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**Bank Loan Supply during Crises:
The Importance of Geographic Diversification**

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Bank Loan Supply during Crises: The Importance of Geographic Diversification*

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Abstract

We classify a large sample of banks according to the geographic diversification of their international syndicated loan portfolio. Our results show that diversified banks maintain higher loan supply during banking crises in borrower countries. The positive loan supply effects lead to higher investment and employment growth for firms. Diversified banks are stabilizing due to their ability to raise additional funding during times of distress, which also shields connected markets from spillovers. Further distinguishing banks by nationality reveals a pecking order: diversified domestic banks are the most stable source of funding, while foreign banks with little diversification are the most fickle. Our findings suggest that the decline in financial integration since the recent crisis increases countries' vulnerability to local shocks.

JEL classification: F21, F36, G21, G30, O16

Keywords: Diversification, Global Banking, Financial Stability, Syndicated Loan Market, Banking Crisis.

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1 Introduction

The last decades saw a steady increase in the importance of globally active banks. Banking integration peaked around 2007, but declined sharply during the global financial crisis. It has become a key objective for policy makers and academics to better understand the effects of integrated banks on financial stability and the real economy (BCBS, 2013). Several papers provide valuable evidence on the costs and benefits of lending by foreign banks.¹ However, an analysis of the consequences of banks' portfolio diversification on financial stability is largely absent from the literature.

In this paper we provide first cross-country evidence on how internationally diversified banks adjust lending during banking crises in their borrower countries. We find that diversified banks stabilize loan supply and smooth shocks. On the loan level, their loan supply during crises is 3.9 % higher, compared to banks with a concentrated portfolio. Higher loan supply has significant real effects on firm performance. Firms at the 75th percentile in terms of loan exposure to diversified banks have 1.5 % higher loan growth during banking crises, relative to firms at the 25th percentile. This translates into stronger investment (4.6 %) and employment (1.1 %) growth. As detailed loan-level data allow us to rigorously control for credit demand effects, the positive effects of diversification reflect banks' loan supply. We also find that the positive loan supply effects of diversified banks are persistent. In the aftermath of a banking crisis, there is a permanent shift towards lending by diversified banks within and across firms.

To measure the degree of portfolio diversification of globally integrated banks, we use disaggregated data on worldwide syndicated lending. For each bank we construct a Herfindahl-Hirschman Index of the geographic diversification of its international loan portfolio, aggregated to the parent bank level. Banks with low portfolio concentration, i.e. those that lend to multiple countries, are classified as diversified. Our classification of banks builds on recent literature on banking integration that shows that geographically diversified banks have lower risk in their portfolio and cheaper access to funding during crises (Bord, Ivashina and Taliaferro, 2015; Levine, Lin and Xie, 2017). They use their

¹For theoretical papers highlighting the importance of banks' diversification and intra-bank capital markets, see Morgan, Rime and Strahan (2004), Cetorelli and Goldberg (2011, 2012), Kalemli-Ozcan, Papaioannou and Perri (2013a), Kalemli-Ozcan, Papaioannou and Peydró (2013b). For empirical evidence on the internal capital market, see De Haas and Van Lelyveld (2010; 2014), Buch and Goldberg (2014), Kerl and Niepmann (2014), Fillat, Garetto, Götz and Smith (2017), and Gilje, Loutskina and Strahan (2016). Claessens (2017) provides an excellent summary on cross-border lending.

internal capital markets to reallocate funds towards regions with high loan demand, thereby smoothing local economic shocks (Gilje, Loutskina and Strahan, 2016; Cortés and Strahan, 2017).² Our measure reflects the positive effects of diversification on obtaining and reallocating funds.

We provide evidence that geographically diversified banks are stabilizing due to their ability to raise new funds during times of distress. If banks are financially unconstrained when hit by a local financial shock, they can raise and distribute new funds to sustain loan supply in affected areas, but also connected non-crisis countries. Banks that face financial constraints must trade off where to allocate existing funds, similar to Stein (1997). Local shocks will then have spillover effects on connected countries. For example, during a banking crisis in Canada unconstrained banks can maintain lending in Canada and Mexico, while constrained banks cut lending in both countries. We show that, for highly diversified banks, maintaining loan growth in a crisis country has no spillover effects on unaffected non-crisis, countries that borrow from the same bank. However, for banks with a concentrated portfolio loan growth also falls in connected, but unaffected borrower countries. We interpret this as evidence that diversified banks have looser ‘financial constraints’ and can raise and distribute new funds to sustain loan supply. Non-diversified banks are financially constrained and must cut back lending in affected and unaffected areas when faced with a shock. To provide additional direct evidence on banks’ liabilities, we further match a subsample of US banks with Federal Deposit Insurance Corporation (FDIC) data on depository institutions. In line with the hypothesis that diversified banks have better access to funding, we find that they raise new deposits at home during banking crises in borrower countries.

We contrast our categorization by diversification with the common classification in the literature by nationality into foreign and domestic banks. Diversified banks can be foreign or domestic, and foreign banks diversified or non-diversified. We find that classifying banks by diversification instead of nationality uncovers strikingly different behavior. While diversified banks stabilize loan supply during banking crises in host markets, foreign banks reduce their loan supply, relative to domestic banks. Our results

²Gilje, Loutskina and Strahan (2016) show that banks distribute windfall profits through their branch network, Cortés and Strahan (2017) find that banks use internal capital markets to reallocate funds towards regions with high loan demand. As in our setting, reallocation has negative effects on connected areas of smaller and less diversified banks that cannot raise new funds. Bord, Ivashina and Taliaferro (2015) provide additional evidence that large and healthy banks raise new deposits to smooth shocks. Our measure reflects that diversified banks have better access to funds during distress and allocate them through their intra-bank market.

reveal the following pecking order: diversified domestic banks are the most stable source of funding, while foreign banks with little diversification are the most fickle. Foreign, but diversified banks occupy an intermediate position between both extremes. The ordering speaks to findings on the flight home effect (Giannetti and Laeven, 2012) and behavior of gross capital flows during crises (Broner, Didier, Erce and Schmukler, 2013).

For robustness, we address alternative explanations to the argument that diversified banks smooth local shocks through better access to funding. We show that diversified banks have lower portfolio risk in terms of volatility of borrower sales growth. While a less risky portfolio could explain banks' stabilizing effect, we show that the positive effect of diversification remains stable once we control for portfolio risk. We then rule out possibility that diversified banks extend a lower share of their total loans to countries in crisis. Including the share of loans in crisis shows that, if anything, diversification becomes more important when a larger share of loans is in distress. To further probe the robustness of our results, we create an alternative measure of diversification that captures banks' international orientation. We group banks by the share of loans extended to foreign borrowers. Banks with a high share of international loans are categorized as 'international', those with primarily domestic loans as 'national'.³ Our two classifications are complementary and positively correlated, but capture different dimensions of banking integration. We find that international banks are weakly stabilizing during host shocks. However, once we include banks' diversification in the regression, the effect on international banks turns insignificant. Instead, we still find that diversification is the relevant factor for positive effects on loan supply. We also ensure that bank size is not driving our results. Further, findings are robust to excluding the global financial crisis, controlling for correlated regional crises affecting several countries at once, or contemporaneous shocks to home markets.

The key identification issue for cross-country studies using aggregate data is to control for loan demand. If diversified banks lend to different firms than banks with a concentrated portfolio, any observed differential change in loan volume reflects both demand and supply effects. Disaggregated data allow us to overcome this challenge. Our loan level analysis employs firm*bank and firm*time fixed effects to absorb all time-varying unobservable firm fundamentals.⁴ The combination of both fixed effects allows

³To exemplify the difference, think of a German bank that lends only to French firms. Under the alternative metric (international portfolio) it is highly international, while in our baseline (diversification) it is not.

⁴See Khwaja and Mian (2008); Jiménez, Mian, Peydró and Saurina (2014a); Jiménez, Ongena, Peydró

shocks to affect each firm at each point in time heterogeneously and accounts for any change in loan demand.⁵ For example, time-varying fixed effects on the firm level absorb changes in firm sales, management, or productivity, while bank*firm fixed effects control for distance between borrowers and lenders. On the firm level, we combine firm with country*industry*time fixed effects to control for time-varying industry demand. The identifying assumption is that loan demand by all firms within the same industry and country changes equally. While in principle firm demand could exhibit heterogeneity within industries, we run loan level regressions to confirm that this is of second order importance. The positive effect of diversification on credit hence reflects loan supply factors.

Our paper contributes to the literature in three ways. First, and to the best of our knowledge, we propose the first cross-country bank-level measure for banks' portfolio integration into the global financial system. Due to data limitations, so far most studies distinguish banks by headquarter location into foreign and domestic and look at cross-border lending.⁶ While bank nationality has been shown to be an important determinant of loan supply, our approach captures the related, but distinct dimension of banks' integration into the financial system, captured by their portfolio allocation. This allows us to shed new light on banks' role during crises. Note that both categorizations need not be mutually exclusive. Diversified banks can be foreign, but domestic banks also diversified, depending on the country in which the shock originates. We find that grouping banks by diversification instead of nationality uncovers new patterns that complement existing findings in the literature on banking integration. It also helps reconcile conflicting findings on the effects of foreign banks during crises. The global scope of our detailed loan-level data allows for clean identification, as well as external validity.

Second, we contribute to the growing literature that analyzes the real effects of financial shocks and highlights the relevance of syndicated lending for firm performance.⁷

and Saurina (2014b); [Morais, Peydró and Ruiz \(2015\)](#).

⁵A related problem is self-selection that arises if, for example, the best firms would pair with diversified banks. To overcome this potential selection bias, we repeat our analysis on the restricted sample of firms that borrowed from both diversified and concentrated banks in each year ([Khwaja and Mian, 2008](#)). Coefficients for the reduced sample have the same sign and are of similar magnitude as for the full sample.

⁶See, for example, [Peek and Rosengren \(1997, 2000\)](#); [Cetorelli and Goldberg \(2011, 2012\)](#); [Schnabl \(2012\)](#); [Correa, Zlate and Sapriza \(2013\)](#); [De Haas and Van Horen \(2013\)](#); [De Haas and Van Lelyveld \(2014\)](#); [Ongena, Peydró and Van Horen \(2015\)](#); [Bremus and Neugebauer \(2018\)](#).

⁷See [Giannetti and Laeven \(2012\)](#); [Correa, Zlate and Sapriza \(2013\)](#); [De Haas and Van Horen \(2013\)](#); [Hale, Tumer and Minoiu \(2016\)](#); [Jiménez, Mian, Peydró and Saurina \(2014a\)](#); [Popov and Van Horen](#)

Our results show that the effects of banking crises are heterogeneous across bank types and that firms' composition of lenders matters. The negative effects we find on the firm level suggest that firms cannot fully substitute syndicated loans across banks. If firms could fully replace syndicated loans by non-integrated banks with loans by diversified banks, exposure to either type would not affect loan growth differentially. However, while substitution is imperfect, we show that in the years following a banking crisis there is a persistent shift towards lending by diversified banks. Both within firms and within industries, the share of loans extended by diversified banks increases. Geographic diversification allows banks to capture a larger share of the market when their local competitors have to contract lending. Viewed from a different angle, this also implies that banking crises persistently alter the composition of lenders.

Finally, while the effect of shocks to banks' home markets and consequent spillovers are well explored, few papers investigate the role of banks during distress in their host markets.⁸ Many crises over the last two decades were shocks to borrower countries and globally integrated banks were usually heavily involved. During the Asian crisis, Japanese and European banks were exposed to markets in Thailand, the Philippines, or South Korea; and during Argentina's woes, American banks had a strong presence in Latin America. As bank lending is a major source of firm financing, it is important to understand how banks react to host country shocks. So far, the discussion has mainly highlighted the costs and benefits of cross-border banking and how foreign banks spread home market shocks to connected markets (Claessens, 2017).

Our results contribute to the discussion on retrenchment in financial integration since the global financial crisis (Milesi-Ferretti and Tille, 2011; Claessens and Van Horen, 2015). Since the financial crisis, there has been a significant decline in cross-border banking and financial integration.⁹ In addition, we show that banks' portfolio diversification declined. The verdict on whether this is good or bad for financial stability is still out. While some studies find that foreign banks adversely affect economic conditions in host markets, our results show that integrated banks with a diversified portfolio smooth financial shocks. Presence in several markets reduces banks' exposure to local shocks and gives them better access to new funds, which they can allocate towards countries in distress. This not only stabilizes lending in affected countries, but also mitigates contagions. In light of our

(2015); Morais, Peydró and Ruiz (2015).

⁸For an exception, see De Haas and Van Lelyveld (2006).

⁹See also Cerutti and Claessens (2016); Bremus and Fratzscher (2015); Bussière, Schmidt and Valla (2016); Emter, Schmitz and Tirpák (2016); European Central Bank (2017).

results the recent decline in global banking is worrisome, as weaker integration into the global financial system, and hence less portfolio diversification, has detrimental effects on stability in host markets.

The remainder of the paper proceeds as follows. Section 2 discusses data and empirical strategy, Section 3 presents our main results. In Section 4 we check the robustness of our findings to alternative explanations, Section 5 provides extensions and additional robustness checks. Section 6 concludes.

