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Geographic diversification and bank lending during crises☆

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ABSTRACT

We classify a large sample of banks according to the geographic diversification of their international syndicated loan portfolio. We show that diversified banks maintain higher loan supply during banking crises in borrower countries. Positive loan supply effects lead to higher firm investment and employment growth. Diversified banks are stabilizing due to their ability to raise additional funding during times of distress. Distinguishing banks by nationality reveals that diversified domestic banks are a stable source of funding, while foreign banks with little diversification are fickle. Findings suggest that declining financial integration makes countries more vulnerable to local financial shocks.

1. Introduction

Recent decades have seen a steady increase in the importance of globally active banks. 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, 2018; FSI, 2018). Several papers provide valuable evidence on the costs and benefits of lending by foreign banks.[1] However, an analysis of the consequences of banks' international portfolio diversification on bank loan supply and financial stability is largely absent from the literature.

In this paper we provide the first cross-country evidence on how internationally diversified banks adjust lending during banking crises in borrower countries. We find that diversified banks stabilize loan supply and smooth shocks. At the bank-firm level, their loan supply during crises is 7.6% higher, compared to banks with a

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[1] For theoretical papers highlighting the importance of bank diversification, see Morgan et al. (2004), Cetorelli and Goldberg (2011, 2012), and Kalemli-Ozcan et al. (2013). For empirical evidence see De Haas and Van Lelyveld (2010); De Haas and Van Lelyveld (2014)), Buch and Goldberg (2015), Kerl and Niepmann (2015), Gilje et al. (2016), Goetz et al. (2016), and Aldasoro et al. (2020). Claessens (2017) provides an excellent summary on cross-border lending.

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concentrated portfolio. Higher loan supply has significant 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. Higher exposure also translates into stronger investment (4.6%) and employment (1.1%) growth. As detailed bank-firm level data allow us to rigorously control for unobservable borrower characteristics through time-varying fixed effects at the firm level, the positive effects of diversification reflect banks' loan supply. Granular fixed effects at the bank-year level ensure that our results are not due to unobservable bank heterogeneity.

To measure the degree of geographic 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 across countries, aggregated to the parent bank level. Banks with low portfolio concentration, i.e., those that lend to multiple countries, are classified as diversified. Banks that extend a large share of their loan portfolio to borrowers in just a few countries are classified as concentrated. To the best of our knowledge, syndicated loan market data are the only data that allow us to measure geographic diversification for a large set of banks operating in many countries. We provide support for the assumption that our diversification metric (constructed from data on syndicated loans) reflects banks' overall loan portfolio allocation across borrower countries: Total cross-border syndicated lending to nonfinancial firms represents around three-quarters of the total volume of cross-border bank lending to nonfinancial borrowers, and syndicated and total cross-border bank lending are highly correlated.

Our classification of banks by portfolio diversification builds on recent literature that causally shows that geographic diversification reduces exposure to idiosyncratic local shocks (Goetz et al., 2016). Diversification implies lower risk and thus provides better access to funding, especially during times of crises (Levine et al., 2020). Based on these findings, we argue that banks that are geographically diversified across countries are financially less constrained during local shocks, which is why they are able to extend more credit.

We report direct evidence in support of the argument that diversified banks can better raise funding, relative to their nondiversified counterparts. We first establish that diversified banks increase their interbank borrowing on the syndicated loan market when hit by a local financial shock. Using data on bank balance sheets from Bankscope, we then show that diversified banks increase their overall wholesale deposits during banking crises in borrower countries. In contrast, nondiversified banks see a decline in wholesale deposit growth during episodes of financial distress. These results are in line with the hypothesis that geographic diversification ensures better access to funding.

We also provide indirect evidence that geographically diversified banks have a stabilizing effect, thanks 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 markets, but also in connected noncrisis countries. Banks that face financial constraints must trade off where to allocate existing funds (similar to Stein, 1997), so local shocks have spillover effects on noncrisis countries. We show that, for highly diversified banks, maintaining loan growth in a crisis country has no spillover effects to unaffected noncrisis countries to which the bank is lending. However, for banks with a concentrated portfolio, loan growth also declines in connected, but unaffected, borrower countries. We interpret this finding as indirect evidence that diversified banks have looser "financial constraints" and can raise new funds to sustain loan supply. Nondiversified banks are financially constrained and must cut back lending in affected and unaffected markets when faced with a shock.

Our results suggest that geographic diversification *across* countries allows for risk-sharing during local country-specific systemic banking crises. To further investigate the link between diversification, risk-sharing, and access to funding, we show that the positive effects of diversification on loan supply and spillovers are significantly lower during episodes of global distress, i.e., when a significant share of banks' global portfolio is subject to shocks. In other words, when several borrower countries experience a crisis at the same time, the risk-sharing benefits of geographic diversification with respect to local idiosyncratic shocks break down and diversified banks also face tighter financial constraints.

Finally, 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 nondiversified. We find that classifying banks by diversification instead of nationality uncovers differences in lending behavior. While diversified banks maintain a higher loan supply than concentrated banks during banking crises, foreign banks reduce their loan supply by more than domestic banks. Further analysis reveals 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 is in line with findings on the flight home effect (Giannetti and Laeven, 2012) and behavior of gross capital flows during crises (Broner et al., 2013).

To examine the robustness of our findings, we address alternative explanations to the argument that diversified banks smooth local shocks through better access to funding. First, we use data on banks' international bond issuance and find that diversification on banks' funding side is positively correlated with diversification on their asset side, and that banks with a more diversified bond portfolio also maintain higher credit supply during local crises. However, asset diversification, measured by banks' portfolio allocation of syndicated loans, is the economically and statistically more significant factor. Second, we exclude that differences in borrower risk explain results. While diversified banks have lower portfolio risk on average, we show that the positive effect of diversification remains stable once we control for the borrower risk in banks' portfolios. Third, we rule out the 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 diversification becomes more important when a larger share of loans is in distress. Finally, we create alternative measures of diversification and specialization that capture potentially correlated aspects of banks' business models. For example, we categorize banks by their share of loans extended to foreign borrowers and by their country and industry specialization, or control for firms' diversification across lenders. Across specifications, bank diversification maintains its positive and significant effect on loan supply during crises.

The key identification challenge for cross-country studies using aggregate data is to control for loan demand. If diversified banks lend to a different set of firms from 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 bank-firm-level analysis employs firm*bank and firm*time fixed effects to absorb all time-varying unobservable firm fundamentals (Khwaja and Mian, 2008; Jiménez et al., 2014). The combination of both fixed effects allows shocks to affect each firm at each point in time heterogeneously and accounts for any change in borrower characteristics. For example, time-varying fixed effects at the firm level absorb changes in firm sales, management, or productivity, while bank*firm fixed effects control for distance between borrowers and lenders. At the firm level, we combine firm with country*industry*time fixed effects to control for time-varying industry demand.

