
CONTROLS FOR REAL LINKAGES:								
Log(total trade) with C countries	-0.2192		-0.0039					
	(0.134)		(0.004)					
Log(total trade) with NC countries	-0.6611		0.0208					
	(0.554)		(0.017)					
Log($ bank presence in C countries)					-0.0866	-0.2455**	0.0059***	0.0050**
					(0.139)	(0.105)	(0.002)	(0.003)
Log($ bank presence in NC countries)					0.0154	-0.0752	0.0075***	0.0045**
					(0.104)	(0.072)	(0.001)	(0.002)
Bank capital and size	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Other bank controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank exposures to non-banks	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Loan-level controls	Yes	Yes			Yes	Yes		
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank country×Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Borrower firm cluster×Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country-pair×Year FE		Yes		Yes				
Observations	297,490	314,148	119,806	130,431	318,820	149,609	134,110	54,642
R^2	0.550	0.589	0.468	0.495	0.550	0.603	0.476	0.429

Notes: The lending regressions in this table account for cross-border real linkages in three different ways: (a) by including the (log) value of total bilateral trade between the bank's country on the one hand, and crisis and non-crisis countries on the other hand (columns 1, 3) (a bank country-level variable); (b) by including country-pair×year FE to account for unobserved time-varying bilateral linkages (columns 2, 4); and (c) by controlling for banks' presence in foreign markets with the (log) value of total bank mergers with and acquisitions of financial firms in crisis and non-crisis countries (a bank-level variable) (columns 5-8). All variables and definitions as in Table 5. Borrower firm clusters use 1-digit industry SIC codes. Summary statistics for measures of real linkages are shown in Section A-II.3. All regressions include a constant term (coefficients not shown). Standard errors are clustered at the bank level. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 10: Robustness—Control for Real Linkages in Bank Profitability Regressions

	(1)	(2)	(3)
Dependent variables:	**ROA**	**ROE**	**NIM**
# direct crisis exp. (C)	-0.0235***	-0.2267*	-0.0259***
	(0.009)	(0.118)	(0.009)
# direct non-crisis exp. (NC)	0.0013	-0.0154	-0.0008
	(0.002)	(0.025)	(0.003)
# indirect crisis exp. through crises (CC)	-0.0075***	-0.0982**	-0.0033
	(0.003)	(0.042)	(0.002)
# indirect non-crisis exp. through crises (CNC)	0.0040***	0.0488**	0.0023**
	(0.001)	(0.019)	(0.001)
# indirect crisis exp. through non-crises (NCC)	0.0009	0.0057	0.0016
	(0.002)	(0.033)	(0.002)
# indirect non-crisis exp. through non-crises (NCNC)	-0.0008*	0.0002	-0.0006
	(0.000)	(0.005)	(0.000)
CONTROLS FOR REAL LINKAGES:			
Log($ bank presence in C countries)	-0.0314*	-0.3478*	-0.0469**
	(0.019)	(0.205)	(0.022)
Log($ bank presence in NC countries)	0.0148*	0.0344	0.0653***
	(0.008)	(0.088)	(0.017)
Bank capital and size	Yes	Yes	Yes
Other bank controls	Yes	Yes	Yes
Bank exposures to non-banks	Yes	Yes	Yes
Bank country×year FE	Yes	Yes	Yes
Observations	14,448	14,445	14,135
R^2	0.429	0.329	0.641

Notes: The profitability regressions in this table account for cross-border real linkages by controlling for the (log) value of total bank mergers with and acquisitions of financial firms in crisis and non-crisis countries, as a proxy for banks' presence in foreign markets. These regressions include all banks from the profitability sample (baseline Table 3). Other bank controls refer to indicators for bank business model (commercial bank, investment bank, other) and entity type (subsidiary, global ultimate owner, other). All variables and definitions as in Table 3. Summary statistics for measures of real linkages are shown in Section A-II.3. All regressions include a constant term (coefficients not shown). Standard errors are clustered at the bank level. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 11: Shock Transmission through Liability-side Network

Dependent variables:	(1) **ROA**	(2) **ROE**	(3) **NIM**	(4) **LOAN SHARE**	(5) **LOAN SPREAD**
	Panel A. Include only liability-side exposures				
LIABILITY-SIDE EXPOSURES					
# direct crisis exp. (C)	-0.0051	-0.0361	-0.0003	-0.0205	0.0014
	(0.005)	(0.051)	(0.005)	(0.044)	(0.001)
# direct non-crisis exp. (NC)	-0.0021	-0.0096	-0.0036	0.0106	-0.0002
	(0.002)	(0.021)	(0.004)	(0.012)	(0.001)
Observations	14,448	14,445	14,445	318,619	134,011
R^2	0.427	0.328	0.639	0.553	0.475
	Panel B. Include both asset- and liability-side exposures				
ASSET-SIDE EXPOSURES					
# direct crisis exp. (C)	-0.0215**	-0.2124*	-0.0242***	-0.0320**	0.0026***
	(0.008)	(0.110)	(0.008)	(0.014)	(0.000)
# direct non-crisis exp. (NC)	0.0014	-0.0148	-0.0009	0.0192***	-0.0012***
	(0.002)	(0.024)	(0.003)	(0.007)	(0.000)
# indirect crisis exp. through crises (CC)	-0.0075***	-0.0983**	-0.0032	-0.0043*	0.0003**
	(0.003)	(0.043)	(0.002)	(0.003)	(0.000)
# indirect non-crisis exp. through crises (CNC)	0.0049***	0.0491**	0.0029***	-0.0064	-0.0001**
	(0.002)	(0.021)	(0.001)	(0.008)	(0.000)
# indirect exp. through non-crises ($NCC + NCNC$)	-0.0008*	0.0003	-0.0005	0.0056***	-0.0005**
	(0.000)	(0.005)	(0.000)	(0.001)	(0.000)
LIABILITY-SIDE EXPOSURES					
# direct crisis exp. (C)	-0.0050	-0.0348	-0.0001	-0.0117	0.0013
	(0.005)	(0.051)	(0.005)	(0.041)	(0.001)
# direct non-crisis exp. (NC)	-0.0020	-0.0078	-0.0034	0.0046	-0.0002
	(0.002)	(0.021)	(0.004)	(0.012)	(0.001)
Bank capital and size	Yes	Yes	Yes	Yes	Yes
Other bank controls	Yes	Yes	Yes	Yes	Yes
Bank exposures to non-banks	Yes	Yes	Yes	Yes	Yes
Loan-level controls				Yes	
Bank FE				Yes	Yes
Bank country×Year FE	Yes	Yes	Yes	Yes	Yes
Borrower firm cluster×Year FE				Yes	Yes
Observations	14,448	14,445	14,135	318,619	134,011
R^2	0.428	0.329	0.639	0.554	0.476