2 Data & Empirical Strategy

This section describes data and construction of main variables. We then discuss the empirical strategy to identify changes in loan supply by banks during borrower-country banking crises, as well as their real effects on firms.

2.1 Geographic Diversification

We categorize banks according to the geographic diversification of their international syndicated loan portfolio. Building on recent literature, we argue that diversification allows banks to access cheaper funding, which they allocate towards borrower countries in crisis (Gilje, Loutskina and Strahan, 2016; Cortés and Strahan, 2017; Levine, Lin and Xie, 2017). The mechanism is especially important during episodes of financial turmoil (Bord, Ivashina and Taliaferro, 2015). For each bank we construct a Herfindahl-Hirschman Index (HHI), based on the share of outstanding loans to each borrower country in each year. The index reflects the geographic dispersion of banks' loan portfolios across multiple countries. Based on the HHI, we then define *diversification* (DIV) for bank b in year t as

$$DIV_{b,t} = 1 - \sum_{j=1}^{J^b} s_{b,j,t}^2 \in [0, \frac{J^b - 1}{J^b}], \quad (1)$$

where $s_{b,j,t}$ measures the share of a bank b 's outstanding loans to borrowers in country j relative to its total outstanding loans in year t . Each bank is active in J^b distinct countries, i.e. where it has at least one borrower. We invert the scale of the HHI for ease of interpretation. A value of zero ($DIV = 0$) implies no diversification (all credit goes to borrowers from one country, what we will call *concentrated portfolio*), while higher values

reflect increasing diversification of banks' loan portfolios across countries. We reason that banks with higher diversification have better access to funds during local financial shocks.

2.2 Data

For our main analysis and to construct banks' diversification, we use data on worldwide syndicated lending. We additionally use country-specific data and further information on borrowing firms' balance sheets. Loan-level data with detailed bank-firm relations comes from Thomson Reuters Dealscan and covers the universe of syndicated loans. Compustat (Global and US) provides firms' balance sheet information. Macroeconomic variables come from the World Bank's World Development Indicators. Finally, we use U.S. bank balance sheet data from FDIC's Statistics on Depository Institutions.

Laeven and Valencia's (2013) Systemic Banking Crises Database provides country-year-level information on episodes of financial distress.¹⁰ From 1995 to 2012, it reports 189 banking crisis (BC) observations. The two conditions that define a banking crisis are *i*) significant signs of financial distress in the banking system (such as bank runs, losses in the banking system, and/or bank liquidations); and *ii*) significant banking policy intervention measures in response to the losses in the banking system. In our sample, there is a concentration of financial turmoil around the time of the Asian crisis and from 2008 onward, during the Great Financial Crisis.

To construct main variables, we use Dealscan data on syndicated loans. Syndicated lending constitutes a significant share of total lending. Around one-third of total international lending is done through the syndicated loan market (Gadanecz and von Kleist, 2002) and it is an important source of financing in both developed and emerging economies (Cerutti, Hale and Minoiu, 2015). Syndicated loans are issued jointly by a group of banks to a single borrower. The lending syndicate includes at least one lead bank (also called lead arranger) and usually further participant banks. Lead banks negotiate terms and conditions of deals, perform due diligence, and organize participants. Therefore, lead arrangers stand in direct contact with the borrower and retain larger loan shares for signaling purposes (Sufi, 2007). Participants are usually not in direct contact with the borrower, but merely supply credit. Compared to other types of bank loans, syndicated

¹⁰While there exist different databases on financial crises, Laeven and Valencia is the most comprehensive for banking crises occurring after 1970 (Chaudron and De Haan, 2014).

loans are on average larger in volume and issued to bigger borrowers.

Dealscan provides extensive information on syndicated loans at origination, including loan amount, maturity, and interest, as well as identity of lenders and borrowers. All data are aggregated at banks' and firms' parent level, consistent with the literature (Sufi, 2007). The aggregation of banks at the parent level captures the ability of banks to make use of their internal capital market to allocate capital across borders.¹¹ We restrict our analysis to loans by banks to non-financial firms and consider lending only by commercial, savings, cooperative and investment banks.¹² We keep both lead arrangers and participants in our sample, and do so for two reasons. First, we are interested in banks' loan portfolio allocation across countries and not specific contractual frictions. As the focal point of our analysis is total credit supply, including both lead arrangers and participants provides a comprehensive picture of the syndicated loan market. Second, excluding participants leads to sample-selection bias. Lead arrangers are large banks operating on a global scale. We aim to compare banks along the dimension of their international diversification. Hence, excluding smaller participant banks with a rather concentrated portfolio will change the control group. Instead of comparing diversified with concentrated banks, focusing on lead arrangers only will lead to a selected group of globally active banks in our sample. We would compare banks' diversification within a group of diversified and internationally integrated banks. To avoid this pitfall, we include leaders and participants in our analysis.

Loan level We decompose syndicated loan deals into loan portions provided by each lender to obtain granular credit level data. Whenever Dealscan provides information on lending shares of each bank, we use this information to split loan volume accordingly (available for 28 % of the deals).¹³ In cases where lending shares are missing we split loan volume on a pro-rata basis among all banks in a syndicate.¹⁴ Transactions with deal status

¹¹Banks may choose to lend to a foreign firm either through direct cross-border lending or through a subsidiary in the foreign market.

¹²In Dealscan, we use lender types Commercial Banks, Finance Companies, Investment Banks, Mortgage Banks, Thrift/S&L, and Trust Companies. Investment banks constitute 3 % of our sample and excluding them does not change results. Borrower types included are Corporations, Insurance Companies, Law Firms, Leasing Companies and Other.

¹³See Giannetti and Laeven (2012); De Haas and Van Horen (2013)

¹⁴In the sub-case of partial information on loan shares, we first use the available information to allocate loan shares. Then, we split the remaining amount equally among banks with missing information. If the sum of the allocation rule is larger than 110 % we consider this an erroneous entry and treat it as if lending share information was not available in the first place.

‘canceled’, ‘suspended’, or ‘rumor’ are removed and all loan nominations transformed into million U.S. Dollars (USD) using the spot exchange rate at origination, provided by Dealscan. If after this allocation procedure the loan portion is smaller than 10,000 USD, we drop the observation to remove erroneously small loans (0.6 % of observations). Overall, we split a total of 293,163 deals into 1,638,343 loan portions. We next use the loan portions to construct each bank’s outstanding loan volume as a stock variable to proxy the loan’s entry on the loan book (Morais, Peydró and Ruiz, 2015). Each outstanding loan remains active until the end of its maturity. We aggregate all outstanding loan portions between a bank-firm combination to obtain bank b ’s outstanding loan volume to firm f in year t , which we define as a loan observation.

To measure banks’ geographic diversification, we construct their distribution of cross-border loans by destination country. Therefore, geographic diversification is based on the nationality of the borrower at origination and not defined by the nationality of the parent bank.¹⁵ For each year, we then aggregate all outstanding loans by each bank to all borrowers from country j and divide by its total outstanding loans to obtain country shares $s_{b,j,t}$. We calculate *diversification* according to Equation (1).

Firm level To examine effects of credit supply on firm behavior, we merge our data set with firm balance sheet information. We aggregate the firm-bank-year data to the firm-year level and then match borrowers in Dealscan with firms in Compustat (Global & US). For merging we use the file provided by Chava and Roberts (2008). Combining Dealscan with Compustat reduces observations, since information for some firms, especially smaller ones, are missing in Compustat. Overall, we are able to successfully match around 32 % of our firm-year observations. We use information on firms’ syndicated loan volume, investment, employment, total assets, sales and fixed assets, where we compute growth rates as log differences.

To capture firms’ relationships with geographically diversified banks, we construct the firm-level metric *exposure*. Intuitively, exposure measures whether firms borrow a lot or little from diversified banks. Specifically, we weight firm f ’s outstanding loan volume by each bank with the bank’s geographic diversification value ($DIV_{b,t}$) in year t . Then, we divide weighted loan volume by firm f ’s total outstanding loan volume in year t across

¹⁵In robustness checks, we use an alternative measure based on parent bank nationality.

all banks:

$$exposure_{f,t} = \frac{\sum_{b=1}^B DIV_{b,t} \cdot loan_{f,b,t}}{\sum_{b=1}^B loan_{f,b,t}} \in [0, max(DIV_{b,t})], \quad (2)$$

where B is the total number of banks with outstanding loans to firm f in year t . Similar to *diversification* on the loan level, $exposure = 0$ implies that a firm borrows exclusively from concentrated banks ($DIV = 0 \forall B$). Higher values of exposure indicate stronger relationships with diversified banks. An overview over all variables and their units of measurement is provided in Table 17.

2.3 Descriptive Statistics

Figures 1 and 2 show the distribution of *diversification* on the loan level and *exposure* on the firm level. About 8 % of all loans are extended by banks with no geographic diversification. The remaining banks have at least some diversification, with a bunching around 0.9. Figure 2 shows that more than 97 % of firms borrow from at least one bank with non-zero geographic diversification. The median (mean) firm has 4 (8) bank connections in a given year. This suggests that firms accessing the syndicated loan market are potentially able to substitute across lenders during crises. The median (mean) number of outstanding loans by banks per year is 2 (33).

[Figures 1 and 2 about here]

Our sample covers the years 1995 to 2012 and includes information on 35,510 firms and 6,962 banks forming a total of 1,724,073 firm-bank-year observations, and 194,726 firm-year observations (9,393 firms and 60,953 observations for the matched Compustat sample). There are a total of 2,046 banks with some diversification and 4,916 banks with zero geographic diversification. The median (mean) value of *diversification* for banks with non-zero diversification is 0.41 (0.40). The group of diversified banks extends around 93 % of all loans, which reflects that they are large lenders. Table 1 highlights the geographical distribution of loans, firms, and banks by region. The majority of loans are extended to borrowers located in Europe, East Asia and Pacific, and North America. Moreover, countries in Europe and Asia have the highest number of geographically diversified banks.¹⁶ North American banks are less diversified as they lend mostly to borrowers located in the

¹⁶We split geographic diversification along the annual median and denote banks with an above median value as diversified.

U.S. or Canada. Finally, the highest incidence of banking crises occurs in Europe, Asia, and, to a lesser extent, in Latin America.

Tables 2, 3, and 4 provide summary statistics of main variables. We split the respective samples by diversification or exposure.¹⁷ For the syndicated loan market, Table 2 shows that loans by geographically diversified banks are larger, have lower interest rates, and are issued at longer maturity than loans by banks with geographically more concentrated portfolios. The large difference in loan volume suggests that geographically diversified banks are on average larger than their less diversified counterparts. In Table 3 the average firm with an above median exposure to diversified banks obtains loans with larger volume, lower interest rates and longer maturity compared to firms with fewer relationships with diversified banks. Table 4 restricts the sample to firms with balance sheet information. Borrowers with high exposure to diversified banks tend to grow slower and are larger than their peers borrowing from banks with a geographically concentrated portfolio. Long-term debt as share of total assets is similar across both groups indicating that they are on average comparable in terms of their need for external finance. Overall, the difference in firm characteristics highlights the need to control for loan demand.

[Tables 1, 2, 3, and 4 about here]

2.4 Empirical Strategy and Identification

To analyze lending behavior by geographically diversified banks and their effect on firms, we use two aggregation levels. To isolate loan supply from loan demand, we begin on the firm-bank-year level (*loan level*). Then, we aggregate the data to the firm-year level (*firm level*) to examine substitution across loans, as well as real effects on firms.

Loan level: Our baseline specification tests how geographic diversification (*DIV*) affects loan volume for each firm-bank pair. To see whether diversification has a positive effect on loan supply during financial turmoil in the borrower country, we interact diversification with a banking crisis dummy (*BC*):

$$\log(\text{loan})_{f,b,t} = \beta_1 BC_{c,t} + \beta_2 DIV_{b,t-1} + \beta_3 BC_{c,t} \times DIV_{b,t-1} + \phi_{f,b} + \tau_t + \varepsilon_{f,b,t}. \quad (3)$$

¹⁷Again, we split geographic diversification along the annual median and denote banks with an above median value as diversified. Same goes for exposure.

The dependent variable $\log(\text{loan})$ denotes the log of outstanding loan volume of firm f from bank b in year t . Banking crisis dummy $BC_{c,t}$ is at the country level and takes value one during a crisis in firm country c in year t . $DIV_{b,t-1}$ is the geographic diversification index on the bank-year level. We lag DIV by one period to avoid contemporaneous effects of the banking crisis on banks' diversification.¹⁸ $\phi_{f,b}$ are firm*bank fixed effects, and τ_t are either firm*year or country*industry*year fixed effects. We cluster standard errors on the firm-country*year level to account for correlation within the same borrower country across firms. Regression (3) is similar in spirit to a difference-in-difference regression. The coefficient of interest β_3 reflects the change in loan supply by diversified banks minus the change in loan supply by concentrated banks. If diversified banks have better access to funds during crises, their loan supply is higher compared to less diversified banks. This is, we expect $\beta_3 > 0$.