Further, our results increase in magnitude when we include bank*year fixed effects that control for unobservable time-varying bank characteristics, for example bank size, risk-taking, or capital ratios. In essence, we are comparing lending by the same bank to the same firm during a crisis, but at different values of diversification. The increase in coefficient size suggests that diversification has a stabilizing effect on lending above and beyond other balance sheet characteristics. Additionally, we match a subsample of banks in Dealscan with bank balance sheet data in Bankscope. This approach allows us to directly control for the marginal effects of several bank characteristics on loan supply during local crises. We show that diversification remains an important and significant explanatory variable for loan supply during crises after controlling for bank size, Tier 1 capital ratio, share of wholesale deposits, leverage ratio, and return on assets.

Our paper contributes to the literature in two ways. First, and to the best of our knowledge, this is the first paper to study the consequences of banks' geographic diversification in a cross-country setting. So far, most studies distinguish banks by their headquarters location, i.e., divide them into foreign and domestic, and look at cross-border lending. This literature finds that bank nationality is an important determinant of loan supply (Cetorelli and Goldberg, 2011; 2012; De Haas and Van Horen, 2013).[2] Our approach reflects the related but distinct dimension of banks' integration into the financial system, captured by their portfolio allocation. 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 and the behavior of foreign and domestic banks. For example, Claessens (2017) states that "long-term debt flows are less volatile and that foreign banks with larger presence, more domestic funding, and closer relationships provide more finance and share risks better."[3] The global scope of our detailed bank-firm-level data allows for clean identification of credit supply effects as well as external validity.

Second, 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 local markets (De Haas and Van Lelyveld, 2006). 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. 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 local shocks in borrower countries. 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 speak to the discussion on retrenchment in financial integration since the Great Financial Crisis (Milesi-Ferretti and Tille, 2011). Since the Great Financial Crisis, there has been a significant decline in cross-border banking and financial integration.[4] In addition, we show that banks' geographic diversification has declined. The verdict on whether this retrenchment enhances or weakens 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 local financial shocks. Presence in several markets reduces banks' exposure to local shocks and gives them better access to new funds that they can allocate towards countries in distress. Thus, higher geographic diversification not only stabilizes lending in affected countries, but also mitigates contagion. In light of our results, the recent decline in global banking is worrisome, as weaker integration into the global financial system, and hence less geographic 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 and evidence on the

[2] See also Peek and Rosengren (1997), Cetorelli and Goldberg (2012), Schnabl (2012), De Haas and Van Lelyveld (2014), Ongena et al. (2015), Correa et al. (2016), and Bremus and Neugebauer (2018).

[3] We also speak to literature analyzing the real effects of financial shocks and highlighting the relevance of syndicated lending for firm performance. See Giannetti and Laeven (2012), Popov and Van Horen (2015), Doerr et al. (2018), Morais et al. (2019), Hale et al. (2020), and Jiménez et al. (2020).

[4] See also Bremus and Fratzscher (2015), Claessens and Van Horen (2015), Cerutti and Claessens (2016), and Emter et al. (2019).

mechanism. In Section 4 we check the robustness of our findings to alternative explanations. Section 5 concludes.

2. Data and empirical strategy

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

2.1. Data

Laeven and Valencia (2013) Systemic Banking Crises Database provides country-year-level information on episodes of financial distress. 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.

For our main analysis and to construct bank diversification, we use data on syndicated loans provided by Thomson Reuters's Dealscan database. 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 loans are on average larger in volume and issued to larger borrowers.

Dealscan provides extensive information on syndicated loans at origination, including loan amount, maturity, and interest, as well as the identity of lenders and borrowers. All data are aggregated at banks' and firms' parent level. We restrict our analysis to loans by banks to nonfinancial firms and consider lending only by commercial, savings, cooperative, and investment banks.[5] We keep 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 more 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.

Syndicated lending constitutes a significant share of banks' total lending to nonfinancial firms, and is an important source of financing for firms (Gadanecz and von Kleist, 2002; Chodorow-Reich, 2014; Cerutti et al., 2015). The syndicated loan market increased significantly in size, from a total of $2 trillion in 1995 to a peak of $6 trillion in 2008 before the onset of the Great Financial Crisis. For the average country in our sample, syndicated lending equals 4.4% of GDP and around 9% of total credit to nonfinancial corporations. It averages 6% of banks' total assets in our sample, and 20% of their commercial and industrial lending. For the average listed firm, around 45% of total long-term debt is comprised of syndicated loans. The share is higher for smaller firms, and slightly higher for firms headquartered in high-income countries, relative to firms headquartered in middle-income countries. To provide background on the external validity of our investigation, in the Online Appendix we compare listed firms that borrow on the syndicated loan market to those that do not borrow on the syndicated loan market. We find that firms taking out syndicated loans are larger and more profitable, but have lower investment ratios and sales growth. They also rely relatively more on long-term debt, but exhibit no economically meaningful differences in terms of sales across geographic segments. These differences suggest that firms borrowing on the syndicated loan market are relatively mature, a fact that should be kept in mind when generalizing our results.

While in general syndicated lending is predominantly done by banks headquartered in high-income economies, it represents an equally important share of total credit or cross-border lending for borrowers in high- and middle-income economies. Fig. 1 compares total cross-border syndicated bank lending to nonfinancial corporations in our sample to official data on total cross-border bank lending to nonfinancial corporations, provided by the Bank for International Settlements' (BIS) Locational Banking Statistics. Panel 1 shows that for both high- and middle-income economies, syndicated lending represents around three-quarters of total cross-border lending to nonfinancial corporations. Panel 2 provides a binned scatterplot of log syndicated credit against log total cross-border credit to nonfinancial corporations and shows a positive and highly significant relation. Fig. 1 suggests that syndicated lending represents the main form of and is highly correlated with total cross-border bank lending to firms.

Bank-firm 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%

[5] In 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.