Notes: This table explores the impact of crisis exposures through the liability-side network. In Panel A we show the results from the baseline profitability and lending regressions where we replace the asset-side exposures with liability-side exposures (both direct and indirect), with all the controls. In Panel B we show baseline profitability and lending regressions in which we add liability-side exposures to crisis and non-crisis countries while simultaneously controlling for asset-side exposures. In the lending regressions of columns 4-5, borrower firm clusters use 1-digit industry SIC codes. Data structure, other bank controls (dummies for lender business model and entity type), and the clustering of standard errors are the same as in the baseline regressions (Tables 3 and 5). Summary statistics for liability-side interbank exposures are shown in Section A-II.3. All regressions include a constant term (coefficients not shown). * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 12: Heterogeneity by Size of Interbank Exposures

Dependent variables:	(1) **ROA**	(2) **ROE**	(3) **NIM**	(4) **LOAN SHARE**	(5) **LOAN SPREAD**
\$-value direct crisis exp. (C)	-0.0924***	-1.2369***	-0.0569**	-0.0938†	0.0052***
	(0.023)	(0.396)	(0.026)	(0.064)	(0.002)
\$-value direct non-crisis exp. (NC)	0.0154	0.1236**	-0.0009	0.0360***	-0.0094**
	(0.011)	(0.050)	(0.003)	(0.012)	(0.003)
\$-value indirect crisis exp. through crises (CC)	0.0053	-0.0006	0.0060	-0.0388***	0.0002
	(0.010)	(0.114)	(0.009)	(0.013)	(0.000)
\$-value indirect non-crisis exp. through crises (CNC)	-0.0060	0.0076	-0.0012	0.0652**	0.0002
	(0.012)	(0.113)	(0.011)	(0.027)	(0.000)
\$-value indirect exp. through non-crises ($NCC + NCNC$)	0.0002	-0.0083	-0.0037***	0.1399	-0.0002
	(0.000)	(0.005)	(0.000)	(0.112)	(0.000)
Bank capital and size	Yes	Yes	Yes	Yes	Yes
Other bank controls	Yes	Yes	Yes	Yes	Yes
Bank exposures to non-banks	Yes	Yes	Yes	Yes	Yes
Loan-level controls				Yes	
Bank FE				Yes	Yes
Bank country×Year FE	Yes	Yes	Yes	Yes	Yes
Borrower firm cluster×Year FE				Yes	Yes
Observations	14,448	14,445	14,135	318,619	134,011
R^2	0.433	0.331	0.639	0.553	0.475

Notes: This table explores heterogeneity in the main baseline results by dollar value of cross-border interbank exposures. We measure total direct and indirect exposures to banks in C and NC countries as the dollar value of exposures scaled by banks' total assets. In columns 4-5, borrower firm clusters use 1-digit industry SIC codes. Data structure, other controls (dummies for lender business model and entity type), and the clustering of standard errors are all as in the baseline regressions (Tables 3 and 5). Summary statistics for the asset-side dollar exposures (% total bank assets) are shown in Section A-II.3. All regressions include a constant term (coefficients not shown). † significant at 15%; * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 13: Heterogeneity by Crisis Intensity

Dependent variables:	(1) **ROA**	(2) **ROE**	(3) **NIM**	(4) **LOAN SHARE**	(5) **LOAN SPREAD**
# direct exp. to high-cost crises (C) [1]	-0.0385***	-0.3889*	-0.0254*	-0.2814***	0.0021***
	(0.015)	(0.213)	(0.014)	(0.085)	(0.001)
# direct exp. to low-cost crises (C) [2]	0.0054	-0.0374	0.0076	-0.0134	-0.0005
	(0.009)	(0.123)	(0.010)	(0.023)	(0.003)
p-value t-test Ho: coeff. [1] > coeff. [2] (in abs. value)	0.422	0.440	0.365	0.294	0.638
Bank capital and size	Yes	Yes	Yes	Yes	Yes
Other bank controls	Yes	Yes	Yes	Yes	Yes
Bank exposures to non-banks	Yes	Yes	Yes	Yes	Yes
Loan-level controls				Yes	
Bank FE				Yes	Yes
Bank country×Year FE	Yes	Yes	Yes	Yes	Yes
Borrower firm cluster×Year FE				Yes	Yes
Observations	14,213	14,211	13,897	318,619	134,011
R^2	0.428	0.329	0.639	0.554	0.475