The key identification challenge is to absorb changes in loan demand to isolate loan supply. Firms borrowing from diversified banks are on average bigger, so loan demand is likely to be correlated with banks' geographic diversification. Due to the granularity of our data, we can overcome this issue. First, firm*bank fixed effects exploit the variation within the same firm-bank combination over time and control for unobservable and time-invariant bank and firm heterogeneity (such as industry, location or average size), as well as for unobservable time-invariant characteristics at the bank-firm level, such as relationship or distance. Second, firm*time fixed effects allow shocks to affect each firm at each point in time heterogeneously. Thereby we control for unobservable time-varying firm fundamentals (such as profitability, risk, and other balance sheet characteristics) to identify credit supply.¹⁹ Essentially we are comparing the same firm borrowing from different banks in a given year, while using only the within variation of each bank-firm combination for estimation (Jiménez, Mian, Peydró and Saurina, 2014a). After absorbing any changes in loan demand our estimates reflect loan supply effects.

Firm level: On the loan level we observe whether credit at the firm-bank level changes differentially during crises, depending on the type of lender. However, the analysis ne-

¹⁸We assume that a firm's bank relationship can be proxied by its previous year credit dependence. This builds on the finding of Ongena and Smith (2001) and Chodorow-Reich (2014) that banking relationships are sticky over time.

¹⁹For each firm-year pair, firm*time fixed effects require observations from at least two banks. On the syndicated loan market, around 97 % of all loans satisfy this condition. The sample selection effect due to this demanding specification is therefore negligible.

glects potential substitution effects and remains silent about the real effects of loan supply on firms. If firms can easily substitute syndicated loans from banks that reduce loan supply with loans by banks that increase loan supply, the substitution offsets the credit contraction of individual banks. In this case, firm exposure to geographically diversified banks becomes irrelevant for firms' syndicated loan growth. Beyond the syndicated loan market, firms may also be able to substitute a fall in syndicated lending through other debt instruments, for example non-syndicated credit or corporate bonds. Such a substitution would imply that we do not find any effect of bank diversification on firms' total debt or investment, *even if* we find an effect on firms' syndicated loan growth. Loan supply only has real effects on firm performance if firms can at most partially substitute the fall in credit.

To test for substitution and real effects, we run the following firm-level regression:

$$\Delta y_{f,t} = \gamma_1 BC_{c,t} + \gamma_2 exposure_{f,t-1} + \gamma_3 BC_{c,t} \times exposure_{f,t-1} + \phi_f + \tau_{c,i,t} + u_{f,t}, \quad (4)$$

In the baseline specification, the dependent variable $\Delta y_{f,t}$ is the log difference of outstanding syndicated loan volume of firm f to *all* its lenders in year t . In further regressions, we use the log difference of total long-term debt to test for substitution into non-syndicated debt instruments. To analyze real effects, we also use investment and employment growth in log differences. Banking crisis dummy ($BC_{c,t}$) varies at the country-level and equals one during banking crisis years in the firm country c . $exposure_{f,t-1}$ is the share of firms f 's outstanding credit from diversified banks as defined in Equation (2), lagged by one period. ϕ_f denote firm fixed effects, and $\tau_{c,i,t}$ denote time-varying country*industry*year fixed effects, where c and i denote firm f 's country and industry. For our Compustat sample we additionally control for time-varying firm demand by including return on assets, leverage, and log of assets. We cluster standard errors at the firm level in all estimations.

Our main coefficient of interest, γ_3 , is on the interaction term ($BC \times exposure$). γ_3 is the firm level counterpart of β_3 , which is the estimated interaction coefficient ($BC \times DIV$) from loan level Equation (3). It shows the change in loan growth for high exposure firms minus the change in loan growth for low exposure firms. If firms can perfectly substitute a fall in lending by one bank with other forms of financing, then $\gamma_3 = 0$ in the respective regression. In turn, a non-zero estimate of γ_3 suggests imperfect substitution. We expect $\gamma_3 > 0$, as higher exposure to diversified banks should lead to higher loan growth during crises.

To identify loan supply, we employ country*industry*time fixed effects to absorb time-varying demand changes for each industry in each country. The identifying assumption is that all firms within one industry of one country change their loan demand equally. How reasonable is it to assume no heterogeneity in firm demand within industries? If there is differential loan demand within industries, our coefficient is biased and does not reflect supply effects. We test the validity of this identifying assumption on the loan-level, where we compare estimates using country*industry*time fixed effects with estimates employing the more rigorous firm*time fixed effects.²⁰ As we will show, coefficients are close, but somewhat larger under country*industry*time fixed effects, so we interpret our firm-level estimates as upper bounds of the true effect.

3 Results

In Section 3.1 we first establish on the loan level that diversified banks smooth local financial shocks, relative to non-diversified banks. Time-varying borrower-fixed effects control for changes in firm demand to isolate supply effects. To examine real effects, we then aggregate to the firm level and show that firms with higher exposure to diversified banks have stronger loan, investment, and employment growth during banking crises. Section 3.2 sheds light on the underlying mechanism and shows that geographic diversification improves banks' access to funding.

Before moving to the regression analysis, Figure 3 shows the stabilizing effect of diversified banks in a non-parametric way. Panel 3a plots log loan volume in the four years prior, during, and after a banking crisis. We split loans into loans by diversified (blue solid line) and non-diversified (dashed black line) banks according to the yearly median of *diversification*. Loan volume follows a similar trend for diversified and non-diversified banks in the years preceding a crisis. However, it diverges sharply during the crisis. Both types of banks see a sharp and persistent contraction in loan volume, but the decline is almost twice as strong for non-diversified banks. The divergence in loan volume is because of banks' portfolio diversification and we will estimate it as the difference in the change in loan supply by diversified banks and the change in loan supply by concentrated banks (coefficient β_3 in regression (3)). We now confirm that the pattern shown in Figure

²⁰Our baseline sample requires each country-industry-year pair to have at least two firms. When we use firm*time fixed effects, we lose around 2 % of observations, as some firms only have one lender connection.

3 holds in regression analysis.

3.1 Main Results

Loan level: Table 6 reports results for regression Equation (3) and shows that diversified banks maintain higher loan growth during banking crises, relative to non-diversified banks. The dependent variable is log loan volume. Column (1) looks at variation within each firm-bank connection by using fixed effects on the firm*bank level. Diversified banks extend loans with higher volume in general, as indicated by the positive coefficient on *diversification*. The coefficient of interest (β_3) on the interaction term ($DIV \times BC$) is highly significant and positive. During banking crises, increasing diversification by one standard deviation increases loan volume by $(0.31 \times 0.135 =)$ 4.2 %. To ensure that the positive effect is due to supply effects, column (2) adds firm*time fixed effects to absorb any time-varying changes in firm demand.²¹ Borrowing from a diversified bank is now not statistically different to borrowing from a non-diversified bank during non-crisis times. The positive effect of diversified banks during banking crises remains significant: increasing diversification by one standard deviation during a banking crisis increases firms' loan volume by 1.2 %. Borrowing from a fully diversified bank ($DIV = 1$) increases the positive effect to 3.9 %, compared to borrowing from banks with an entirely concentrated portfolio ($DIV = 0$). Comparing columns (1) and (2), we see that absorbing demand effects reduces the coefficient on the interaction term by around two-thirds. The change in size suggests that diversified banks lend to borrowers of higher resilience and better quality during crises.²² However, after controlling for loan demand, there remains a positive and significant loan supply effect associated with higher geographic diversification.

Figure 3, Panel 3b plots log loan volume after removing loan demand effects through firm*time fixed effects.²³ Comparing it to Panel 3a, we see that demand effects explain a large part of the overall decline in loan volume. Strikingly, after removing demand effects, diversified banks maintain their loan supply during the crisis and increase it in the following years. Non-diversified banks reduce loan volume persistently. The increase

²¹The coefficient on banking crisis is now absorbed by firm*year fixed effects.

²²In Section 3.2 we show that firms with higher exposure to diversified banks are less risky and have lower volatility in terms of sales and asset growth.

²³We plot the residual of a regression of log(loan volume) on firm*time fixed effects that absorb any unobservable change in firms' loan demand. After absorbing demand effects the residual reflects banks' credit supply.

in loans by diversified banks suggests that there is substitution in lending across banks – a notion we will confirm in Section 5. As in Panel 3a, loan supply follows a similar trend for both bank types prior to the crisis. By absorbing any changes in firms’ loan demand, Panel 3b provides a clean identification of the stabilizing effect of portfolio diversification on loan supply.

When we move to the firm level, we can no longer control for credit demand through firm*time fixed effects. Instead, we use country*industry*year fixed effects, so we assume that firms within the same country-industry-year pair change demand similarly. To verify this assumption, column (3) runs the loan level regression with country*industry*year fixed effects. Comparing coefficients with column (2) indicates how appropriate we capture demand effects. The coefficient of interest has the same sign and significance, but is larger in column (3). Controlling for time-varying industry demand leads to an overestimation of the effect by about one third. The increase in the coefficient on $DIV \times BC$ suggests that even within four-digit industries, there is variation in loan demand.²⁴ We therefore interpret our firm level results as an upper bound of the true effect.

To further support our identifying assumption, we repeat the exercise carried out in columns (1)–(3) on a smaller sample of firms that borrowed from both concentrated and diversified banks (Khwaja and Mian, 2008). This specification alleviates concerns about firms self-selecting into bank relationships. If the best firms pair only with diversified banks, selection effects bias our results. By focusing on firms that borrowed from both diversified and non-diversified banks in each year, we circumvent this potential pitfall. Columns (4)–(6) repeat the exercise carried out in columns (1)–(3) on the restricted sample. In all specifications we find a significant positive effect of diversification during banking crises. The magnitude is similar to columns (1)–(3), which is evidence that results are robust to self-selection. However, note that the change in coefficient β_3 from column (5) to (6) is around 20 % and smaller than from (2) to (3). This is in line with expectations, as the sample is selected on the theoretical argument that firms borrowing from diversified and non-diversified banks simultaneously behave similar towards both bank types. All in all results in Table 6 show that diversified banks sustain higher loan supply during crisis times, relative to banks with a concentrated loan portfolio.

[[Table 6 about here](#)]

²⁴Note that the standard deviation of *diversification* is 0.089 for each firm-year pair, but 0.072 for each country-industry-year pair. Adjusting for the difference in variation reduces the difference between both columns to about 20 %.

Firm level: Loan-level regressions identify changes in individual firm-bank connections. If firms can substitute between bank types during banking crises, changes in individual loans need not affect firms. Suppose a firm borrowing from a non-diversified bank sees a contraction in loan supply. Forming a new borrowing relationship with a diversified bank mitigates the negative credit supply shock. To examine whether credit supply shocks have real effects, we aggregate to the firm-year level. Tables 7 and 8 show results for estimating regression Equation (4). Firms with higher exposure to diversified banks fare better during banking crises, relative to firms with low exposure.

[Tables 7 and 8 about here]

In Table 7, column (1) controls for unobservable time-invariant firm characteristics through firm fixed effects. The dependent variable is loan growth $\Delta loan_{f,b,t}$. In line with expectations, the coefficient on *exposure* is negative, because diversified banks lend predominately to larger firms in developed economies, which have lower average growth rates. The negative coefficient on banking crisis implies that borrowers' credit growth declines by 14.2 % during banking crises when they have no connections to diversified banks (*exposure*= 0). Higher exposure to diversified banks attenuates the negative effect. The coefficient on the interaction term of exposure and banking crisis (*exposure* \times *BC*) is positive and statistically significant at the 1 % level. Increasing exposure from the 25th to 75th percentile increases loan growth during a crisis by $(0.39 \times 0.055 =)$ 2.1 %. To remove time-varying demand shocks, column (2) absorbs shocks on the country*year level, column (3) on the more granular country*industry*year level.²⁵ In both specifications, coefficients are of similar sign, magnitude, and significance. In our preferred specification in column (3), moving a firm from the 25th to 75th percentile in terms of exposure to diversified banks leads to 1.5 % higher loan growth. Average loan growth equals 3.6 %, so the positive effect of borrowing from diversified banks is sizeable. The effect on the firm level is similar in size to effects on the loan level. This suggests that frictions hamper firms from switching across bank types during recessions, a common finding in the literature (Ongena and Smith, 2001; Chodorow-Reich, 2014).

In Table 8 we restrict our sample to firms for which we have balance sheet information. To analyze real effects, we use long-term debt, employment, and investment as dependent variables (all in log differences). For each dependent variable, we run a parsimonious specification with firm fixed effects, as well as one enriched with time-varying

²⁵As *banking crisis* does not vary on the industry level, the coefficient is absorbed by fixed effects.

firm controls and time-varying fixed effects at the country*year level.²⁶ We consistently find that firms borrowing from diversified banks have significantly higher growth rates during crises. In the more stringent specification, moving borrowers from the 25th to 75th percentile in terms of exposure to diversified banks leads to higher long-term debt (4.1 %, column (2)), employment (1.1 %, column (4)), and investment growth (4.6 %, column (6)) during crises. Similar to loan growth in Table 7, growth rates are lower for high-exposure borrowers in normal times and fall during banking crises. This reflects that diversified banks lend to larger firms that have lower average growth rates (see Table 4). Controlling for common time-varying shocks on the country level as well as time-varying firm controls in general reduces the magnitude and significance of the effect.