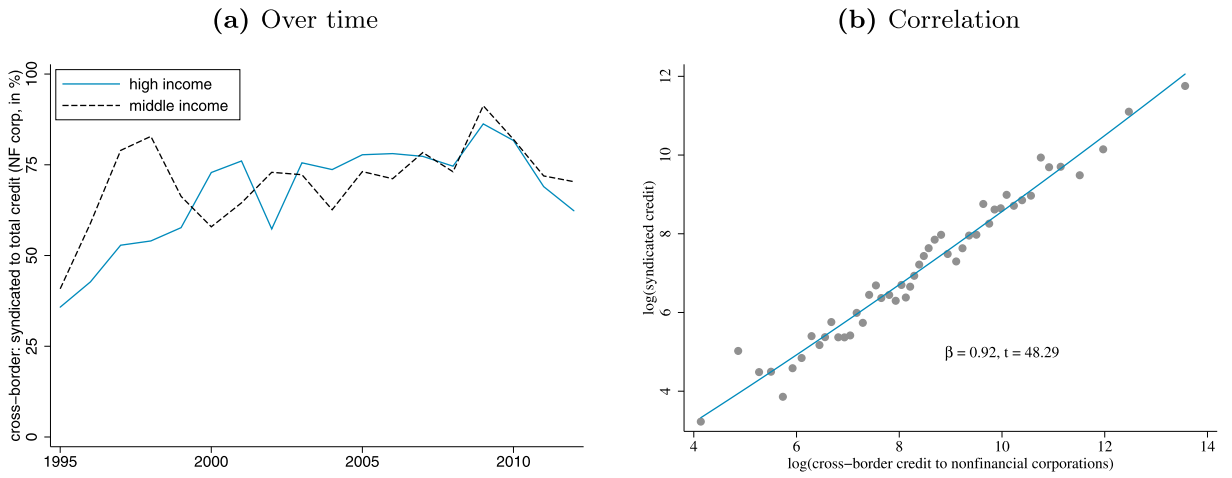

Fig. 1. Cross-border bank lending to nonfinancial corporations. Panel a plots the ratio of total syndicated credit over total cross-border bank lending to nonfinancial corporations over time. Data is aggregated to the lender country-borrower-country level. We split countries into high- (solid line) and middle-income (dashed line) countries, as defined by the World Bank. Panel b plots the correlation between log(syndicated credit) and log(cross-border bank lending to nonfinancial corporations) with linear fit (solid line). The sample includes the universe of syndicated loans issued between 1995 and 2012 covered in Dealscan. Data on aggregate cross-border bank lending to nonfinancial corporations is provided by the BIS Locational Banking Statistics. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

of the deals). In cases in which lending shares are missing, we split loan volume on a pro rata basis among all banks in a syndicate (Giannetti and Laeven, 2012; De Haas and Van Horen, 2013). In the sub-case of partial information on loan shares, we first use the available information to allocate loan shares and then split the remaining amount equally among banks with missing information. Entries for which the sum of the allocation rule is larger than 110% are treated as if lending share information were not available in the first place.[6] Transactions with deal status "cancelled", "suspended", or "rumour" 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 USD 10,000 we drop the observation to remove erroneously small loans (0.6% of observations). Overall, we split a total of 293,163 deals into loan portions, although the exact number of observations slightly varies across specifications due to the demanding fixed effects structure.

We next use these loan portions to construct each bank's outstanding loan volume as a stock variable to proxy the loan's entry on banks' loan books (Jiménez et al., 2014; Morais et al., 2019). Each outstanding loan remains active until it matures.[7] For example, a syndicated loan issued in 1995 with a maturity of five years remains active until 2000. We then aggregate all outstanding loan portions between a bank-firm combination to obtain bank b's outstanding loan volume to firm f in year t to the bank-firm-year level, which we define as our baseline unit of observation. Total loan volume in a given year hence corresponds to the sum of the value of all outstanding (new as well as continuing loans) from a certain bank to a firm.

To measure geographic diversification, we construct banks' distribution of cross-border loans by destination country of their borrowers. Essentially, geographic diversification captures the distribution of bank loans across borrower countries. To construct this metric, we proceed in three steps. First, we sum bank b's active loans to all borrowers in country j at time t, for example all loans by Deutsche Bank to firms in France. Second, we divide bank b's lending to all borrowers in country j over bank b's total lending. Thereby, we obtain bank b's lending share to country j at time t ($s_{b,j,t}$). For example, Citigroup's lending share to the United States is 52% out of its total syndicated lending in 2007. Third, we construct *geographic diversification* as a Herfindahl index using lending shares by country as follows:

$$DIV_{b,t} = 1 - \underbrace{\sum_{j=1}^{J^b} s_{b,j,t}^2}_{HHI} \quad \in [0, \frac{J^b - 1}{J^b}]. \tag{1}$$

Variable $s_{b,j,t}$ 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.

[6] In the Online Appendix we show that within the subsample of observations for which loan allocation information is available the correlation between a split by allocation share provided directly by Dealscan and a split on a pro rata basis is 0.91. Both splits result in a similar distribution with almost identical mean and dispersion.

[7] As Dealscan captures information at loan origination only, this construction assumes that loans are not repaid before maturity and that loan shares are not sold by banks on secondary markets as in Morais et al. (2019). To examine the robustness of our findings to loan share sales by participating banks, in robustness checks we focus on lead arrangers only, as they are found to retain a larger loan share for signaling purposes (Sufi, 2007); see Online Appendix.

Building on recent literature, we argue that diversification allows banks to access new funding during local shocks that they allocate towards borrower countries in crisis, a mechanism that is especially important during episodes of financial turmoil (Gilje et al., 2016; Cortés and Strahan, 2017; Levine et al., 2020). We will discuss the mechanism in more detail below. A potential source of endogeneity is that a bank's decision to diversify is correlated with unobservable bank characteristics. We will discuss identification in Section 2.3.

Bank diversification reflects the allocation of banks' syndicated loan portfolio across countries. To the best of our knowledge, data on syndicated lending is the only available granular data on international bank lending for banks headquartered in different countries. They are hence the only data that allow us to measure geographic diversification for banks operating in a large set of countries. A further advantage of the data is that cross-border syndicated lending to nonfinancial corporations represents around three-quarters of the total volume of cross-border bank lending to nonfinancial borrowers (see Fig. 1), and that syndicated and total cross-border bank lending are highly correlated. In other words, although our measure of bank diversification across countries is based on syndicated lending, it incorporates the majority of total cross-border bank lending and is therefore likely a reasonable proxy for banks' overall loan portfolio allocation across borrower countries.[8]

We merge lending banks active in Dealscan with balance sheet data from Bankscope. To link Dealscan with Bankscope, we match 229 institutions by their ultimate bank parent in Dealscan with the bank holding company in Bankscope, using name, address, newspaper reports, and bank websites as information. Once we restrict the sample to banks with consistent information on total assets, share of wholesale deposits, Tier 1 capital ratio, leverage ratio, and return on equity, we end up with a sample of 130 banks and 393,760 bank-firm observations. These cover around one-quarter of all bank-firm level observations.

Firm level. To examine effects of credit supply on firm performance, we aggregate our firm-bank-year data to the firm-year level and match borrowers in Dealscan with firms in Compustat based on Chava and Roberts (2008). Combining Dealscan with Compustat reduces observations, since information for some firms, especially smaller ones, is missing in Compustat. Overall, we are able to successfully match around 32% of our firm-year observations. We collect information on firms' syndicated loan volume, long-term debt, investment, employment, total assets, sales, and fixed assets. We compute growth rates as log differences.

[8] In the Online Appendix, we show that geographic diversification based on syndicated lending is significantly correlated with diversification based on banks' bond issuance across financial centers, their share of foreign subsidiaries and share of assets held in foreign subsidiaries, as well as the geographic diversification of their subsidiaries across countries. These positive correlations suggest that diversification based on banks' international syndicated lending is a valid proxy for banks' overall global diversification.

To capture firms' dependence on 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 all banks:

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

B is the total number of banks with outstanding loans to firm f in year t. Similar to *diversification* at the bank-firm 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.

2.2. Descriptive statistics

Fig. 2 shows the distribution of *diversification* at the bank-firm level (Panel 2a) and *exposure* at the firm level (Panel 2b). 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. Panel 2b shows that more than 97% of firms borrow from at least one bank with nonzero geographic diversification. The median (mean) firm has four (eight) bank connections in a given year, suggesting that firms with access to 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 two (33).