Notes: This table explores heterogeneity in the main baseline results by crisis intensity. Crisis intensity is measured as the first principal component of all the crisis cost indicators in the Laeven and Valencia (2013) database (see Section 6.2 for details and footnote 35 for full list of crisis indicators). Crises are split into high/low-severity crises as above/below median value of the first principal component. Then, for each bank-year, we calculate separately the # of direct exposures to banks in high-cost crisis countries and low-cost crisis countries. We also report the p-value for a one-sided t-test of the null hypothesis that cross-border interbank exposures to high-cost crises have a greater impact on bank profitability and lending decisions than do interbank exposures to low-cost crises. All regressions control for direct NC exposures to banks, indirect C and NC exposures to banks, and direct C and NC exposures to non-banks. In columns 4-5, borrower firm clusters use 1-digit industry SIC codes. Data structure, other bank controls (dummies for lender business model and entity type), and the clustering of standard errors are the same as in the baseline regressions (Tables 3 and 5). A constant term is included (coefficients not shown). * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 14: Heterogeneity by Bank Business Model

Dependent variables:	(1) **ROA**	(2) **ROE**	(3) **NIM**	(4) **LOAN SHARE**	(5) **LOAN SPREAD**
# direct crisis exp. (C) × Major lender [1]	-0.0319***	-0.3111*	-0.0360***	-0.0467***	0.0037***
	(0.011)	(0.164)	(0.011)	(0.010)	(0.001)
# direct crisis exp. (C) × Major borrower [2]	-0.0119	-0.1145	-0.0146	-0.1517	-0.0059
	(0.010)	(0.121)	(0.011)	(0.122)	(0.006)
# direct crisis exp. (C) × Other	-0.1344	-0.7524	0.0210	-0.0440***	0.0018***
	(0.124)	(1.154)	(0.173)	(0.015)	(0.001)
p-value t-test Ho: coeff. [1] > coeff. [2] (in abs. value)	0.628	0.700	0.646	0.177	0.494
Bank capital and size	Yes	Yes	Yes	Yes	Yes
Other bank controls	Yes	Yes	Yes	Yes	Yes
Bank exposures to non-banks	Yes	Yes	Yes	Yes	Yes
Loan-level controls				Yes	
Bank FE				Yes	Yes
Bank country×Year FE	Yes	Yes	Yes	Yes	Yes
Borrower firm cluster×Year FE				Yes	Yes
Observations	14,448	14,445	14,135	318,619	134,011
R^2	0.428	0.329	0.639	0.555	0.476

Notes: This table explores heterogeneity in the main baseline results by bank business model. Banks are split into major lenders (with above-median asset-side interbank exposures as a share of total assets over the sample period 1990-2012); major borrowers (with above-median liability-side interbank exposures as a share of non-deposit liabilities over the sample period); and all remaining (other) banks. This approach allows us to include spline terms for our key # of direct crisis exposures (C) variable for banks that fall into these three categories. In columns 4-5, borrower firm clusters use 1-digit industry SIC codes. Data structure, other bank controls (dummies for lender business model and entity type), and the clustering of standard errors are the same all as in the baseline regressions (Tables 3 and 5). All regressions include a constant term (coefficients not shown). * significant at 10%; ** significant at 5%; *** significant at 1%.

Internet Appendix (not for publication)

A-I Shock transmission mechanism

Here we show how a simple shock transmission mechanism gives rise to our specifications. Assume that bank performance can be measured by Y, and let the exposure of bank i to bank j_1 be denoted by E_{ij_1}, where E is an indicator for the presence of an exposure. Let Cr_i denote an indicator for a financial crisis in the country of bank i and X_i denote the (1×K) matrix of bank i's K characteristics. We hypothesize that the returns of bank i can be written as follows (omitting the time subscript for simplicity):

$$Y_i = \alpha + X_i\beta + \lambda Cr_i + \gamma \sum_{j_1} E_{ij_1} Y_{j_1} \tag{1}$$

Note that the performance of bank i, Y_i, is a function of its own characteristics, X_i and Cr_i, and the performance of the banks (j_1s) to which it is exposed.[38] Equation 1 can be expanded infinitely and simplifies to:

$$\begin{aligned} Y_i = {} & \alpha + X_i\beta + \lambda Cr_i + \gamma \sum_{j_1} E_{ij_1}\alpha + \gamma \sum_{j_1} E_{ij_1} X_{j_1}\beta + \gamma \sum_{j_1} E_{ij_1}\lambda Cr_{j_1} \\ & + \gamma^2 \sum_{j_1}\sum_{j_2} E_{ij_1}E_{j_1j_2}\alpha + \gamma^2 \sum_{j_1}\sum_{j_2} E_{ij_1}E_{j_1j_2}X_{j_2}\beta + \gamma^2 \sum_{j_1}\sum_{j_2} E_{ij_1}E_{j_1j_2}\lambda Cr_{j_2} + ... \\ & + \gamma^n \sum_{j_1} ... \sum_{j_n} E_{ij_1}E_{j_1j_2}...E_{j_{n-1}j_n}\alpha + \gamma^n \sum_{j_1} ... \sum_{j_n} E_{ij_1}E_{j_1j_2}...E_{j_{n-1}j_n}X_{j_n}\beta + \\ & + \gamma^n \sum_{j_1} ... \sum_{j_n} E_{ij_1}E_{j_1j_2}...E_{j_{n-1}j_n}\lambda Cr_{j_n} \end{aligned} \tag{2}$$

where j_1 represents the direct (first-degree) connections of bank i, j_2 represents the indirect (second-degree) connections of bank i etc., and n is the highest-degree (indirect) connection of bank i. Note that the union of the sets of first-degree connections of all j_1 banks corresponds to the set of second-degree connections of bank i. Equation 2 shows how the performance of bank i depends on its direct and indirect exposures to borrowers in all countries, and especially in countries that are experiencing banking crises.