Our loan- and firm-level findings show that firms can at most imperfectly substitute declines in syndicated lending by other forms of funding. Credit supply by diversified banks leads to real effects for firms. Results from Table 7 suggest that firms cannot switch from concentrated to diversified banks in the syndicated loan market. Otherwise, exposure in previous periods would not affect loan growth. The positive effects of exposure in Table 8 on long-term debt, as well as investment and employment, additionally indicate that firms cannot substitute from syndicated into non-syndicated lending. In sum, Tables 6–8 establish that changes on the syndicated loan market have real economic effects, which cannot be undone through other forms of credit. Borrowing from diversified banks significantly increases firms’ loan growth during times of financial distress. In other words, diversified banks stabilize loan supply and smooth local financial shocks. In the following sections, we provide evidence that banks’ diversification and internal capital markets explain our results.

3.2 Mechanism

Recent studies argue that diversified banks have better access to funding during times of financial distress and use their internal capital market to distribute resources among affiliates to smooth local shocks.²⁷ So far, our results do not tell us whether banks reallocate existing funds across affiliates, or raise new funds to sustain credit supply. The

²⁶Unfortunately, the low number of observations per industry leads to a large loss of observations when we use country*industry*year fixed effects.

²⁷See for example Morgan, Rime and Strahan (2004); Goldberg (2009); Cetorelli and Goldberg (2012); Buch and Goldberg (2014); Bord, Ivashina and Taliaferro (2015); Coleman, Correa, Feler and Goldrosen (2017); Cortés and Strahan (2017); Levine, Lin and Xie (2017).

answer to the question has important implications, as the former implies spillover effects to unaffected markets, while the latter does not. Suppose there is a negative financial shock in Germany. Will a bank that is active in Germany and France move funds from France to Germany and reduce lending in France to prop up German affiliates? Or can it raise new funds, which allows it to stabilize lending in Germany while maintaining loan supply in France?

If diversification improves banks' access to funds in times of distress, it relaxes their 'financial constraints'. The additional funds could be raised in the crisis country, but also in unaffected borrower markets and transferred via the intra-bank capital market. 'Constrained' non-diversified banks cannot raise new funds when they face a negative shock. Instead, they must trade off where to allocate existing liquidity within their bank network. Any reallocation of funds towards crisis countries will then lead to negative spillover effects to borrower markets that are connected to the bank. By analyzing changes in loan supply in connected countries, we thus can provide indirect evidence on banks' internal capital markets.

To answer the question we aggregate to the bank-borrower country-year level and define the variable *connected*. For each bank-country-year triplet, *connected* equals one for all non-crisis countries k ($\neq j$) in year t if country j has a crisis (where k and j sum up to all borrower countries from bank b in year t).²⁸ In the spirit of Giroud and Mueller (2015, 2017) the coefficient on *connected* shows how loan growth changes in all *connected countries* that borrow from bank b , but do not experience a crisis. We run regressions of the following form:

$$\begin{aligned} \Delta \text{loan}_{b,j,t} = & \phi_{b,j} + \tau_t + \rho_1 BC_{j,t} + \rho_2 \text{connected}_{b,k,t} + \rho_3 DIV_{b,t-1} \\ & + \rho_4 DIV_{b,t-1} \times BC_{j,t} + \rho_5 DIV_{b,t-1} \times \text{connected}_{b,k,t} + u_{b,j,t}, \end{aligned} \quad (5)$$

where the dependent variable is loan growth by bank b to all borrowers in j at t in log differences. *DIV* is our diversification metric on the bank level. We use bank-borrower country ($\phi_{b,j}$) and time (τ_t) fixed effects to analyze changes within a bank-borrower country connection and absorb common trends. We expect banking crises to affect loan growth negatively, so $\rho_1 < 0$. If there are spillover effects, connected markets see a fall in loan growth and $\rho_2 < 0$. From our previous results, we expect that diversified banks stabilize loan growth in host country j , so $\rho_4 > 0$. If diversified banks are financially

²⁸For example, for a bank that lends to Germany, France, and Italy, where Germany experiences a crisis in 2005, *connected* takes on value one for France and Italy in 2005 and zero otherwise.

unconstrained, they mitigate spillover effects and the coefficient on the interaction term ($DIV \times connected$) is positive ($\rho_5 > 0$). In other words, if $\rho_5 > 0$ we conclude that diversified banks have better access to financing during host market shocks and transfer resources through their intra-bank capital market. We cluster at the bank level to account for serial and cross-sectional dependence across borrowers from the same bank. In all regressions, we include borrower-country macroeconomic controls trade (in % of GDP), inflation rate, log GDP per capita, and log population.

Table 9 shows that globally diversified banks have higher loan growth in crisis countries, and shield connected countries from spillovers. Column (1) shows that during banking crises, and in line with our previous findings, countrywide loan growth drops significantly by 3.0 %. Column (2) confirms for the aggregate level that diversified banks are stabilizing, relative to banks with a concentrated portfolio. Similar to findings on the loan and firm level, the coefficient on diversification, interacted with banking crisis, is significant and positive. For banks with zero diversification, loan growth falls by 5.4 % during banking crises. Increasing diversification from the 25th to the 75th percentile attenuates the effect by $(0.63 \times 0.164 =)$ 4.1 %. Note that the highly significant coefficient on $DIV \times BC$ is equal in magnitude to the negative coefficient on banking crisis. This implies that banks with a fully diversified portfolio are able to completely offset the negative effect of a banking crisis on countrywide loan growth.

In column (3) we introduce our new variable *connected*. The negative and significant coefficient on *connected* implies that banks reduce lending by 2.9 % in unaffected countries when another borrowing country experiences a banking crisis. Note that the spillover effect is about two-thirds the size of the coefficient on banking crisis. Column (4) adds interaction terms. The positive and highly significant coefficients on $DIV \times BC$ and $DIV \times connected$ show that diversified banks stabilize loan supply in their host country, and reduce contagion effects. Moving a bank from the 25th to the 75th percentile reduces spillover effects from -6.3 % to zero. Fully diversified banks are thus able to offset the crisis-induced decline in loan supply both in affected and connected countries.

[[Table 9 about here](#)]

We interpret our results as evidence that being geographically diversified allows banks to tap new funds during crises, which reduces the need to withdraw capital from other markets. The ability to raise new deposits stabilizes banks' loan growth in the crisis

country, but also shields connected markets from negative spillovers. This finding is in line with recent literature. [Levine, Lin and Xie \(2017\)](#) show that diversified banks have lower risk in their portfolio, which allows them to access cheaper funding during times of distress. Complementary, [Cortés and Strahan \(2017\)](#) find that banks use internal capital markets to reallocate funds towards regions with high loan demand. Similar to our findings, the reallocation has negative effects on connected areas for smaller and less diversified banks that cannot raise new funds. [Bord, Ivashina and Taliaferro \(2015\)](#) provide additional evidence that large and healthy banks raise new deposits to smooth shocks and shield connected markets from spillovers.

So far, our analysis focuses on the asset side of banks' balance sheets. We will now present direct evidence on the liability side to test the relationship between diversification and access to funding for a subsample of US banks. We merge 334 of our Dealscan banks with bank data provided by the FDIC's Statistics on Depository Institutions (SDI). For US banks, we obtain quarterly information on deposits, assets, return on assets, net interest margins, as well as Tier 1 capital, which results in a total of 6,446 bank-quarter observations.²⁹ To see whether host country (non-US) shocks lead to an increase in deposits for diversified banks, we regress banks' log deposits on its diversification metric (*DIV*), interacted with the share of syndicated loans extended to crisis countries (*loans in crisis*). We control for size, Tier 1 capital ratio, return on assets, and net interest margin, as well as bank and quarter fixed effects. If diversified banks can tap new funds during times of distress, we expect a positive effect of diversification on US deposits.

Table 10 shows that diversified banks increase their deposits in response to a host country shock. Column (1) shows that for the average bank, deposits fall when it has a higher share of loans in distress. This could reflect that depositors question liquidity or solvency of the bank when parts of its loans are in distress. Once we add our interaction terms and controls in columns (2) and (3), we find that diversified banks increase their deposits during crises in borrower countries. Increasing diversification by one standard deviation leads to an increase in deposits of around 0.5 % (evaluated at the mean of share of loans in crisis). Thus, diversified banks raise new funds in their home market when faced with a shock in their host country. When we look at different types of

²⁹Dealscan and FDIC classify banks' parents by different criteria. With this caveat in mind, we match on subsidiary names, but assign each bank its parent's diversification value from Dealscan. SDI in general cover FDIC-insured depository institutions, which constitute most of the U.S. retail banking market. This leads to sample selection, as several banks in the syndicated loan market are not FDIC-insured.

deposits in columns (4)-(6), we see that the effect is driven by demand and money market deposits. Both types of deposits are short term and readily available, so it is reasonable to assume that banks cover their immediate needs following a crisis by raising short-term funding. There is no effect on time deposits (column (4)). While the sample covers only a limited number of US banks and has limited external validity, the strong positive effect of diversification on deposit growth supports our hypothesis that diversified banks can raise new funds during times of distress.³⁰

[[Table 10 about here](#)]

4 Robustness

We argue that banks' geographic diversification is the reason that they stabilize loan supply. In this section we address potential alternative explanations. To ensure identification of supply effects, we run variants of loan-level regression Equation (3). In all regressions, firm*bank and firm*time fixed effects absorb credit demand.

Foreign banks Diversified banks lend a significant share of their loans to foreign markets. A large literature finds that foreign and domestic banks differ during crisis episodes, which raises the concern that our classification by portfolio allocation simply reflects banks' nationality.³¹ Table 11 shows that a categorization of banks by diversification is different from a categorization by nationality. We include a foreign bank dummy that takes on value 1 if a banks' home country is not equal to its host country.³² Column (1) shows that foreign banks reduce lending by 1.6 % during host banking crises. Once we include our diversification metric in column (2), a non-diversified foreign bank reduces loan supply by 4.4 %. Diversified banks, on the other hand, are still stabilizing. Compared to baseline results in Table 6, the coefficient on $DIV \times BC$ increases in size to 8 % once we control for banks' nationality. This suggests that domestic banks with a diversified portfolio are the most stabilizing source of funding. We confirm this suspicion in column

³⁰Note that in columns (5)-(6) the coefficient on *share of loans in crisis* is negative. For concentrated banks, deposits fall in the US during host country shocks. A possible explanation is that they have to transfer existing funds to their affiliates in affected areas.

³¹For a recent summary, see [Claessens \(2017\)](#).

³²As nationality is constant within firm-bank connections, the coefficient on foreign bank is absorbed by fixed effects.

(3), where we interact the foreign dummy with diversification. For ease of interpretation we redefine *diversification* as a dummy with value one if diversification is above the yearly median. The interaction effect between diversification and foreign bank during banking crisis is highly significant and negative. The coefficients on interaction terms $DIV \times BC$ (*foreign bank* $\times BC$) remain positive (negative) and significant at the 1 % (5 %) level. In terms of economic significance, effects differ extensively across bank types. During banking crises, non-diversified foreign banks reduce lending by 1.9 %. Domestic diversified banks increase their relative loan supply by 8.2 %. The intermediate group of diversified foreign banks increases loan supply by 2.4 %. Results in columns (1)-(3) confirm the following pecking order: diversified domestic banks ($DIV = 1$, foreign bank = 0) are the most stable source of funding, while foreign banks with little diversification ($DIV = 0$, foreign bank = 1) are the most fickle. Foreign diversified banks lie in the middle. The ordering ties with findings on the flight home effect (Giannetti and Laeven, 2012) and behavior of gross capital flows during crises (Broner, Didier, Erce and Schmukler, 2013).

International loan portfolio The fact that banks extend international loans could itself reflect a different business model, regardless of diversification, and be responsible for our main findings. To take into account the international allocation of banks' loan portfolio, analogous to our diversification metric in Equation (1) we define banks' international portfolio as the ratio of international loans to total loans:

$$INT_{b,t} = \frac{\text{intl. syndicated loan volume}_{b,t}}{\text{total syndicated loan volume}_{b,t}} \in [0, 1]. \quad (6)$$

Intl. syndicated loan volume $_{b,t}$ is the sum of all loans by bank b in year t to firms located in a different country than the bank's parent entity. *Total syndicated loan volume* $_{b,t}$ is total lending in year t to all firms, domestic and foreign. We call banks with a low value of INT 'national', those with a high value 'international'. Figure 4 plots both metrics against each other, where international portfolio (INT) is on the x-axis, and banks' geographic diversification (DIV) on the y-axis (the blue line represents the quadratic fit). The humped shaped relationship that fans out for higher values of INT reflects the conceptual differences underlying each metric: banks that only lend domestically are in the bottom left corner (local on both metrics). Banks that lend exclusively to one foreign country are in the bottom right corner. They are globally integrated by our second definition (INT), but concentrated by our first (DIV), as they lend internationally but

are not diversified.³³ The dispersion in diversification for a given level of ‘internationality’ indicates that banks lending internationally differ widely in the geographic allocation of their portfolio – being international does not automatically imply diversification. That being said, the correlation between both metrics is high (0.81).