Our sample covers the years 1995 to 2012 and includes information on 35,510 firms and 6962 banks, forming a total of 1,621,124 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 2046 banks with positive diversification and 4916 banks with zero geographic diversification. The median (mean) value of *diversification* for banks with nonzero diversification is 0.41 (0.40). The group of diversified banks extends around 93% of all loans, which reflects that they are large lenders. In our sample, 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. North American banks are less diversified as they lend mostly to borrowers located in the United States or Canada. Finally, the highest incidence of banking crises occurs in Europe, Asia, and Latin America.

Table 1 provides general descriptive statistics for our main variables. Tables 2 provides summary statistics and differences in means when we split the respective samples by diversification along the yearly median. At the bank-firm-year level, Panel (a) shows that loans by geographically diversified banks are larger, have lower interest rates, and are issued at longer maturity than loans by banks with

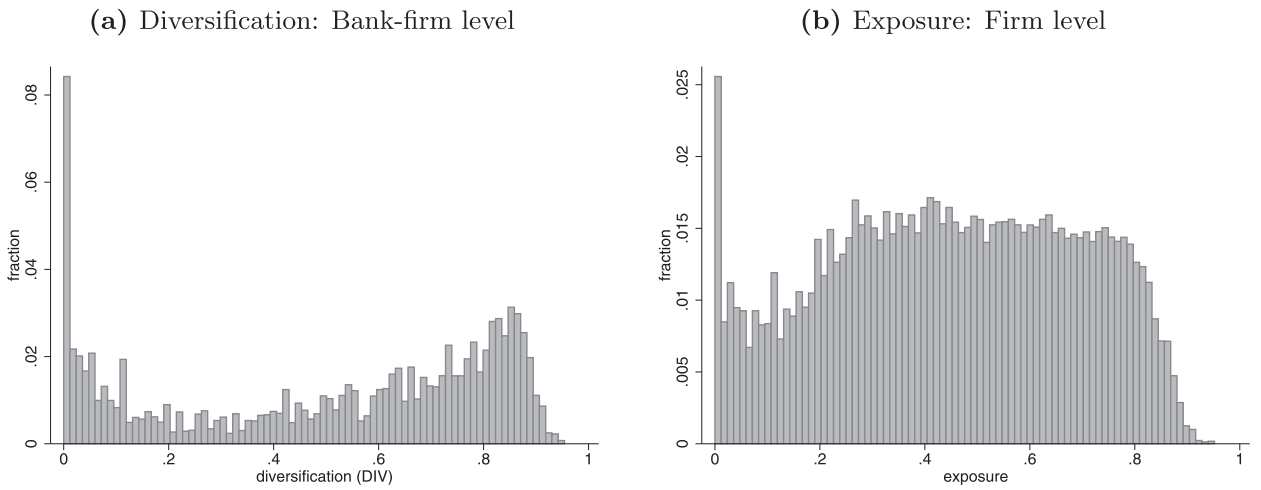

Fig. 2. Bank diversification and firm exposure. Panel a plots the distribution of bank diversification across borrower countries at the bank-firm-year level, as defined in Eq. (1). A value of zero implies no diversification, while higher values reflect increasing diversification of banks' syndicated loan portfolios across countries. Panel b plots distribution of firm exposure to diversified banks at the firm-year level, as defined in Eq. (2). Exposure measures whether firms borrow to a larger or smaller extent from diversified banks. Variable construction is based on the universe of syndicated loans issued between 1995 and 2012 covered in Dealscan.

Table 1
Descriptive statistics.

	mean	sd	min	max	count
(a) Bank-firm					
log(loan vol)	2.95	2.29	−4.31	6.88	1,621,124
diversification (DIV)	0.49	0.31	0.00	0.95	1,621,124
Δ vol (int)	0.01	0.31	−1.39	1.61	395,989
Δ vol	0.01	0.88	−2.00	2.00	485,107
(b) Bank					
diversification (DIV)	0.58	0.31	0.00	0.94	654
log(assets)	12.04	1.57	6.87	15.08	654
Tier 1 capital ratio	0.11	0.06	0.00	1.09	654
wholesale deposits	0.27	0.23	0.00	1.00	654
leverage ratio	0.05	0.03	0.00	0.29	654
return on equity	0.06	0.21	−1.00	1.00	654
(c) Firm					
exposure	0.44	0.24	0.00	0.95	196,446
Δ loan volume	0.04	0.39	−7.87	9.94	196,446
Δ long-term debt	0.04	0.64	−3.38	3.38	54,515
Δ employment	0.03	0.19	−0.98	0.99	52,295
Δ investment	0.03	0.62	−2.94	2.43	55,377
log total assets	7.43	2.38	1.81	15.27	52,809
return on assets	0.06	0.09	−0.93	0.34	52,809
leverage	0.31	0.21	0.00	1.67	52,809

This table shows descriptive statistics for main variables at the bank-firm-year, bank-year, and firm-year level from 1995–2012. For detailed variable definitions, see text. The table reports the mean, standard deviation (sd), minimum (min), maximum (max), and number of observations (count).

geographically more concentrated portfolios. Panel (b) focuses on the sample of banks we successfully match to Bankscope and shows that diversified banks are significantly larger, and have a higher share of wholesale deposits and a lower leverage ratio. The difference in bank characteristics highlights the need to control for observable and unobservable bank characteristics.

Table 3 reports summary statistics at the firm level. In Panel (a), 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. Panel (b) restricts the sample to firms with balance sheet information from Compustat. Borrowers with high exposure to diversified banks tend to grow more slowly 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. Similar to the bank level, the difference in firm characteristics highlights the need to control for firm characteristics to isolate loan supply.

Merging syndicated loan market data to Bankscope and Compustat leads to a decline in sample size. To provide context on the arising sample selection, the Online Appendix shows that the average bank in the matched Dealscan-Bankscope sample extends larger loans, is more diversified, and serves more borrowers. There is a relative increase in the share of loans to U.S.-based companies. We find no economically meaningful change in the relative importance of specific two-digit industries across the samples. In the matched Dealscan-Compustat sample, the average bank again extends larger loans to more borrowers and is more diversified. There is a relative decrease in the share of loans to U.S.-based companies, and only minor changes in the industry composition of borrowers. When comparing the results from these subsamples to results obtained from the full sample, it is worth taking these differences into account.

2.3. Empirical strategy and identification

To analyze lending during crises by geographically diversified banks and their effect on firms, we use two aggregation levels. To isolate loan supply from loan demand,

Table 2
Summary statistics: Bank-firm and bank level.