Based on Equation 2, a complete empirical specification would link measures of bank performance

[38] Empirical tests of Equation 1 that regress bank profitabilty (ROA, ROE, NIM) on average bank profitability of counterparty banks deliver statistically significant coefficients on average counterparty bank profitability at the conventional levels, controlling for bank variables (capital, size, and dummies for bank business model and entity type) as well as bank country and year fixed effects.

to bank controls, an indicator for the location of a bank in a country experiencing a banking crisis, the bank's first, second, and higher-degree exposures, and the characteristics of all counterparty banks. The coefficient γ^n decays exponentially and hence drastically reduces the potential impact of higher-degree connections. For this reason, in the implementation of Equation 2 we include only first and second-degree exposures.[39]

Adding subscripts for time t and bank country h, and allowing constant α to vary by bank country and year (α_{ht}), the most complete specifications are as follows:

$$Y_{it} = \alpha_{ht} + X_{it}\beta_0 + \sum_{j_1} E_{ij_1t}X_{j_1t}\beta_1 + \lambda_1 \sum_{j_1} E_{ij_1t}Cr_{j_1t} + \mu_1 \sum_{j_1} E_{ij_1t}NCr_{j_1t}$$
$$+ \sum_{j_1}\sum_{j_2} E_{ij_1t}E_{j_1j_2t}X_{j_2t}\beta_2 + \lambda_2 \sum_{j_1}\sum_{j_2} E_{ij_1t}E_{j_1j_2t}Cr_{j_2t} + \mu_2 \sum_{j_1}\sum_{j_2} E_{ij_1t}E_{j_1j_2t}NCr_{j_2t} + \varepsilon_{it}, \tag{3}$$

where X_{it} is a vector of bank characteristics, Cr_{jt} is a dummy variable that takes value 1 if country j has a crisis in year t, and NCr_{jt} is a dummy variable that takes value 1 if country j does not have a crisis in year t. Subsequent terms refer to bank-level control variables and the number of bank borrowers in countries with systemic banking crises to which bank i is exposed through its first- and second-degree connections. To arrive at this specification, observe that $\lambda_1 = \gamma(\alpha + \lambda)$, $\mu_1 = \gamma\alpha$, $\lambda_2 = \gamma^2(\alpha+\lambda)$, $\mu_2 = \gamma^2\alpha$ from Equation 1 above. However, in estimating these coefficients separately, we relax the assumption of exponential decay with increased exposure distance. All variables enter the regressions contemporaneously.

When we estimate Equation 3 above we find that the characteristics of counterparty banks yield coefficients that are jointly statistically insignificant under most specifications. Therefore, we estimate parsimonious specifications without these characteristics, but our regression results are robust to their inclusion. (See Table A1 for bank profitability regressions that control for these characteristics.)

[39] There are no estimates on the size of γ in interbank networks, but we can take some cues from the literature on shock propagation in production networks. Most models of production networks predict that the impact of firm-level shocks attenuates rapidly as they travel through production chains further from the source (Acemoglu, Carvalho, Ozdaglar and Tahbaz-Salehi, 2012), consistent with empirical evidence from the Great East Japan earthquake (Carvalho, Nirei, Saito and Tahbaz-Salehi, 2016). In the presence of additional financial frictions, Wu (2017) shows that "network effects" after firm-level shocks in the U.S. are persistent up to four connections away from the origins.

A-II Data Description

A-II.1 Dealogic Loan Analytics and Bankscope

To construct our bank-level dataset on cross-border interbank exposures and bank characteristics, we proceed as follows:

- Step 1. We download data on 170,274 individual loan deals signed between January 1990 and December 2012 from Dealogic's Loan Analytics. To construct the cross-border *interbank* exposures, we retain only the 16,526 loans extended from banks to banks. We drop the deals for which the lender is recorded as "unknown", "undisclosed syndicate", or "undisclosed investor (unknown)", as well as a small number of intra-group deals and deals that involve multiple borrowers (representing less than 1% of the sample). We also drop deals with missing maturity information and deals from lenders that are located in territories without an International Financial Statistics (IFS) code, namely Guernesey, Isle of Man, Jersey, and occupied Palestinian Territory. For lender country we use the variable "lender nationality" as reported in Dealogic Loan Analytics; for borrower country we use the variable "deal nationality" after checking that the variable is correct by comparing banks that appear both as borrowers and lenders. We drop lenders that are classified as investment managers, special purpose vehicles, development banks, multilateral agencies, and miscellaneous. Bank borrowers are identified using the general industry group "Finance" and the sub-classifications commercial and savings banks, provincial banks, municipal banks, savings and loans, and investment banks.

- Step 2. Given that some bank names are recorded in Dealogic Loan Analytics with typos, or they refer to banks that have changed their name over time, or have been acquired by or merged with other banks, we clean up the bank names in preparation for merging with Bankscope (Bureau van Dijk) as follows:

  - If a bank changed its name during 1990-2012, we retain its Bankscope name (as of end-2012) throughout the sample period.
  - If two or more banks merged during the sample period to form a new bank, they are kept as distinct banks until the year of the merger and cease to exist after the merger; the bank resulting from the merger is kept subsequent to the merger.

  - If a bank was acquired by another bank, it appears as a distinct bank until the year of the acquisition.
  - Lending from multiple branches of the same bank in a foreign country is aggregated.
  - Lending from off-shore branches of a bank is aggregated.

- Step 3. After cleaning the bank names, we hand-match all the banks on a locational basis, by name and country, with balance sheet data from Bankscope. We use various sources to learn the institutional history of banks and make correct matches, including banks' corporate websites, the Federal Reserve Board National Information Center website and Bloomberg Businessweek. We treat subsidiaries and branches for which balance sheet information is available in Bankscope as distinct entities and do not link them to parent financials.