[[Figure 4 about here](#)]

Columns (4)-(7) in Table 11 show that diversification, not internationality, leads to positive loan supply effects. Column (4) shows that banks with a fully international portfolio stabilize loan growth by 2.3 %, significant at the 5 % level. However, once we include diversification in column (5), the positive effect disappears and turns negative, albeit insignificant. The positive stabilizing role of diversified banks remains. When we interact both metrics in columns (6) and (7), the following picture emerges. During banking crises, banks with international loans are stabilizing only if they have a diversified portfolio (positive coefficients on $DIV \times INT$ and $DIV \times INT \times BC$). Banks with a concentrated, but international, portfolio have a significant negative impact on loan supply (coefficient of -0.084 on $INT \times BC$ in column (7)). We conclude that diversification, not banks’ nationality, or whether they lend to foreign borrowers, explains the positive effects on loan supply during host country banking crises.

[[Table 11 about here](#)]

Share of loans in crisis An alternative explanation for our results is that diversified banks extend a smaller share of their total loan portfolio to countries in crisis. Once a banking crisis hits a borrower country, the asset side of a more diversified bank is less exposed to adverse effects such as loan write-downs. To test whether asset diversification is driving results we define for each bank *share of loans in crisis* as the share of total loans in year t that are extended to all borrower countries in crisis.³⁴ Diversified and concentrated banks have a similar average share of loans in crisis (32 %), but diversified banks’ median share of loans in crisis is significantly higher (6.5 % to 1%). In Table 12, column (1), we control for the share of loans in crisis, as well as its interaction

³³The lower bound of the arch reflects the minimum level of diversification for each bank, given that it lends to more than one country. The upper bound, in turn, shows banks that lend to more than one country, but have a diversified (read: not geographically concentrated) portfolio.

³⁴For each bank b in year t , we define *share of loans in crisis* $_{t,b} = \frac{\sum_c BC_{t,c} L_{t,b,c}}{\sum_c L_{t,b,c}}$, where c denotes all countries borrowing from bank b in year t .

with banking crisis. Our main coefficient of interest increases compared to our baseline loan-level regression (from 0.039 to 0.054). Hence the positive effect of diversification is not driven by the share of loans in crisis. For a given share of loans in distress, better diversification leads to higher loan supply. Once we introduce a triple interaction term in column (2), we see that a higher share of loans in crisis reduces loan volume for banks with no diversification. Instead, for a given share of loans in crisis countries, diversified banks stabilize loan volume, as indicated by the significant positive coefficient of $DIV \times share\ of\ loans \times BC$. The negative, but insignificant coefficient on $DIV \times BC$ could suggest that banks reduce lending to countries where they only hold a small share of loans. Diversification becomes more important for loan supply when a high share of loans is in distress.

[[Table 12 about here](#)]

Portfolio risk Banks differ in terms of borrower risk (Neuhann and Saidi, 2016; Levine, Lin and Xie, 2017). If diversified banks extend loans to less risky borrowers, they are less exposed to the negative effects of a crisis. To address this issue, for each bank we compute portfolio risk by taking the standard deviation of sales growth for each firm in non-crisis years. We consider non-crisis years only, as the stabilizing role of diversified banks during crises could lead to a downward bias in measured volatility. Table 5 shows that firms with low exposure to diversified banks are riskier in terms of volatility of investment, employment, asset, and sales growth. Firms are assigned into top and bottom tercile according to their exposure for each year.³⁵ In Table 12, column (3), we ensure that our baseline finding survives for the smaller sample of loans to borrowers with balance sheet information. Diversified banks still have significantly higher loan supply. Once we include portfolio risk (interacted with banking crisis) in column (4), we see that higher portfolio risk reduces loan supply during a banking crisis.³⁶ However, the main coefficient of interest on $DIV \times BC$ increases. Including a triple interaction effect in column (5) keeps the main coefficient stable. We also see that higher portfolio risk reduces loan supply for non-diversified banks. The positive triple interaction term indicates that for a given level of portfolio risk, better diversification leads to higher loan supply during crisis. We interpret this as evidence that portfolio risk is not responsible for the stabilizing

³⁵ We restrict the analysis to observations for which we have balance sheet data, which reduces the number of loan-level observations by around 60 %.

³⁶Portfolio risk is constant for banks and thus absorbed by fixed effects.

effect we find, but that banks' diversification still leads to significantly higher loan supply during crises – in the presence of portfolio risk, the positive effect of diversification gains in importance.

[Table 5 about here]

Bank size Table 12, column (6) controls for bank size. As we have no direct data on bank size for the full sample, we assume that bigger banks grant larger loans and use loan size as proxy. To ensure that diversification has a positive effect on loan supply above and beyond banks' size, for each year we create quintiles by total loan volume. We then include size-quintile*year fixed effects in our regression. We thus compare lending between each bank-firm pair within a given size class of banks in each year. We also include firm*time fixed effects to absorb any change in loan demand. The positive and significant effect of diversification on loan supply survives once we control for banks' size. After including size*year fixed effects, during a banking crisis fully diversified banks have 3.7 % higher loan volume compared to non-diversified banks within the same size-year bin.

5 Extensions

This section presents extensions and further robustness checks of our baseline findings. We show that our diversification metric correlates with macro variables of financial integration; effects are stronger for financially constrained firms; diversified banks extend loans at longer maturity, but higher interest during crises; and that, following a crisis, there is a shift in firms' portfolios towards lending by diversified banks.

Macro evidence We use syndicated loan market data to construct our bank diversification metric. Syndicated lending represents a sizable share of firm debt and cross-border loans (Gadanecz and von Kleist, 2002). We now show that our metric (aggregated to the country level) correlates with aggregate country-level variables. Figure 5, Panel a) shows a strong positive relationship between borrowing countries' total syndicated lending (as share of GDP) against total credit (as share of GDP). Countries with a high level of

overall credit also have a high level of syndicated loan volume.³⁷ Panels b)–d) show the relationship between our diversification metric and aggregate measures of banking integration. Diversification is positively correlated with the share of foreign bank assets (as share of total bank assets), claims by foreign banks, as well as foreign liabilities (both as share of GDP).³⁸ Hence, countries with a high share of firms borrowing from diversified banks are also better financially integrated. They have higher foreign bank presence in their domestic market, as well as larger claims on foreign countries. Taken together, this implies that syndicated lending in our data is positively correlated with total credit, and our diversification metric captures financial integration.

[Figure 5 about here]

Financial constraints We split firms into financially constrained and unconstrained. As constrained firms rely more on external credit to finance employment and investment, higher exposure to diversified banks should have stronger effects. For each year we group firms into bottom and top tercile according to their payout ratio (*payout*) and size (*size*). We classify firms as financially constrained if they are in the bottom tercile, and unconstrained if they are in the top tercile (Almeida and Campello, 2007; Chaney, Sraer and Thesmar, 2012). In Table 13, columns (1)–(4) use employment growth as dependent variable, columns (5)–(8) investment growth. All regressions include baseline controls, as well as firm and country*year fixed effects. For both dependent variables, the positive effect of exposure to diversified banks during crises is significantly stronger for constrained (*cons.*) than unconstrained (*uncons.*) firms. Note that our Compustat sample covers large and listed firms. The stronger effects for financially constrained firms reassure us that effects would extend to a sample covering small firms as well. In general, small firms are found to be more bank dependent and also more credit constrained and therefore loan supply decisions matter more.

Maturity and interest rates Beside changes in loan amount, banks can alter maturity or the interest rate of loans. To test whether banks use these margins to restrict or expand loan supply, we rerun firm level regression Equation (4), but replace the de-

³⁷A regression of total credit on syndicated credit with country fixed effects yields a coefficient of 0.29 with t-value 11.47.

³⁸Data is provided by the Bank for International Settlements, the World Bank World Development Indicators, as well as Global Financial Development Database. See Table 17 for details.

pendent variable by *maturity* (in months), and *interest spread* over LIBOR (in basis points). Table 14 shows that borrowing from diversified banks leads to a higher spread and longer maturity during crises. While the effect on maturity is quantitatively negligible and insignificant, a one standard deviation increase in exposure increases the spread by around 7 basis points. We interpret this as evidence that diversified banks are willing to extend loans during crises, but compensate higher risk through higher interest rates. Columns (3)-(5) further examine the robustness of our results. The dependent variable is loan growth. Column (3) excludes the global crisis and restricts the sample to years 1995–2008. Column (4) introduces a global financial crisis (GFC) dummy with value one during banking crises in years 2008, 2009, and 2010. In both columns, our main effect remains positive and significant. The recent financial crisis does not drive our results. Finally, column (5) introduces a regional crisis dummy.³⁹ The negative coefficient on *exposure* \times *regional BC* suggests that during crises affecting several countries at once, the positive effect of diversification is weakened. Yet, our baseline effect remains stable.

[[Tables 13 and 14 about here](#)]

Substitution effects While we showed above that diversified banks sustain higher loan supply and credit growth to firms during crises, we now investigate how the differing behavior of diversified and concentrated banks changes the structure of the economy. First, we look at substitution effects on the firm level. While firms cannot perfectly offset changes in loan supply by switching across banks, Table 15 shows that there is nonetheless an increase in reliance on diversified lenders. We run a regression of firms’ exposure (i.e. the share of loans coming from diversified banks) on the banking crisis dummy. Columns (1)-(4) use firm and region*year fixed effects, and look at within firm changes, while controlling for common regional shocks. All regressions include firm-country controls trade, inflation, log GDP per capita, and log population. There is a significant and positive effect of banking crisis on firms’ exposure. The average firm sees an increase in its exposure to diversified lenders by 0.7 % during the year of the crisis. Effects are highly persistent even three years after the crisis. Besides a shift in exposure within firms, there could also be a shift across firms towards firms that borrow more from diversified banks. Columns (5)-(8) use country*industry instead of firm fixed effects and compare

³⁹The *regional BC* dummy takes on value one for Asian countries during the Asian crisis (1997-1999), South American countries during the Latin crisis (1995-1996), as well as the Great Financial Crisis in Europe and the US.

how exposure changes across firms within a given country-industry pair. Results show that during a banking crisis there is a shift towards borrowers from diversified banks. The share of loans from diversified banks increases by 0.3 % in the year of the crisis. It is still 1.1 % higher three years after the crisis. The stronger effect on the industry level suggests that on top of a shift towards diversified lenders *within* firms, there is also a shift within industries *across* firms towards borrowers with higher exposure.

[[Tables 15 and 16 about here](#)]

The increase in firms' reliance on diversified banks should be mirrored in banks' loan portfolios. We run the following regression on the bank (b) – borrower country (j) – year (t) level:

$$share_{b,j,t} = \gamma_1 BC_{j,t} + \gamma_2 diversification_{b,t} + \gamma_3 DIV_{b,t} \times BC_{j,t} + X_{j,t} + \epsilon_{b,j,t}.$$

$share_{b,j,t}$ denotes bank b's share of total loans in country j in year t and X is a set of controls for the borrower country. Based on our above findings, we expect that a banking crisis leads to a decline in $share$ ($\gamma_1 < 0$), but the decline should be smaller or absent for diversified banks ($\gamma_3 > 0$), as they are a more stable source of funding. The coefficient γ_2 on DIV is expected to be negative, as diversified banks will have a lower average loan share than concentrated banks. In each regression, we use bank*borrower country fixed effects and analyze variation in loan shares within a specific bank-borrower country connection. We also employ time-varying fixed effects on the bank country level to absorb changes in each banks' home country. If, for example, there is a contemporaneous negative shock in a banks' home country that we do not account for, the stabilizing effect of diversification is likely to be muted. Again, all regressions include borrower-country controls trade, inflation, log GDP per capita, and log population.

Table 16, column (1), shows that a banking crisis in host country j reduces banks' share of loans extended to j by 0.7 %. The effect is significant at the 1 % level and economically meaningful. The median loan share is 2.2 %, so a banking crisis reduces banks' loan share by around 31 % relative to the median. Once we interact our crisis dummy with our diversification metric in column (2), we see that *i*) in non-crisis times, diversified banks have a lower loan share in host countries than concentrated banks; and *ii*) their share falls by less during banking crises. Columns (2)-(5) lead the dependent variable by subsequent periods. In each specification we find that diversified banks reduce their loan share by less. For example, in column (2), fully diversified banks reduce their

loan share by 0 %, compared to 1.3 % for banks with no diversification. Combining our evidence in Tables 15 and 16, we find that banking crises in host countries increase borrowers' reliance on lending by diversified banks. The long-run effects of the increase in importance of diversified banks on financial stability and, for example, spillover effects, is an interesting question for future research.

6 Conclusion

We develop a novel metric to categorize banks according to the geographic diversification of their international loan portfolio. For a large sample of international syndicated loans, we find that diversified banks are a resilient source of financing for firms that experience a countrywide financial crisis. Borrowing from diversified banks increases loan, investment, and employment growth significantly. Detailed loan-level data ensures proper identification of supply effects, as we absorb changes in firm demand through time-varying fixed effects on the firm level. Our results provide evidence that diversification allows banks to raise new funds during times of distress, which are then allocated towards affiliates in distress. This not only stabilizes loan supply in affected countries, but also reduces spillover effects to connected markets.