(a) Bank-firm level (Dealscan)					
	diversified		**concentrated**		**mean diff.**
	mean	sd	mean	sd	*t*
Δ loan volume	0.03	(0.36)	0.01	(0.34)	–23.95
loan volume (m)	105.98	(304.67)	76.75	(237.82)	–68.21
loan spread (bp)	134.21	(105.80)	187.96	(127.72)	259.99
maturity (months)	75.43	(47.77)	70.82	(41.13)	–65.91
Observations	797,132		823,992		1,621,124

(b) Bank level (Bankscope)					
	diversified		**concentrated**		**mean diff.**
	mean	sd	mean	sd	*t*
diversification (DIV)	0.72	(0.21)	0.16	(0.20)	–62.52
log(assets)	12.29	(1.65)	10.76	(1.64)	–17.76
Tier 1 capital ratio	10.17	(5.42)	10.62	(3.70)	1.14
share wholesale deposits	0.32	(0.23)	0.29	(0.31)	–2.82
leverage ratio	4.72	(2.80)	7.10	(2.99)	11.86
return on equity (%)	12.28	(25.08)	12.84	(27.48)	1.49
Observations	697		706		1,403

Panel (a) provides descriptive statistics at the bank-firm-year (loan) level, Panel (b) at the bank-year level for the smaller sample of banks matched to Bankscope. The sample is split by the yearly median according to banks' diversification across borrower countries, as defined in Eq. (1). Above median observations are denoted as *diversified*, those below as *concentrated*. *mean* denotes the mean, *sd* the standard deviation, and *mean diff.* the *t*-value for the difference in means across both groups. The sample period is 1995–2012.

Table 3
Summary statistics: Firm level.

(a) Dealscan sample					
	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	99,948		99,986		199,934

(b) Compustat sample					
	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	29,613		33,168		62,781

Panels (a) and (b) provide descriptive statistics at the firm-year (firm) level. Panel (a) shows descriptive statistics for the full sample of Dealscan firms, Panel (b) for the smaller sample of firms matched to Compustat. The samples are split by the yearly median according to firm exposure to diversified banks, as defined in Eq. (2). Above median observations are denoted as *high exposure*, those below 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. The sample period is 1995–2012.

we begin at the bank-firm-year level (*bank-firm level*). We then aggregate our data to the firm-year level (*firm level*) to examine substitution across lenders, as well as real effects.

Bank-firm level. Our baseline specification tests whether banks' diversification has a positive effect on loan supply during financial turmoil in the borrower country. We estimate the following specification:

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

Dependent variable $log(loan)$ denotes the log of outstanding loan volume to firm f by bank b in year t. Banking crisis dummy $BC_{c,t}$ varies at the country level and takes

Table 4
Determinants of bank diversification.

dep. var.:	(1) DIV (cont)	(2) DIV (median)	(3) DIV (cont)	(4) DIV (median)
log(assets)	0.080***	0.113***	0.072*	0.042
	(0.017)	(0.031)	(0.038)	(0.045)
Tier 1 capital ratio	−0.000	−0.004	−0.001	−0.001
	(0.004)	(0.008)	(0.001)	(0.001)
share wholesale deposits	0.437***	0.602***	−0.064	−0.219**
	(0.102)	(0.146)	(0.048)	(0.108)
leverage ratio	−0.014	−0.024	0.009	−0.017
	(0.011)	(0.018)	(0.007)	(0.015)
return on equity	0.001*	0.002	0.000	0.000
	(0.001)	(0.001)	(0.000)	(0.000)
Observations	761	761	756	756
R-squared	0.336	0.282	0.956	0.890
Bank FE	–	–	Yes	Yes

This table reports results for regressions at the bank-year level of the following type: $diversification_{b,t} = controls_{b,t} + \epsilon_{b,t}$. The dependent variable is banks' *diversification* across borrower countries, as defined in Eq. (1), in columns (1) and (3) or a dummy with value one if diversification is above the yearly median, and zero if it is below, in columns (2) and (4). Columns (3) and (4) use bank fixed effects. Bank balance sheet data are from Bankscope. All standard errors are clustered at the bank level. The sample period is 1995–2012. Values in parentheses denote standard errors. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

the value one during a crisis in firm country c in year t. $DIV_{b,t-1}$ is the geographic diversification index at the bank-year level. We lag *DIV* by one period to avoid contemporaneous effects of the banking crisis on diversification. $\phi_{f,b}$ denotes firm*bank fixed effects; τ_t are either firm*year or country*industry*year fixed effects. $\psi_{b,t}$ denotes bank*year fixed effects. We cluster standard errors at the firm-country level to account for serial correlation within the same borrower country across firms and time. The inclusion of firm*bank fixed effects, combined with a dependent variable in levels, implies an interpretation in changes. Regression (3) is thus similar 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. That is, we expect $\beta_3 > 0$.

The key identification challenge is to absorb loan demand and 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, with firm*bank fixed effects we 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 or location), 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. 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 et al., 2014). To mitigate the potential problem of bank-firm selection, we repeat our analysis on the restricted sample of firms that borrow from both diversified and concentrated banks in each year in the Online Appendix. After absorbing any unobservable borrower characteristics, our estimates reflect loan supply effects.

Since diversification (*DIV*) is a choice variable, it raises concerns about endogeneity in regression Eq. (3). We do not have a bank-level instrument, but undertake indirect attempts to address the issue. First, we include bank*year fixed effects to control for unobservable time-varying bank characteristics, for example bank size, risk-taking, or capital ratios. With bank*year fixed effects, we hold all time-varying unobservable bank characteristics constant and compare lending by the *same* bank to the *same* firm (due to firm*time fixed effects) at different levels of diversification. Second, we directly control for observable determinants of diversification at the bank-year level ($X_{b,t}$), interacted with *banking crisis* ($BC_{c,t}$). Controlling for their interaction allows us to isolate the direct effect of diversification on lending. For example, diversified banks could be larger. If larger banks maintain a relatively higher loan supply during local crises, the coefficient on diversification would be biased if we do not control for bank size. To this end, we match a subsample of banks in Dealscan with bank balance sheet data in Bankscope. As predictors of diversification, we include bank size (log assets), Tier 1 capital ratio, the share of wholesale deposits over total deposits, leverage ratio, and return on equity.

Before reporting estimation results for regression Eq. (3), we investigate the relation between bank diversification and other bank characteristics. Table 4 shows results for regressions with diversification as the dependent variable and bank covariates as explanatory variables. We use two dependent variables, diversification as a continuous variable (defined in Eq. (1)) and as a dummy with value one for banks with diversification above the yearly median. Columns (1) and (2) compare levels of diversification across banks. *log(assets)* and *share wholesale deposits* have positive coefficients, significant at the 1% level, indicating that diversified banks differ in terms of size and

funding structure from concentrated banks. Since our baseline regression includes bank*firm fixed effects, it exploits *within*-bank variation. Hence, columns (3) and (4) replicate columns (1) and (2), but add bank fixed effects. Only size remains a significant predictor for diversification in column (3). The sizeable increase in R^2 when adding bank fixed effects suggests that a large part of the variation of diversification within banks is explained by time-invariant bank characteristics. As we will show below, specifications that include bank*year fixed effects and bank characteristics interacted with the crisis dummy yield similar coefficients in terms of sign, size and significance to specifications without these controls. These findings alleviate concerns about omitted variable bias.