We construct cross-border exposures for the 6,083 banks that appear as lenders or borrowers in the interbank loans granted during 1990-2012. After merging these banks with financial statement information from Bankscope, and removing banks with missing data, we are left with 1,869 banks. Then we construct cross-border interbank exposures using information on lender and borrower identity, loan amount, and loan maturity. We treat loans as non-amortizing bullet loans. We use the same approach to construct cross-border exposures for each bank-borrower pair where borrowers are banks or non-banks (i.e., non-financial firms or sovereigns). In network terminology, we do not allow cycles in the computation of second-degree exposures.

In the empirical analysis we use the *number* of crisis and non-crisis exposures as opposed to their dollar value to limit measurement error. For the specifications that require loan shares, we use the actual shares as reported when available. When loan shares are not available, we estimate them following the regression-based approaches based on de Haas and van Horen (2013) and Kapan and Minoiu (2018). Specifically, we predict them on the basis of a regression model that is estimated on the sample of loans with reported shares. The dependent variable is the loan share and the regressors are loan amount (log), syndicate size, and dummies for loan currency, firm country, firm industry, bank role (lead vs. non-lead), bank country, and year:quarter. The model has an adjusted R^2 of close to 75%. The results are robust to the approach of Duchin and Sosyura (2014), in which missing shares are imputed as follows: for lead banks, we use the mean share of the lead bank in the sample of loans with reported shares and for simple participants we split the remainder of the loan in equal shares.

A-II.2 Orbis Zephyr

The Orbis Zephyr database of mergers and acquisitions (M&A) is a comprehensive source of deal information offered by Bureau van Dijk (BvD). It reports detailed information on individual M&A deals, including the identity, location, and industry of the acquiror firm, those of the target firms, and deal-level characteristics (deal status, type, value, currency, etc.). For our analysis, we download information on all financial sector deals signed during 1995–2012 (where the target is a financial sector firm, with 4-digit SIC code between 6000 and 6799). Our starting year is 1995 as the database is very sparsely populated prior to 1995 (there are only 28 deals during 1986–1994). We keep completed deals (that is, we drop withdrawn, postponed, pending, unconditional, and announced deals). We remove deals with missing or "undisclosed investor" information on acquiror and target names. We further retain deal types such as majority stake acquisitions, minority stake acquisitions (with stake of at least 5%), and mergers. For simplicity we ignore demergers, which only represent 0.45% of the sample. Then we match acquirors in Orbis Zephyr with banks in our profitability and lending datasets, using the BvD ID number, a common identifier across BvD databases. For unmatched banks we perform additional exact (string) matches based on bank name and country. The matched sample for our lending regressions comprises 564 banks out of almost 1,200 banks; and for our profitability regressions it comprises 751 banks out of 1,869 banks.

A-II.3 Additional Descriptive Statistics

	N	Mean	St. Dev.	Min	Max
A. REAL LINKAGES					
Log(total trade with C countries)	297,490	3.806	5.17	0.00	14.26
Log(total trade with NC countries)	297,490	13.772	0.81	7.97	15.14
Log(\$ bank presence in C countries)	149,609	1.101	2.73	0.00	11.97
Log(\$ bank presence in NC countries)	149,609	2.495	3.37	0.00	10.98
B. OTHER CROSS-BORDER EXPOSURES					
Liability-side exposures					
# direct crisis exp. (C)	14,448	1.257	4.84	0	75
# direct non-crisis exp. (NC)	14,448	1.348	7.90	0	171
Asset-side \$ exposures (% assets)					
\$-value direct crisis exp. (C)	14,448	0.03	0.52	0.00	40.43
\$-value direct non-crisis exp. (NC)	14,448	0.51	3.90	0.00	100.00
\$-value indirect crisis exp. through crises (CC)	14,448	0.12	2.24	0.00	100.00
\$-value indirect non-crisis exp. through crises (CNC)	14,448	0.17	2.68	0.00	100.00
\$-value indirect exp. through non-crises ($NCC + NCNC$)	14,448	1.46	8.24	0.00	100.00

Notes: The table reports descriptive statistics for additional regression variables in the lending and profitability datasets. *Data sources*: Bankscope, Dealogic Loan Analytics, U.N. Comtrade International Trade Statistics, Orbis Zephyr, Laeven and Valencia (2013).

A-III Additional Tables

Table A1: Crisis Exposures and Bank Profitability–Controlling for the Characteristics of Counterparty Banks

Dependent variables:	(1) **ROA**	(2) **ROA**	(3) **ROE**	(4) **ROE**	(5) **NIM**	(6) **NIM**
# direct crisis exposures (C)	-0.0216**	-0.0170*	-0.2415*	-0.1477	-0.0230***	-0.0183**
	(0.009)	(0.009)	(0.124)	(0.115)	(0.008)	(0.009)
# direct non-crisis exposures (NC)	0.0011	0.0035*	-0.0001	0.0056	-0.0020	-0.0004
	(0.002)	(0.002)	(0.024)	(0.028)	(0.002)	(0.003)
# indirect crisis exposures through crises (CC)		-0.0067**		-0.1006**		-0.0035
		(0.003)		(0.048)		(0.002)
# indirect non-crisis exposures through crises (CNC)		0.0046***		0.0439*		0.0019*
		(0.002)		(0.023)		(0.001)
# indirect exp. through non-crises ($NCC + NCNC$)		-0.0004		-0.0003		-0.0007
		(0.000)		(0.006)		(0.000)
p-value t-test Ho: joint insignificance of counterparty bank characteristics	0.0662	0.109	0.223	0.597	0.374	0.215
Bank size and capital	Yes	Yes	Yes	Yes	Yes	Yes
Other bank controls	Yes	Yes	Yes	Yes	Yes	Yes
Bank exposures to non-banks	Yes	Yes	Yes	Yes	Yes	Yes
Bank country×year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	14,448	14,448	14,445	14,445	14,135	14,135
R^2	0.441	0.441	0.346	0.346	0.659	0.659