When we contrast our measure with the standard classification by nationality, we find that domestic, diversified banks are the most resilient source of financing, while foreign banks provide no insurance. The negative effect of foreign banks is increasing in the concentration of their portfolio. We also exclude candidate explanations other than diversification. Geographic diversification remains a significant factor contributing to higher stability in lending even after we control for banks' international orientation, share of loans in crisis, and portfolio risk.

This paper contributes to the debate on the costs and benefits of financial integration. Figure 6 shows that banks' diversification declined during the global financial crisis and remained depressed thereafter. Our results suggest that the recent retrenchment in financial integration following the Great Financial Crisis is worrisome (Milesi-Ferretti and Tille, 2011; Cerutti and Claessens, 2016; Claessens and Van Horen, 2015). While cross-border lending constitutes a potential source of contagion, we show that internationally active and diversified banks have better access to funds during banking crises in their borrower countries and increase resilience to local shocks.

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A Appendix

A.1 Descriptives

Figure 1: **Diversification – loan level**

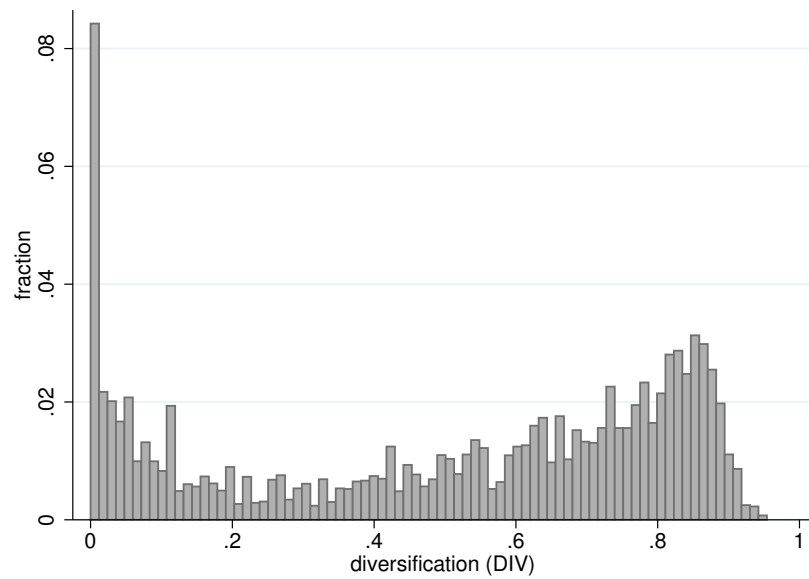
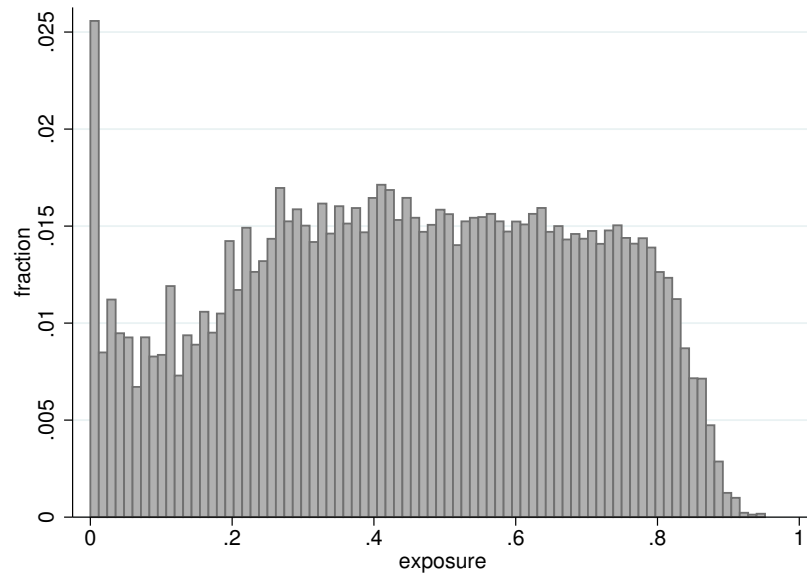
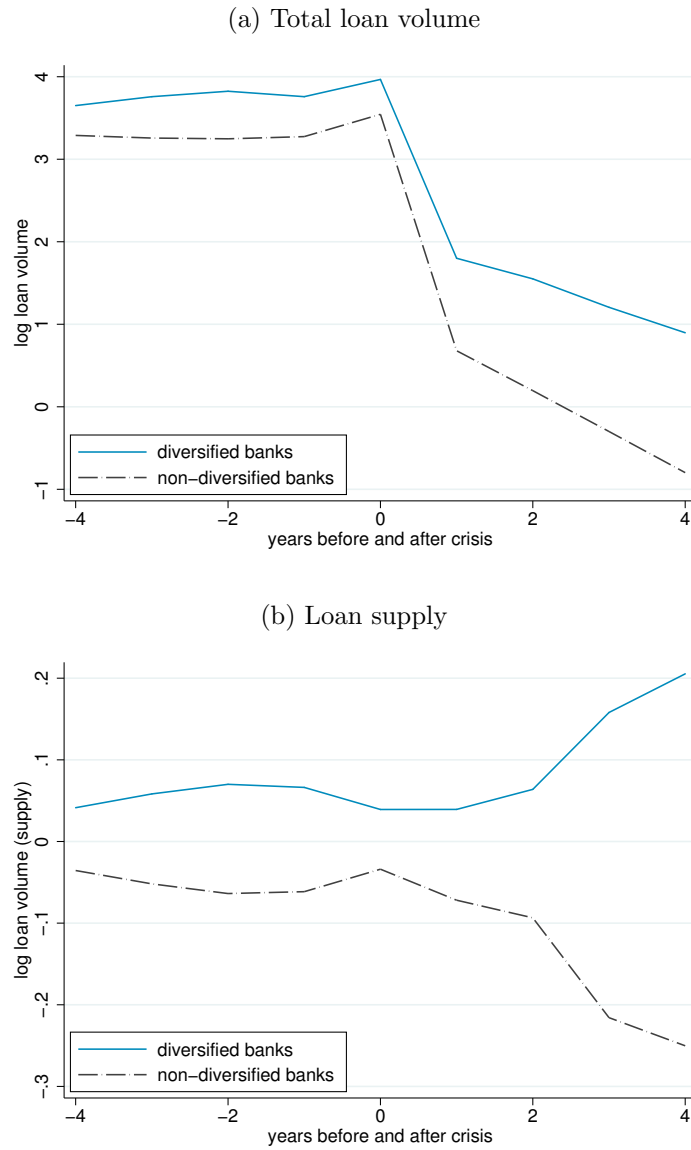


Figure 2: **Exposure – firm level**



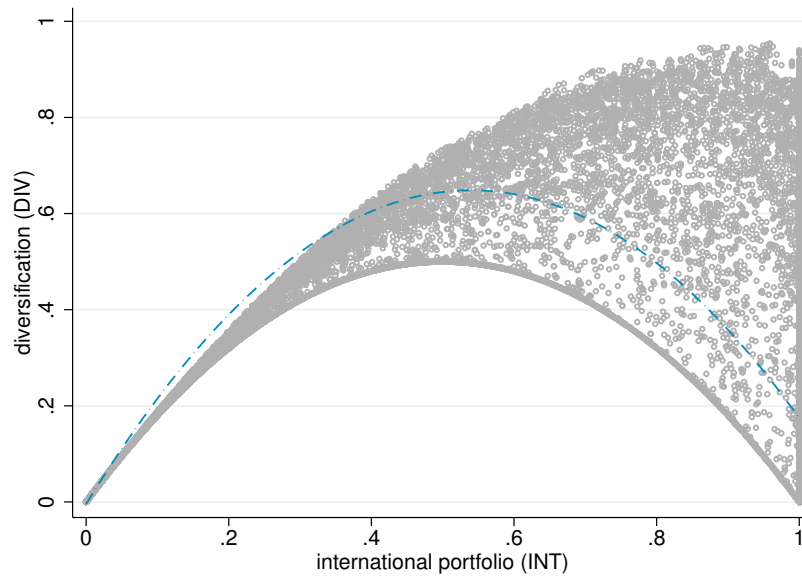
Note: Figure 1 shows the loan-level distribution of banks' diversification, Figure 2 the firm-level distribution of firms' exposure. The mass of observations shifts from the right tail towards the middle, indicating that most firms borrow from both diversified and concentrated banks in each year. For detailed variable definitions see Table 17 and text.

Figure 3: Loan volume during a crisis



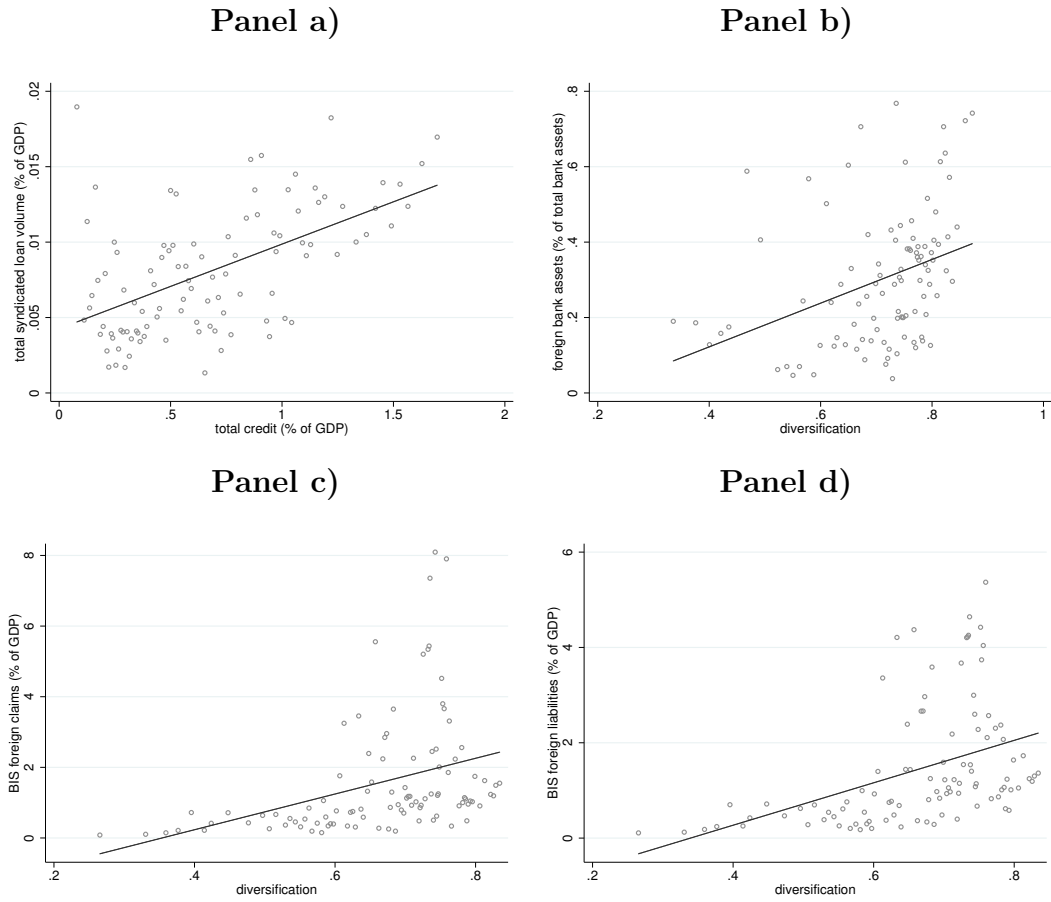
Note: Both panels show the evolution of $\log(\text{loan volume})$ in the four years prior, during, and the four years after a banking crisis. A value of 0 on the x-axis denotes the year of the banking crisis. We split the sample by the yearly median for banks with high and low values of diversification. Panel 3a shows the unconditional average across all banks. Both diversified and concentrated banks see a decline in outstanding loan volume during the crisis and the following years, but concentrated banks see a stronger fall. Panel 3b plots the residual of a regression of $\log(\text{loan volume})$ on firm*time fixed effects that absorb unobservable change in loan demand. After absorbing demand effects, both lines reflect changes in loan supply. Diversified banks do not reduce loan supply during the crisis and increase it in the following years, while concentrated banks reduce loan volume during and after the crisis. For detailed variable definitions see Table 17 and text.