Firm level. At the bank-firm level we observe whether bank diversification affects loan supply. However, the analysis cannot uncover potential substitution effects and remains silent about the real effects of changes in loan supply. 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 is irrelevant for firms' aggregate syndicated loan growth. Firms can also substitute a fall in syndicated lending through other types of long-term debt instruments, for example nonsyndicated credit or corporate bonds. Such a substitution would imply that there is no effect of bank diversification on firms' long-term debt or investment, *even if* we find an effect on firms' syndicated loan growth. Loan supply will only have 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:

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

In the baseline specification, the dependent variable $\Delta y_{f,t}$ is the log difference of outstanding syndicated loan volume of firm f across *all* its lenders in year t. In further regressions, we use the log difference of total long-term debt to test for substitution into nonsyndicated debt instruments.[9] To analyze real effects, we also use investment and employment growth in log differences as a dependent variable. Banking crisis dummy ($BC_{c,t}$) varies at the country level and equals one during banking crisis years in firm country c. $exposure_{f,t-1}$ denotes the share of firm f's outstanding credit by diversified banks as defined in Eq. (2), lagged by one period. ϕ_f denotes firm fixed effects and $\tau_{c,i,t}$ denotes time-varying country*year or country*industry*year fixed effects. 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.

Our main coefficient of interest, γ_3, is on the interaction term ($BC \times exposure$). γ_3 is the firm-level equivalent of β_3 that is the estimated interaction coefficient ($BC \times DIV$) in bank-firm level Eq. (3). γ_3 indicates 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 turn, $\gamma_3 > 0$ suggests imperfect substitution, as higher exposure to diversified banks leads to higher loan growth during crises.

To control for loan demand, we employ country*year or country*industry*time fixed effects to absorb time-varying shocks within each country or country-industry cell. The identifying assumption is that all firms within one industry or 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 at the bank-firm level by comparing estimates using country*industry*time fixed effects with estimates using the more rigorous firm*time fixed effects. As we will show, coefficients are slightly larger under a specification with country*industry*time fixed effects. We interpret our firm-level estimates as an upper bound of the true effect.

3. Results

In Section 3.1 we first establish at the bank-firm level that diversified banks smooth local financial shocks, relative to nondiversified banks. Time-varying borrower fixed effects control for changes in firm demand to isolate supply effects. To examine real effects, we then aggregate the data 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 geographically diversified banks raise new funding during crises. Finally, Section 3.3 investigates the role of banks' bond diversification.

Before moving to the regression analysis, Fig. 3, Panel 3a, shows the stabilizing effect of diversified banks in a nonparametric way. It plots log loan volume in the four years prior, during, and after a banking crisis. We split our sample along the yearly median of *diversification* into loans by diversified (blue solid line) and nondiversified (dashed black line) banks. Loan volume follows a similar trend for diversified and nondiversified 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 nondiversified banks. The divergence in loan volume across diversified and concentrated banks corresponds to coefficient β_3 in regression Eq. (3). Panel 3a hence suggests that diversified banks provide more credit, relative to concentrated banks. We now investigate this pattern in greater detail.

[9] Compustat defines long-term debt as debt obligations due more than one year from the company's balance sheet date or due after the current operating cycle. Besides loans and lines of credit, it includes bonds, mortgages and similar debt, industrial revenue bonds, or loans on insurance policies, among others. Hence, long-term debt includes not only syndicated loans, but also other types of bank loans, as well as bonds.

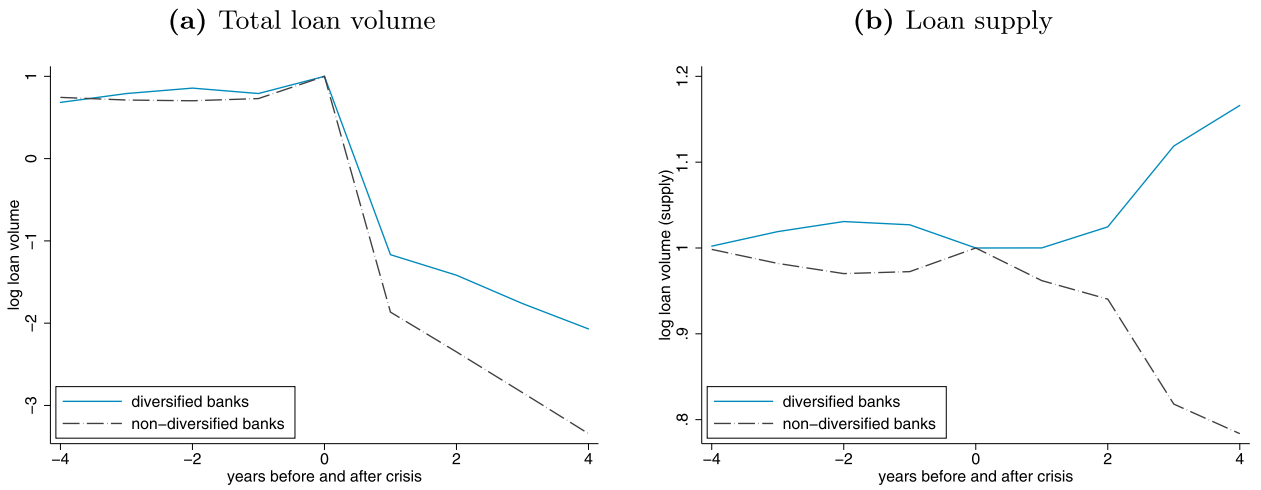

Fig. 3. Loan volume during a crisis. This figure plots the evolution of bank-firm lending (log loan volume) in the four years prior to, during, and after a banking crisis. A value of 0 on the x-axis denotes the year of the banking crisis in the borrower country. We split the sample by the yearly median for banks with high and low values of bank diversification, as defined in Eq. (1). Loan volume is normalized to 1 in $t = 0$. Panel 3a plots the evolution of unconditional average log loan volume, reflecting demand and supply factors. Diversified (solid line) and concentrated (dashed line) banks see a decline in outstanding loan volume during the crisis and the following years, but concentrated banks see a stronger fall. Panel b plots the residuals of a regression of log loan volume on firm*time fixed effects that absorb unobservable changes in loan demand, i.e., it plots the evolution of average loan supply over time by bank type. Conditional on firm*time fixed effects, diversified banks (solid line) do not reduce loan supply during the crisis and increase it in the following years, while concentrated banks (dashed line) reduce loan volume during and after the crisis. There are no differential pretrends. Variable construction is based on the universe of syndicated loans issued between 1995 and 2012 covered in Dealscan. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

3.1. Main results

Bank-firm level. Table 5 reports results for regression Eq. (3) and shows that diversified banks maintain higher loan growth during banking crises, relative to nondiversified banks. Column (1) looks at variation within each firm-bank connection by using fixed effects at 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 $(0.31 \times 0.287 =)$ 8.9%. 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. The coefficient on *banking crisis* is now absorbed by firm*year fixed effects. Borrowing from a diversified bank is now not statistically different from borrowing from a nondiversified bank during noncrisis times. The positive effect of diversified banks during banking crises remains significant: increasing diversification by one standard deviation during a banking crisis increases loan volume by 4.9%. Comparing columns (1) and (2), we see that absorbing demand effects reduces the size of the coefficient on the interaction term by around 40%. The change in size suggests that diversified banks lend to borrowers of higher resilience and higher quality during crises, highlighting the necessity of absorbing loan demand in our estimation. However, after controlling for loan demand, there remains a positive and significant loan supply effect associated with higher geographic diversification.