Notes: This table examines the robustness of our bank profitability results to controlling for the characteristics of first-degree and second-degree counterparty banks. The dependent variables are bank ROA, ROE, and NIM, and the data are at the bank-year level during 1997–2012. The characteristics of counterparty banks include direct and indirect exposures to banks and non-banks, capital, size, and dummies for business model and entity type (coefficients not shown). All other variables and definitions as in Table 3. Standard errors are clustered at the bank level. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table A2: Crisis Exposures and Bank Profitability—Persistence

Dependent variables:	(1) **ROA** 1 yr	(2) **ROA** 2 yrs	(3) **ROA** 3 yrs	(4) **ROE** 1 yr	(5) **ROE** 2 yrs	(6) **ROE** 3 yrs	(7) **NIM** 1 yr	(8) **NIM** 2 yrs	(9) **NIM** 3 yrs
# direct crisis exposures (C)	-0.0166**	-0.0188**	-0.0160**	-0.3267***	-0.2530**	-0.0160**	-0.0147**	-0.0162**	-0.0154**
	(0.008)	(0.008)	(0.006)	(0.126)	(0.112)	(0.006)	(0.007)	(0.007)	(0.006)
# direct non-crisis exposures (NC)	0.0019	0.0014	0.0006	0.0139	-0.0047	0.0006	-0.0017	-0.0019	-0.0017
	(0.002)	(0.002)	(0.002)	(0.026)	(0.025)	(0.002)	(0.003)	(0.003)	(0.003)
# indirect crisis exposures through crises (CC)	-0.0125***	-0.0097***	-0.0069***	-0.1037*	-0.0966*	-0.0069***	-0.0023	-0.0030	-0.0023
	(0.003)	(0.003)	(0.002)	(0.062)	(0.051)	(0.002)	(0.002)	(0.002)	(0.002)
# indirect non-crisis exposures through crises (CNC)	0.0064***	0.0055***	0.0040***	0.0476*	0.0465**	0.0040***	0.0020	0.0023	0.0017
	(0.002)	(0.002)	(0.001)	(0.027)	(0.024)	(0.001)	(0.001)	(0.001)	(0.001)
# indirect exp. through non-crises ($NCC + NCNC$)	-0.0005	-0.0006*	-0.0003	-0.0004	0.0003	-0.0003	-0.0001	-0.0001	-0.0001
	(0.000)	(0.000)	(0.000)	(0.006)	(0.005)	(0.000)	(0.000)	(0.000)	(0.000)
Bank size and capital	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Other bank controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank exposures to non-banks	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank country×year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	12,695	12,669	10,980	12,692	12,665	10,980	12,573	12,542	10,858
R^2	0.425	0.488	0.515	0.343	0.382	0.515	0.628	0.657	0.673

Notes: This table explores the persistence of the effects of crisis exposures on bank profitability. The dependent variables are bank ROA, ROE, and NIM calculated over the subsequent 1, 2, and 3 year periods. All variables and definitions as in Table 3. Standard errors are clustered at the bank level. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table A3: Crisis Exposures and Bank Profitability—Heterogeneity by Bank Size and Capital

Dependent variables:	(1) **ROA**	(2) **ROE**	(3) **NIM**	(4) **ROA**	(5) **ROE**	(6) **NIM**	(7) **ROA**	(8) **ROE**	(9) **NIM**
# direct crisis exposures (C)×Small bank [1]	-0.0390***	-0.4847**	-0.0305**						
	(0.014)	(0.242)	(0.015)						
# direct crisis exposures (C)×Large bank [2]	-0.0152	-0.1110	-0.0219**						
	(0.009)	(0.103)	(0.009)						
# direct crisis exposures (C)×Low capital [1]				-0.0206**	-0.2655**	-0.0214**			
				(0.009)	(0.129)	(0.009)			
# direct crisis exposures (C)×High capital [2]				-0.0255*	-0.0592	-0.0329**			
				(0.015)	(0.165)	(0.016)			
# direct crisis exposures (C)×Small bank×Low capital							-0.0501***	-0.8735***	-0.0362*
							(0.013)	(0.287)	(0.019)
# direct crisis exposures (C)×Large bank×Low capital							-0.0136	-0.1211	-0.0174*
							(0.010)	(0.108)	(0.010)
# direct crisis exposures (C)×Small bank×High capital							-0.0283	-0.1139	-0.0249
							(0.020)	(0.229)	(0.019)
# direct crisis exposures (C)×Large bank×High capital							-0.0260	-0.0762	-0.0489*
							(0.025)	(0.220)	(0.025)
# direct non-crisis exposures (NC)	0.0010	-0.0192	-0.0012	0.0012	-0.0163	-0.0010	0.0010	-0.0214	-0.0011
	(0.002)	(0.024)	(0.003)	(0.002)	(0.024)	(0.003)	(0.002)	(0.024)	(0.003)
# indirect crisis exposures through crises (CC)	-0.0062**	-0.0777**	-0.0028	-0.0075***	-0.0956**	-0.0034	-0.0058**	-0.0594	-0.0027
	(0.003)	(0.038)	(0.002)	(0.003)	(0.041)	(0.002)	(0.003)	(0.036)	(0.002)
# indirect non-crisis exposures through crises (CNC)	0.0044***	0.0414**	0.0027**	0.0049***	0.0483**	0.0029***	0.0043***	0.0351*	0.0027**
	(0.002)	(0.020)	(0.001)	(0.002)	(0.021)	(0.001)	(0.002)	(0.019)	(0.001)
# indirect exp. through non-crises ($NCC + NCNC$)	-0.0007*	0.0011	-0.0005	-0.0008*	0.0005	-0.0005	-0.0007*	0.0013	-0.0005
	(0.000)	(0.005)	(0.000)	(0.000)	(0.005)	(0.000)	(0.000)	(0.005)	(0.000)
p-value t-test coeff. [1]> coeff. [2] (in abs. value)	0.070	0.070	0.313	0.384	0.000	0.254			
Other bank controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank exposures to non-banks	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank country×year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	14,448	14,445	14,135	14,448	14,445	14,135	14,448	14,445	14,135
R^2	0.441	0.346	0.659	0.441	0.346	0.659	0.441	0.346	0.659