Figure 4: **Diversification and international portfolio**



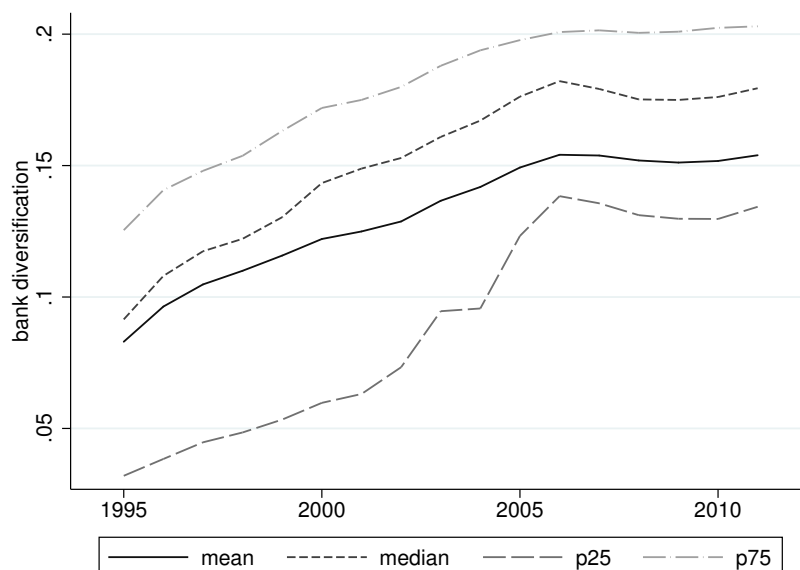
Note: This figure shows the relationship between banks' portfolio diversification (DIV) and the international allocation of their loan portfolio (INT) on the loan level. The blue dashed line is a quadratic fit. Higher values denote more portfolio diversification, and a higher share of loans extended to foreign borrowers, respectively. For detailed variable definitions see Table 17 and text.

Figure 5: Macro evidence



Note: This figure shows the relationship between our sample data and aggregate data on total credit, as well as our diversification metric and aggregate measures of financial integration. All scatter plots depict scatter points as well as a linear fit, where the underlying data is aggregated to the country-year level. For detailed variable definitions see Table 17 and text.

Figure 6: Banks' diversification over time



Note: This figure shows the change in banks' diversification over time. Diversification is computed according to Equation (1). It plots the mean, median, 25th, and 75th percentile from 1995 to 2012. Diversification increased steadily until around 2006, but then decreased during the recent global financial crisis and remains depressed ever since. Less-diversified banks drive the decline. For detailed variable definitions see Table 17 and text.

Table 1: Summary statistics – by region

	loans	firms	banks	DIV	BC
East Asia and Pacific	386973	8767	1642	266	28
Europe and Central Asia	379177	6033	1118	269	128
Latin America and Caribbean	39622	626	126	21	24
Middle East and North Africa	30164	334	176	54	0
North America	860634	19176	3711	74	6
South Asia	20379	458	116	8	0
Sub-Saharan Africa	7124	116	73	14	3
Total	1724073	35510	6962	706	189

Note: This table shows the geographic distribution of our sample. *loans* denotes the number of firm-bank-year observations, *firms* and *banks* the number of individual firms and banks. *DIV* stands for diversification and denotes the number of banks with non-zero portfolio diversification. Finally, *BC* stands for banking crisis and denotes the number of country-year observations with banking crises. For detailed variable definitions see Table 17 and text.

Table 2: **Summary statistics – loan level**

	diversified		concentrated		mean diff.
	mean	sd	mean	sd	t
Δ loan volume	0.02	(0.36)	0.01	(0.34)	-17.00
loan volume (m)	101.67	(296.04)	75.53	(266.63)	-60.94
loan spread (bp)	137.08	(107.52)	191.17	(131.07)	263.55
maturity (months)	76.12	(49.16)	71.39	(42.22)	-67.76
Observations	854370		869703		1724073

Note: This table shows descriptive statistics on the firm-bank-year (loan) level. The sample is split by the yearly median according to banks' diversification. Highly diversified observations are denoted *diversified*, those with low diversification as *concentrated*. *mean* denotes the mean, *sd* the standard deviation, and *mean diff.* the t-value for the difference in means across both groups. For detailed variable definitions see Table 17 and text.

Table 3: **Summary statistics – firm level Dealscan**

	high exposure		low exposure		mean diff.
	mean	sd	mean	sd	t
Δ loan volume	0.04	(0.39)	0.03	(0.39)	-2.34
loan volume (m)	763.80	(1982.62)	323.47	(723.77)	-65.52
loan spread (bp)	169.81	(130.74)	235.06	(137.16)	92.05
maturity (months)	83.62	(64.15)	64.91	(42.38)	-76.95
Observations	99948		99986		199934

Note: This table shows descriptive statistics on the firm-year (firm) level for the full sample of Dealscan firms. The sample is split by the yearly median according to firms' exposure. High exposure firms are denoted *high exposure*, those with low exposure as *low exposure*. *mean* denotes the mean, *sd* the standard deviation, and *mean diff.* the t-value for the difference in means across both groups. For detailed variable definitions see Table 17 and text.

Table 4: **Summary statistics – firm level Compustat**

	high exposure		low exposure		mean diff.
	mean	sd	mean	sd	t
Δ employment	0.03	(0.17)	0.03	(0.20)	2.96
Δ investment	0.03	(0.59)	0.04	(0.64)	2.66
Δ sales	0.07	(0.32)	0.09	(0.22)	6.66
investment ratio	0.22	(1.39)	0.23	(0.26)	1.71
return on assets	0.06	(0.08)	0.06	(0.11)	-4.76
employment (th)	17.04	(37.40)	6.48	(15.09)	-45.22
log total assets	8.51	(2.30)	6.48	(2.06)	-115.61
market to book ratio	1.58	(1.01)	1.61	(1.11)	2.06
long-term debt ratio	0.25	(0.20)	0.24	(0.22)	-7.53
Observations	29613		33168		62781

Note: This table shows descriptive statistics on the firm-year (firm) level for the smaller sample of matched Compustat firms. The sample is split by the yearly median according to firms' exposure. High exposure firms are denoted *high exposure*, those with low exposure as *low exposure*. *mean* denotes the mean, *sd* the standard deviation, and *mean diff.* the t-value for the difference in means across both groups. For detailed variable definitions see Table 17 and text.

Table 5: **Risk – firm level**

	high exposure		low exposure		mean diff.
	mean	sd	mean	sd	t
investment growth sd	0.54	(0.32)	0.62	(0.37)	10.63
employment growth sd	0.14	(0.10)	0.16	(0.12)	7.20
assets growth sd	0.18	(0.14)	0.20	(0.16)	6.87
sales growth sd	0.18	(0.12)	0.19	(0.14)	2.94
Observations	3689		3893		7582

Note: This table shows descriptive statistics on the firm-year (firm) level for the smaller sample of matched Compustat firms. *Risk* is defined as firms' standard deviation of investment/employment/asset7sales growth in non-crisis times. The sample is split by the yearly median according to firms' exposure. High exposure firms are denoted *high exposure*, those with low exposure as *low exposure*. *mean* denotes the mean, *sd* the standard deviation, and *mean diff.* the t-value for the difference in means across both groups. For detailed variable definitions see Table 17 and text.

A.2 Results

A.2.1 Main Results

Table 6: Loan level – loan supply

VARIABLES	(1) full sample log loan volume	(2) full sample log loan volume	(3) full sample log loan volume	(4) KM sample log loan volume	(5) KM sample log loan volume	(6) KM sample log loan volume
banking crisis (BC)	0.040 (0.029)			-0.005 (0.017)		
diversification (DIV)	0.309*** (0.060)	0.005 (0.018)	0.013 (0.017)	0.199*** (0.061)	0.047** (0.019)	0.063*** (0.021)
DIV × BC	0.135*** (0.026)	0.039*** (0.013)	0.063*** (0.013)	0.145*** (0.028)	0.056*** (0.021)	0.071*** (0.023)
Observations	1,724,073	1,691,064	1,724,073	666,119	664,935	665,949
R-squared	0.954	0.976	0.965	0.966	0.979	0.975
Firm*Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm*Year FE	-	Yes	-	-	Yes	-
Country*Industry*Year FE	-	-	Yes	-	-	Yes
Cluster	Country*Year	Country*Year	Country*Year	Country*Year	Country*Year	Country*Year

Note: This table shows regressions on the bank-firm-year (loan) level. The dependent variable is log of total outstanding loan volume; *banking crisis (BC)* is a dummy with value one during banking crises in the firm country, as defined in [Laeven and Valencia \(2013\)](#); *diversification (DIV)* is banks' portfolio diversification. For detailed variable definitions see Table 17 and text. All standard errors are clustered at the firm country-year level. *full sample* denotes the full sample with all loan-level observations, while *KM sample* restricts the sample to firms that borrow from diversified and concentrated banks in each year. *** p<0.01, ** p<0.05, * p<0.1

Table 7: Firm level – loan growth

VARIABLES	(1) Δ loan volume	(2) Δ loan volume	(3) Δ loan volume
banking crisis	-0.142*** (0.006)		
exposure	-0.475*** (0.019)	-0.185*** (0.021)	-0.182*** (0.022)
exposure × BC	0.055*** (0.014)	0.050*** (0.017)	0.039** (0.019)
Observations	196,337	196,337	196,038
R-squared	0.138	0.172	0.317
Firm FE	Yes	Yes	Yes
Country*Year FE	-	Yes	-
Country*Industry*Year FE	-	-	Yes
Cluster	Firm	Firm	Firm

Note: This table shows regressions on the firm-year (firm) level. The dependent variable is log difference of firms' total outstanding loan volume; *banking crisis* (BC) is a dummy with value one during banking crises in the firm country, as defined in Laeven and Valencia (2013); *exposure* is firms' exposure to diversified banks. For detailed variable definitions see Table 17 and text. All standard errors are clustered at the firm level. *** p<0.01, ** p<0.05, * p<0.1

Table 8: Firm level – real effects

VARIABLES	(1) Δ long-term debt	(2) Δ long-term debt	(3) Δ employment	(4) Δ employment	(5) Δ investment	(6) Δ investment
banking crisis	-0.084*** (0.023)		-0.064*** (0.006)		-0.131*** (0.017)	
exposure	-0.269*** (0.037)	-0.261*** (0.049)	-0.155*** (0.013)	-0.074*** (0.014)	-0.242*** (0.032)	-0.163*** (0.038)
exposure × BC	0.131*** (0.043)	0.105* (0.057)	0.071*** (0.012)	0.029** (0.014)	0.123*** (0.034)	0.119*** (0.042)
Observations	53,574	49,340	51,445	47,496	54,638	51,845
R-squared	0.172	0.233	0.279	0.349	0.137	0.231
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Country*Year FE	-	Yes	-	Yes	-	Yes
Controls	-	Yes	-	Yes	-	Yes
Cluster	Firm	Firm	Firm	Firm	Firm	Firm

Note: This table shows regressions on the firm-year (firm) level. The dependent variables are log difference of firms' long-term debt, employment, and investment; *banking crisis* (BC) is a dummy with value one during banking crises in the firm country, as defined in Laeven and Valencia (2013); *exposure* is firms' exposure to diversified banks. *log total assets*, *return on assets*, and *leverage* are firm-level controls. For detailed variable definitions see Table 17 and text. All standard errors are clustered at the firm level. *** p<0.01, ** p<0.05, * p<0.1

Table 9: **Bank level – Spillover effects**

VARIABLES	(1) Δ loan vol.	(2) Δ loan vol.	(3) Δ loan vol.	(4) Δ loan vol.	(5) Δ loan vol.
banking crisis (BC)	-0.030*** (0.005)	-0.054*** (0.008)	-0.049*** (0.006)	-0.068*** (0.009)	-0.022* (0.012)
connected			-0.029*** (0.006)	-0.063*** (0.012)	-0.039*** (0.014)
diversification (DIV)		-0.018 (0.019)		-0.034* (0.018)	-0.042** (0.019)
DIV × BC		0.053*** (0.014)		0.052*** (0.014)	0.027 (0.017)
DIV × connected				0.064*** (0.018)	0.061*** (0.018)
Observations	167,213	167,213	167,213	167,213	166,976
R-squared	0.212	0.212	0.212	0.213	0.237
Bank*Borrower Country FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	-
Bank Country*Year FE	-	-	-	-	Yes
Controls	macro	macro	macro	macro	macro
Cluster	Bank	Bank	Bank	Bank	Bank

Note: This table shows regressions on the bank-firm country-year (bank) level. The dependent variable is log of total outstanding loan volume by bank b to all borrowers in country j ; *banking crisis (BC)* is a dummy with value one during banking crises in the firm country, as defined in [Laeven and Valencia \(2013\)](#); *diversification (DIV)* is banks' portfolio diversification. *connected* is a dummy with value one when $BC = 1$ for all countries connected to bank b that are not country j and have no contemporaneous banking crisis. All regressions include borrower-country macroeconomic controls trade (in % of GDP), inflation rate, log GDP per capita, and log population. For detailed variable definitions see [Table 17](#) and text. All standard errors are clustered at the bank level. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 10: **FDIC SDI – Mechanism**

VARIABLES	(1) log deposits	(2) log deposits	(3) log deposits	(4) log time dep.	(5) log demand dep.	(6) log money market dep.
loans in crisis	-0.640*** (0.212)	0.085 (0.058)	0.089 (0.066)	0.106 (0.099)	-0.243** (0.107)	-0.138 (0.268)
diversification (DIV)		0.240 (0.156)	0.228 (0.137)	0.016 (0.331)	0.255 (0.376)	0.435** (0.176)
DIV × loans in crisis		6.290** (2.734)	6.340** (2.757)	0.747 (7.667)	24.402*** (6.500)	11.786* (6.716)
Observations	6,446	6,446	6,446	6,074	6,021	5,909
R-squared	0.930	0.991	0.991	0.949	0.962	0.983
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Quarter FE	-	-	Yes	Yes	Yes	Yes
Controls	-	Yes	Yes	Yes	Yes	Yes
Cluster	State	State	State	State	State	State