Fig. 3, Panel 3b, plots log loan volume after removing loan demand effects through firm*time fixed effects. 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. Nondiversified banks reduce loan volume persistently. Similar to Panel 3a, loan supply follows a similar trend for both bank types prior to the crisis. After absorbing any changes in unobservable firm characteristics, Panel 3b illustrates the stabilizing effect of geographic diversification on loan supply.

At the firm level, we can no longer control for credit demand through firm*time fixed effects. Instead, we use country*industry*year fixed effects and implicitly assume that firms within the same country-industry-year pair change demand across lenders similarly. To verify this assumption, column (3) estimates bank-firm-level regressions with country*industry*year fixed effects. Comparing coefficients with column (2), the coefficient of interest has the same sign and significance, but is larger in magnitude in column (3). Controlling for time-varying industry demand leads to an overestimation of the effect by about 25%. The increase in the coefficient size suggests that within four-digit industries there is heterogeneity in loan demand. We therefore interpret our firm-level results as an upper bound of the true effect.

Firm*year fixed effects control for loan demand. However, it could still be the case that diversified banks fundamentally differ from concentrated banks. Table 2, Panel (b), shows that diversified banks are larger and rely more on wholesale funding. To account for observable and unobservable differences across banks that could be related to diversification, in columns (4)–(6) we include bank balance sheet items and bank*year fixed effects. In column (4), we

Table 5
Diversified banks supply more credit during local crises.

dep. var.:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	log(loan vol)						Δ vol	
banking crisis (BC)	0.011							
	(0.011)							
diversification (DIV)	0.321*	−0.021	−0.020	0.059				
	(0.191)	(0.062)	(0.070)	(0.101)				
DIV × BC	0.287***	0.158***	0.223***	0.187***	0.247***	0.176**	0.295***	0.275***
	(0.025)	(0.016)	(0.017)	(0.053)	(0.073)	(0.086)	(0.082)	(0.082)
log(assets) × BC						0.018		0.000
						(0.011)		(0.011)
WS deposits × BC						0.133***		0.039
						(0.043)		(0.046)
Tier 1 capital ratio × BC						0.001		0.000
						(0.001)		(0.002)
leverage ratio × BC						0.007		−0.001
						(0.006)		(0.007)
return on equity × BC						−0.000		0.000
						(0.000)		(0.000)
Observations	1,621,124	1,621,124	1,621,124	393,763	393,760	393,760	485,107	485,107
R-squared	0.955	0.977	0.966	0.979	0.979	0.979	0.851	0.851
Firm*Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm*Year FE	–	Yes	–	Yes	Yes	Yes	Yes	Yes
Country*Industry*Year FE	–	–	Yes	–	–	–	–	–
Bank*Year FE	–	–	–	–	Yes	Yes	Yes	Yes

This table reports results at the bank-firm-year (loan) level. The dependent variable is log of total outstanding loan volume in columns (1)–(6). *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' geographic diversification across borrower countries, as defined in Eq. (1). Columns (1)–(6) add different layers of fixed effects and bank controls interacted with the banking crisis dummy *BC*. Column (1) uses bank*firm fixed effects, column (2) adds firm country*firm industry*year fixed effects, and column (3) adds firm*time fixed effects. Columns (4)–(8) restrict the sample to the matched Dealscan-Bankscope sample. Column (4) uses bank*firm and firm*time fixed effects, column (5) adds bank*year fixed effects, and column (6) adds additional interaction terms of *banking crisis* with a set of bank balance sheet items. Columns (7) and (8) are analogous to columns (5) and (6), but use loan growth along the extensive margin as the dependent variable. This definition bounds growth rates to lie in $[-2, 2]$, where a value of -2 implies that a bank terminated a relationship with a borrower, and a value of 2 that it formed a new one. Standard errors are clustered at the firm-country level. The sample period is 1995–2012. Values in parentheses denote standard errors. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

estimate our baseline regression on the reduced sample of banks that we matched to Bankscope. Although the decline in sample size is sizeable, the estimated coefficients in column (4) are similar in sign, size, and significance to the full sample in column (2). In column (5) we include bank*year fixed effects in addition to bank*firm and firm*year fixed effects to control for unobservable time-varying bank characteristics, for example bank size, risk-taking, capital, or bank nationality. Column (5) thus compares lending by the *same* bank to the *same* firm during a crisis at different levels of diversification, holding all unobservable bank characteristics constant. Compared to column (4), the coefficient of interest increases in magnitude (the coefficient on diversification is now absorbed by fixed effects). Increasing diversification by one standard deviation during a banking crisis increases loan volume by 7.6%, suggesting that the positive effect of diversification is not explained by unobservable bank characteristics.

While the positive and significant coefficient on *DIV* × *BC* suggests that bank diversification has a positive effect on loan supply conditional on bank covariates, bank characteristics could still have a differential *marginal* effect during crises. We thus include bank balance sheet items interacted with the banking crisis dummy *BC* in column (6). The coefficient on *DIV* × *BC* remains positive and significant, but declines in magnitude compared to column (5). While banks with a higher share of wholesale deposits also exhibit significantly higher loan supply during local crises, diversification maintains its statistically and economically significant effect. We thus conclude from columns (1)–(6) that the stabilizing effect of diversified banks is due neither to borrower loan demand effects, nor explained by time-varying unobservable bank characteristics, and is robust to controlling for the marginal effect of major bank balance sheet variables during local banking crises.

Finally, columns (7) and (8) repeat the estimation in columns (5) and (6), but use the growth rate in lending as the dependent variable. We find a strong and significant positive effect of bank diversification on bank loan growth in both specifications.[10] All in all, results in Table 5 show that diversified banks sustain a higher loan supply during crisis times, relative to banks with a concentrated loan portfolio.

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. To examine whether credit supply shocks have real effects, we aggregate to the firm-year level. Table 6 shows results for regression Eq. (4).

[10] To account for the extensive margin, i.e., the beginning and end of bank-firm relationships, we standardize the change in lending by its respective mid-points $\Delta vol_{b,f,t} = \frac{vol_{b,f,t} - vol_{b,f,t-1}}{vol_{b,f,t} + vol_{b,f,t-1}} \times 2$. This definition bounds growth rates to lie in the interval $[-2, 2]$. A value of -2 implies that a bank terminated a relationship with a borrower and 2 that it formed a new one.