Notes: This table explores heterogeneity in the bank profitability results by bank size and capital. The dependent variables are bank ROA, ROE, and NIM. Large banks and high-capital banks are defined as having above-median size and equity capital. All variables and definitions as in Table 3. Standard errors are clustered at the bank level. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table A4: Crisis Exposures and Bank Lending—More Granular Loan Demand Controls

	(1)	(2)	(3)	(4)	(5)
	All firms	All firms	All firms	All firms	All firms
Dependent variables:	**LOAN SHARE**			**LOAN SPREAD**	
			loan subsample with non-missing price data		
# direct crisis exp. (C)	-0.0441***	-0.0444***	-0.0648***	0.0024***	0.0025***
	(0.010)	(0.010)	(0.016)	(0.000)	(0.000)
# direct non-crisis exp. (NC)	0.0153**	0.0152**	0.0255***	-0.0010***	-0.0011***
	(0.006)	(0.006)	(0.006)	(0.000)	(0.000)
# indirect crisis exp. through crises (CC)	-0.0011	-0.0010	-0.0029	0.0002*	0.0002*
	(0.003)	(0.003)	(0.003)	(0.000)	(0.000)
# indirect non-crisis exp. through crises (CNC)	0.0121	0.0122	-0.0144***	-0.0001	-0.0001
	(0.009)	(0.009)	(0.004)	(0.000)	(0.000)
# indirect exp. through non-crises ($NCC + NCNC$)	0.0034**	0.0034**	0.0061***	-0.0005***	-0.0005***
	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)
Bank size and capital	Yes	Yes	Yes	Yes	Yes
Other bank controls	Yes	Yes	Yes	Yes	Yes
Bank exposures to non-banks	Yes	Yes	Yes	Yes	Yes
Loan-level controls	Yes	Yes	Yes		
Bank FE	Yes	Yes	Yes	Yes	Yes
Bank country×Year FE	Yes	Yes	Yes	Yes	Yes
Borrower firm cluster×Year FE	Yes	Yes	Yes	Yes	Yes
Industry SIC classification	3-digit	4-digit	4-digit	3-digit	4-digit
Observations	318,040	318,008	135,817	133,704	133,696
R^2	0.568	0.568	0.522	0.521	0.522

Notes: This table shows the robustness of the main bank lending results to constructing borrower firm clusters using a more granular SIC industry classification—specifically a 3- or 4-digit classification (instead of a 1- or 2-digit classification as in the baseline results). In column 3 we restrict the loan-share regression sample to the subsample of loans for which we have pricing information to make sure our results are robust to potential concerns about non-randomly missing pricing data in the syndicated loan dataset. Variables, definitions, and data structure as in Table 5. Borrower firm clusters refer to all firms in the same country, industry (at the 3- or 4-digit SIC classification level), and risk category (investment grade or speculative grade). All regressions include a constant term (coefficients not shown). Standard errors are clustered at the bank level. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table A5: Crisis Exposures and Bank Lending—Subsample of Worldscope-matched Borrowing Firms

	(1)	(2)
	Non-financial firms	Non-financial firms
	LOAN SHARE	**LOAN SPREAD**
# direct crisis exp. (C)	-0.0217*	0.0026**
	(0.012)	(0.001)
# direct non-crisis exp. (NC)	0.0032*	-0.0012***
	(0.002)	(0.000)
# indirect crisis exp. through crises (CC)	-0.0031	-0.0001
	(0.002)	(0.000)
# indirect non-crisis exp. through crises (CNC)	0.0157	-0.0001
	(0.010)	(0.000)
# indirect exp. through non-crises ($NCC + NCNC$)	0.0062	0.0002
	(0.005)	(0.000)
Bank size and capital	Yes	Yes
Other bank controls	Yes	Yes
Bank exposures to non-banks	Yes	Yes
Loan-level controls	Yes	
Bank FE	Yes	Yes
Bank country×Year FE	Yes	Yes
Borrower firm cluster×Year FE	Yes	Yes
Observations	62,456	27,554
R^2	0.548	0.577

Notes: This table shows the robustness of the main bank lending results in the significantly smaller sample of borrowing firms that we are able to match to Worldscope for real effects regressions. Variables, definitions, and data structure as in Table 5. Borrower firm clusters refer to all firms in the same country, industry (at the 1-digit SIC classification level), and risk category (investment grade or speculative grade). All regressions include a constant term (coefficients not shown). Standard errors are clustered at the bank level. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table A6: Crisis Exposures and Real Effects—More Granular Firm Demand Controls