Note: This table shows regressions on the bank-quarter level for FDIC SDI data (US banks only). The dependent variables are log deposits; *loans in crisis* is banks' share of loans extended to countries with a banking crisis, as defined in [Laeven and Valencia \(2013\)](#); *diversification (DIV)* is banks' portfolio diversification. All regressions include $\log(\text{assets})$, *tier 1 capital ratio*, *net interest margin*, and *return on assets* as bank-level controls. For detailed variable definitions see [Table 17](#) and text. All standard errors are clustered at the US state level. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

A.2.2 Extensions

Table 11: Foreign and international banks

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	log loan volume	log loan volume	log loan volume	log loan volume	log loan volume	log loan volume	log loan volume
diversification (DIV)		-0.002 (0.018)	0.005 (0.017)		-0.024 (0.022)	-0.116*** (0.027)	-0.102*** (0.025)
DIV × BC		0.080*** (0.015)	0.077*** (0.011)		0.059*** (0.017)	0.067*** (0.017)	0.018 (0.034)
foreign bank × BC	-0.016** (0.008)	-0.044*** (0.011)	-0.019** (0.009)				
DIV × foreign bank			0.006 (0.007)				
DIV × foreign bank × BC			-0.045*** (0.010)				
int. portfolio (INT)				0.047*** (0.013)	0.059*** (0.018)	0.011 (0.022)	0.023 (0.023)
INT × BC				0.023** (0.012)	-0.016 (0.017)	-0.026 (0.016)	-0.084*** (0.024)
DIV × INT						0.158*** (0.036)	0.132*** (0.035)
DIV × INT × BC							0.120** (0.059)
Observations	1,691,064	1,691,064	1,691,064	1,691,064	1,691,064	1,691,064	1,691,064
R-squared	0.976	0.976	0.976	0.976	0.976	0.976	0.976
Firm*Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm*Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cluster	Country*Year	Country*Year	Country*Year	Country*Year	Country*Year	Country*Year	Country*Year

Note: This table shows regressions on the bank-firm-year (loan) level. The dependent variable is log of total outstanding loan volume; *banking crisis (BC)* is a dummy with value one during banking crises in the firm country, as defined in Laeven and Valencia (2013); *diversification (DIV)* is banks' portfolio diversification. *foreign bank* is a dummy with value one if bank country and firm country differ. In column (3), *DIV* is a dummy with value 1 if a bank has above median diversification in a given year. *int. portfolio (INT)* is banks' portfolio share that is extended to foreign borrowers. For detailed variable definitions see Table 17 and text. All standard errors are clustered at the firm country-year level. *** p<0.01, ** p<0.05, * p<0.1

Table 12: Crisis loans and portfolio risk

VARIABLES	(1) log loan volume	(2) log loan volume	(3) log loan volume	(4) log loan volume	(5) log loan volume	(6) log loan volume
diversification (DIV)	0.001 (0.018)	0.002 (0.018)	-0.017 (0.019)	-0.025 (0.019)	-0.025 (0.019)	-0.024* (0.013)
DIV × BC	0.054*** (0.013)	-0.033 (0.033)	0.026** (0.011)	0.047*** (0.013)	0.047*** (0.013)	0.037*** (0.010)
share of loans in crisis	0.010 (0.014)	0.011 (0.014)				
BC × share of loans in crisis	0.032 (0.020)	-0.030 (0.033)				
DIV × BC × share of loans in crisis		0.099** (0.041)				
portfolio risk (sales) × BC				-0.021*** (0.003)	-0.021*** (0.006)	
DIV × portfolio risk (sales) × BC					-0.002 (0.011)	
Observations	1,691,064	1,691,064	1,596,872	1,596,872	1,596,872	1,691,064
R-squared	0.976	0.976	0.974	0.974	0.974	0.990
Firm*Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm*Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank Size*Year FE	-	-	-	-	-	Yes
Cluster	Country*Year	Country*Year	Country*Year	Country*Year	Country*Year	Country*Year

Note: This table shows regressions on the bank-firm-year (loan) level. The dependent variable is log of total outstanding loan volume; *banking crisis (BC)* is a dummy with value one during banking crises in the firm country, as defined in [Laeven and Valencia \(2013\)](#); *diversification (DIV)* is banks' portfolio diversification. *share of loans in crisis* denotes banks' share of total loans extended to countries that suffer a banking crisis. *portfolio risk (sales)* is banks' portfolio risk, measured as the average standard deviation of borrowers' sales growth in non-crisis times. Column (6) includes time-varying fixed effects for quintiles of loan size (*Bank Size*Year FE*). For detailed variable definitions see [Table 17](#) and text. All standard errors are clustered at the firm country-year level. *** p<0.01, ** p<0.05, * p<0.1

A.2.3 Robustness

Table 13: Firm level – financial constraints

VARIABLES	(1) uncons. payout Δ employment	(2) cons. payout Δ employment	(3) uncons. size Δ employment	(4) cons. size Δ employment	(5) uncons. payout Δ investment	(6) cons. payout Δ investment	(7) uncons. size Δ investment	(8) cons. size Δ investment
exposure	-0.055* (0.029)	-0.103*** (0.032)	-0.033 (0.024)	-0.033 (0.024)	0.024 (0.080)	-0.265*** (0.083)	-0.075 (0.067)	-0.106 (0.079)
exposure × BC	-0.003 (0.024)	0.094*** (0.033)	0.063 (0.041)	0.041* (0.025)	-0.058 (0.072)	0.277** (0.109)	-0.077 (0.134)	0.201** (0.084)
Observations	11,347	12,207	15,598	15,433	12,017	12,808	16,742	16,660
R-squared	0.336	0.472	0.333	0.413	0.272	0.317	0.249	0.260
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country*Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cluster	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm

Note: This table shows regressions on the firm-year (firm) level. The dependent variables are log difference of firms' employment and investment; *banking crisis (BC)* is a dummy with value one during banking crises in the firm country, as defined in [Laeven and Valencia \(2013\)](#); *exposure* is firms' exposure to diversified banks. All regressions include *log total assets*, *return on assets*, and *leverage* as firm-level controls. *uncons.* and *cons.* denote constrained and unconstrained firms, split into bottom and top tercile of payout ratio or size for each year. For detailed variable definitions see [Table 17](#) and text. All standard errors are clustered at the firm level. *** p<0.01, ** p<0.05, * p<0.1

Table 14: Firm level – maturity and sample selection

VARIABLES	(1) loan spread	(2) maturity	(3) 1995-2008 Δ loan volume	(4) GFC Δ loan volume	(5) regional crisis Δ loan volume
exposure	-35.486*** (6.932)	6.392*** (1.763)	-0.249*** (0.027)	-0.186*** (0.022)	-0.182*** (0.022)
exposure \times BC	30.816*** (6.288)	2.636 (1.899)	0.070*** (0.023)	0.057*** (0.022)	0.054** (0.022)
exposure \times GFC				0.066** (0.025)	
exposure \times GFC \times BC				-0.100*** (0.031)	
exposure \times regional BC					-0.029* (0.018)
Observations	139,505	199,799	133,542	196,038	196,038
R-squared	0.905	0.951	0.338	0.317	0.317
Firm FE	Yes	Yes	Yes	Yes	Yes
Country*Industry*Year FE	Yes	Yes	Yes	Yes	Yes
Cluster	Firm	Firm	Firm	Firm	Firm

Note: This table shows regressions on the firm-year (firm) level. The dependent variable is firms' average *loan spread* over LIBOR (in basis points) and *maturity* (in months) in columns (1) and (2), and log difference of firms' total outstanding loan volume in columns (3)-(5); *banking crisis (BC)* is a dummy with value one during banking crises in the firm country, as defined in [Laeven and Valencia \(2013\)](#); *exposure* is firms' exposure to diversified banks. *Great Financial Crisis (GFC)* is a dummy with value one during banking crises from 2008-2010. *regional crisis* is a dummy with value one during regional banking crises in Asia, Latin America, and Europe. For detailed variable definitions see [Table 17](#) and text. All standard errors are clustered at the firm level. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 15: Substitution towards diversified lenders

VARIABLES	(1) firm t exposure	(2) firm t+1 exposure	(3) firm t+2 exposure	(4) firm t+3 exposure	(5) industry t exposure	(6) industry t+1 exposure	(7) industry t+2 exposure	(8) industry t+3 exposure
banking crisis	0.007*** (0.002)	0.006** (0.002)	0.010*** (0.002)	0.007** (0.003)	0.003 (0.004)	0.005 (0.004)	0.012*** (0.004)	0.011*** (0.004)
Observations	192,495	155,610	123,045	98,076	192,495	159,703	127,892	101,469
R-squared	0.924	0.926	0.928	0.928	0.505	0.497	0.489	0.485
Firm FE	Yes	Yes	Yes	Yes	-	-	-	-
Country*Industry FE	-	-	-	-	Yes	Yes	Yes	Yes
Region*Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cluster	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm

Note: This table shows regressions on the firm-year (firm) level. The dependent variable is firms' exposure to diversified banks (the share of total loans extended by diversified banks), where we lead the dependent variable by up to 3 periods. *banking crisis (BC)* is a dummy with value one during banking crises in the firm country, as defined in [Laeven and Valencia \(2013\)](#). Columns (1)-(4) use firm fixed effects and look at within firm variation, columns (5)-(8) use country-industry fixed effects and look at changes across firms within industries. For detailed variable definitions see [Table 17](#) and text. All standard errors are clustered at the firm level. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 16: **Diversified banks increase their loan share**

VARIABLES	(1) t share	(2) t share	(3) t+1 share	(4) t+2 share	(5) t+3 share
banking crisis (BC)	-0.007*** (0.002)	-0.013*** (0.004)	-0.012*** (0.004)	-0.010*** (0.003)	-0.010*** (0.003)
diversification (DIV)		-0.310*** (0.013)	-0.198*** (0.011)	-0.125*** (0.010)	-0.067*** (0.010)
DIV × BC		0.013*** (0.005)	0.008* (0.005)	0.005 (0.004)	0.003 (0.005)
Observations	199,427	173,368	149,664	127,568	109,366
R-squared	0.959	0.967	0.968	0.970	0.971
Bank*Borrower Country FE	Yes	Yes	Yes	Yes	Yes
Bank Country*Year FE	Yes	Yes	Yes	Yes	Yes
Cluster	Bank	Bank	Bank	Bank	Bank

Note: This table shows regressions on the bank-firm country-year (bank) level. The dependent variable is banks' share of total outstanding loan volume extended to all borrowers in country j , up to a lead of three years; *banking crisis (BC)* is a dummy with value one during banking crises in the firm country, as defined in [Laeven and Valencia \(2013\)](#); *diversification (DIV)* is banks' portfolio diversification. For detailed variable definitions see [Table 17](#) and text. All standard errors are clustered at the bank level. *** p<0.01, ** p<0.05, * p<0.1

B Variable Definitions

Table 17: Variable definitions

variable	description/item	unit/comment
loan volume	outstanding syndicated loans	million
loan spread	interest spread over LIBOR	basis points
maturity	loan maturity	months
banking crisis (BC)	banking crisis in borrower country	dummy
connected	connected countries with no contemporaneous banking crisis	dummy
diversification (DIV)	diversification index	[0,1-1/J], bank level
exposure	firm exposure to diversified banks	[0,1-1/J], firm level
investment ratio	capx/ppent _{t-1} (CS)	%
long-term debt ratio	dltt/at (CS)	%
employment	emp (CS)	thousand
sales	sale (CS)	million
assets	at (CS)	million
return on assets (ROA)	(opid - depam)/at (CS)	%
sales growth	ln(sale _t) - ln(sale _{t-1}) (CS)	%
payout ratio	(dvt + prstkc)/oibdp (CS)	%
fixed assets	ppe (CS)	million
capital-labor ratio	ppe/emp (CS)	%
foreign bank (FB)	borrower country ≠ lender country	dummy, bank level
international portfolio (INT)	int. loan volume to total loan volume	[0,1], bank level
great financial crisis (GFC)	years 2008-2010	dummy
regional BC	regional banking crisis for Asia, Latin America, Europe, and US	dummy
home BC	banking crisis in lender country	dummy, bank level
share of loans in crisis	share of syndicated loans extended to crisis countries in year <i>t</i>	%
portfolio risk (sales)	standard deviation of borrower sales growth in non-crisis times	
credit to GDP	FD.AST.PRVT.GD.ZS (WB WDI)	%
BIS foreign claims	total cross-border claims (BIS CBS)	%
BIS foreign liabilities	total cross-border liabilities (BIS CBS)	%
foreign bank assets	as share of total bank assets (WB GFDD)	%

Note: CS stands for Compustat, WB for World Bank, GFDD for Global Financial Development Database, WDI for World Development Indicators, BIS for Bank for International Settlements, CBS for Consolidated Banking Statistics.