	(1)	(2)	(3)	(4)
Dependent variables:	**INVESTMENT RATIO**		**ASSET GROWTH**	
# direct crisis exp. (C)×Small firm [1]	-0.0341***	-0.0370***	-0.0341***	-0.0370***
	(0.011)	(0.011)	(0.011)	(0.011)
# direct crisis exp. (C)×Large firm [2]	-0.0224***	-0.0286***	-0.0224***	-0.0286***
	(0.008)	(0.008)	(0.008)	(0.008)
# direct non-crisis exp. (NC)	-0.0069	-0.0064	-0.0069	-0.0064
	(0.004)	(0.004)	(0.004)	(0.004)
# indirect crisis exp. through crises (CC)	0.0031	0.0064	0.0031	0.0064
	(0.016)	(0.017)	(0.016)	(0.017)
# indirect non-crisis exp. through crises (CNC)	0.0042	0.0026	0.0042	0.0026
	(0.008)	(0.008)	(0.008)	(0.008)
# indirect exp. through non-crises (NCC+NCNC)	-0.0010	-0.0009	-0.0010	-0.0009
	(0.002)	(0.002)	(0.002)	(0.002)
p-value t-test coeff. [1]< coeff. [2]	0.180	0.280	0.209	0.226
Lender banks' capital and size	Yes	Yes	Yes	Yes
Lender banks' other controls	Yes	Yes	Yes	Yes
Lender banks' exposures to non-banks	Yes	Yes	Yes	Yes
Firm controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Firm country×Industry×Year FE	Yes	Yes	Yes	Yes
Industry SIC classification	3-digit	4-digit	3-digit	4-digit
Observations	7,615	7,493	7,615	7,493
R-squared	0.871	0.874	0.871	0.874

Notes: This table shows the robustness of the main real effects results to controlling for firm demand using a more granular SIC industry classification—specifically a 3- or 4-digit classification (instead of a 1- or 2-digit classification as in the baseline results). Variables, definitions, and data structure as in Table 8. Firm clusters refer to all firms in the same country, industry (at the 3- or 4-digit SIC classification level) and year. All regressions include a constant term (coefficients not shown). Standard errors are clustered at the bank level. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table A7: Crisis Exposures and Bank Profitability—Falsification Tests

A. Pre-Existing Trends	(1) Lag ROA 2 yrs	(2) Lag ROA 4 yrs	(3) Lag ROA 6 yrs	(4) Lag ROE 2 yrs	(5) Lag ROE 4 yrs	(6) Lag ROE 6 yrs	(7) Lag NIM 2 yrs	(8) Lag NIM 4 yrs	(9) Lag NIM 6 yrs
# direct crisis exposures (C)	-0.0016	-0.0029	-0.0007	-0.0136	0.0066	-0.0711	-0.0020	-0.0011	0.0061
	(0.006)	(0.007)	(0.012)	(0.065)	(0.061)	(0.117)	(0.006)	(0.008)	(0.012)
# indirect crisis exposures through crises (CC)	-0.0040**	-0.0019	-0.0054	-0.0425	0.0995	-0.0872	-0.0014	0.0003	-0.0010
	(0.002)	(0.003)	(0.003)	(0.030)	(0.076)	(0.077)	(0.002)	(0.004)	(0.007)
Other bank controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank country×year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	11,350	8,688	6,285	11,350	8,688	6,285	11,175	8,530	6,141
R^2	0.398	0.398	0.417	0.331	0.335	0.364	0.652	0.664	0.678
B. Fake Shocks and Fake Interbank Links	ROA Fake shocks	ROA Fake links	ROA Fake shocks+links	ROE Fake shocks	ROE Fake links	ROE Fake shocks+links	NIM Fake shocks	NIM Fake links	NIM Fake shocks+links
# direct crisis exposures (C)	0.0087	0.0095*	0.0028	-0.1154	0.0519	-0.1258	-0.0176	0.0004	-0.0086
	(0.011)	(0.005)	(0.008)	(0.177)	(0.046)	(0.125)	(0.016)	(0.003)	(0.014)
# indirect crisis exposures through crises (CC)	-0.0252	-0.0077	0.0013	-0.1724	-0.0930	0.0221	-0.0289	0.0008	0.0052
	(0.025)	(0.005)	(0.003)	(0.338)	(0.075)	(0.038)	(0.035)	(0.003)	(0.006)
Other bank controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank country×year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	14,448	14,448	14,448	14,445	14,445	14,445	14,135	14,135	14,135
R^2	0.440	0.440	0.440	0.344	0.345	0.344	0.659	0.660	0.659

Notes: This table shows the results of two falsification tests for the bank profitability measures that check whether the main results are driven by the financial network itself rather than pre-existing trends in bank profitability (Panel A), or spurious shocks and spurious network links (Panel B). The dependent variables are bank ROA, ROE, and NIM; and the data are at the bank-year level during 1997–2012. To rule out pre-existing trends, we replace the bank profitability variables with their lags for 2, 4, and 6 years prior to the shock. Panel A shows that none of the estimates on direct and indirect C exposures are consistently significant at the conventional levels. To rule out spurious shocks and network links, we employ three approaches. First, for each year we randomize the crisis dates across countries. That is, we randomly assign false crises to banks, keeping the number of false crises equal to the number of real crises within the year (and keeping the set of interbank connections unchanged). Second, we change only the set of interbank links by randomly re-assigning banks' cross-border interbank connections. Third, we allow both interbank links (network structure) and shocks to change by keeping the distribution of C and NC exposures fixed within the year but randomly re-assigning the exposures across banks. Panel B shows that the main coefficients of interest hold up, suggesting that randomly reassigning shocks, interbank connections, or both, yields statistically insignificant effects on bank profitability. These findings give us confidence that the main results of the paper are driven by the financial network itself rather than pre-existing trends in bank profitability, or spurious network connections and financial shocks. All variables and definitions as in Table 3. Standard errors are clustered at the bank level. * significant at 10%; ** significant at 5%; *** significant at 1%.