Table 6
Firms exposed to diversified banks grow faster during crises.

dep. var.:	(1)	(2)	(3)	(4)	(5)	(6)
	Δ loan volume			Δ long-term debt	Δ employment	Δ investment
banking crisis	−0.142***					
	(0.006)					
exposure	−0.475***	−0.185***	−0.182***	−0.261***	−0.074***	−0.163***
	(0.019)	(0.021)	(0.022)	(0.049)	(0.014)	(0.038)
exposure × BC	0.055***	0.050***	0.039**	0.105*	0.029**	0.119***
	(0.014)	(0.017)	(0.019)	(0.057)	(0.014)	(0.042)
Observations	196,337	196,337	196,038	49,340	47,496	51,845
R-squared	0.138	0.172	0.317	0.233	0.349	0.231
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Country*Year FE	–	Yes	–	Yes	Yes	Yes
Country*Industry*Year FE	–	–	Yes	–	–	–

This table reports results at the firm-year (firm) level. In columns (1)–(3), the dependent variable is log difference of firms' total outstanding loan volume. In columns (4)–(6), the dependent variable is the 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, as defined in (2). Columns (1)–(3) add different layers of fixed effects. Column (1) uses firm fixed effects, column (2) firm and firm country*year fixed effects, and column (3) firm and firm country*firm industry*year fixed effects. Columns (4)–(6) use firm and firm country*year fixed effects. Standard errors are clustered at the firm level. The sample period is 1995–2012. Values in parentheses denote standard errors. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Firms with higher exposure to diversified banks fare better during banking crises, relative to firms with low exposure.

Columns (1)–(3) use the log difference in syndicated loan volume $\Delta loan_{f,t}$ as the dependent variable. Column (1) controls for unobservable time-invariant firm characteristics through firm fixed effects. In line with expectations, the coefficient on *exposure* is negative, because diversified banks lend predominately to larger firms in developed economies that 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 the 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 at the country*year level, and column (3) at the more granular country*industry*year level. 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 the 75th percentile in terms of exposure to diversified banks leads to 1.5% higher loan growth during crises. Average loan growth equals 3.6%, so the positive effect of borrowing from diversified banks is sizeable. The effect at the firm level is similar in size to effects on the bank-firm level. This suggests that frictions keep firms from switching across lenders during recessions, a common finding in the literature (Ongena and Smith, 2001; Chodorow-Reich, 2014).

In columns (4)–(6) we restrict our sample to firms for which we have balance sheet information. We use long-term debt, employment, and investment as dependent variables (all in log differences). For each dependent variable, we run a specification with firm fixed effects, time-varying firm controls and time-varying fixed effects at the country*year level. We consistently find that firms borrowing from diversified banks have significantly higher growth rates during crises. Moving borrowers from the 25th to 75th percentile in terms of exposure to diversified banks leads to higher long-term debt (4.1%, column (4)), employment (1.1%, column (5)), and investment growth (4.6%, column (6)) during crises. Similar to loan growth in columns (1)–(3), growth rates are lower for high-exposure borrowers in normal times and fall during banking crises.

Our loan- and firm-level findings show that firms can at most imperfectly substitute declines in syndicated lending with other forms of funding, for example nonsyndicated credit or corporate bonds. The positive effects of exposure on investment and employment additionally indicate that bank diversification and higher loan supply have real effects. In sum, Table 6 establishes that changes on the syndicated loan market have economic consequences that cannot be undone through other forms of credit. Borrowing from diversified banks significantly increases firms' loan growth during times of local financial distress.

3.2. Mechanism

We argue that geographic diversification across countries gives banks better access to new funding, for example to wholesale deposits, during local shocks in one of their borrower countries. Our argument is based on recent literature that causally shows that diversified banks have lower risk, because geographic expansion reduces exposure to idiosyncratic local shocks (Goetz et al., 2016). Better diversification and lower risk improve access to funding, especially during crises times (Levine et al., 2020).[11] In this section, we provide evidence that banks that are geographically diversified across countries are financially less constrained during local shocks. We first show direct evidence for the subset of banks that borrow on the syndicated loan market, as well as for banks for which we have balance sheet

[11] Related papers show that banks use their internal capital market to distribute resources among affiliates to smooth local shocks. See for example Goldberg (2009), Cetorelli and Goldberg (2012), Buch and Goldberg (2015), Coleman et al. (2017), and Cortés and Strahan (2017).

Table 7
Diversified banks can raise new funding during crises.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Dealscan				Bankscope			
dep. var.:	Δ loan vol	P(increase)	Δ loan vol	P(increase)	Δ WS dep	Δ WS dep (share)	Δ WS dep	Δ WS dep (share)
loans in crisis (dummy)	−0.145**	−0.151	−0.103	−0.134	−0.268**	−0.141	−0.274***	−0.149
	(0.065)	(0.109)	(0.074)	(0.109)	(0.115)	(0.172)	(0.102)	(0.163)
Diversification (DIV)	−0.298	−0.140	−0.373*	−0.219	−0.478***	−0.361	−0.402***	−0.279
	(0.219)	(0.251)	(0.225)	(0.258)	(0.157)	(0.236)	(0.140)	(0.223)
DIV × loans in crisis (dummy)	0.337***	0.420**	0.271**	0.408**	0.402***	0.202	0.425***	0.232*
	(0.121)	(0.181)	(0.132)	(0.185)	(0.088)	(0.132)	(0.079)	(0.126)
Observations	2694	2694	2694	2694	704	704	704	704
R-squared	0.567	0.628	0.589	0.638	0.459	0.378	0.573	0.447
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country*Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Size*Year FE	–	–	Yes	Yes	–	–	–	-
Bank Controls	–	–	–	–	–	–	Yes	Yes

This table reports results at the bank-year level for banks covered in Dealscan and Bankscope. The dependent variables are log differences in bank-to-bank syndicated loans in columns (1) and (3) and a dummy with value one if banks see an increase in loan volume in columns (2) and (4) and the change in wholesale deposits (absolute or as share of total deposits) in columns (5)–(8). *loans in crisis* is a dummy if banks have a positive share of loans extended to countries with a banking crisis, as defined in Laeven and Valencia (2013); *diversification (DIV)* is banks' geographic diversification across borrower countries. All regressions include bank fixed effects and bank-country*year fixed effects. Columns (3) and (4) additionally include bank size*year level fixed effects (bank size is defined as quintiles of total bank loan volume in a given year). Regressions in columns (7)–(8) include *log(assets), Tier 1 capital ratio*, and *return on equity* as bank controls. Standard errors are clustered at the bank level. The sample period is 1995 to 2012. Values in parentheses denote standard errors. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

data. We then report indirect evidence for the full sample of banks that lend in our syndicated loan market sample.

To shed light on banks' liability side, we analyze bank *borrowing* on the syndicated loan market. First, for all financial institutions (SIC codes 6000–6199, 35,876 loans) that borrow on the syndicated loan market, we construct the yearly log-change in banks' syndicated borrowing in a given year. We compute bank b's interbank borrowing from lenders $l \in L$ in year t as $interbank_{b,t} = \sum_{l=1}^{L} loan_{b,l,t}$. This provides us with a sample of 351 banks and 2964 bank-year observations across 53 countries. Second, we use our matched Dealscan-Bankscope sample of 130 banks and the change in absolute (or share over total) wholesale deposits as the dependent variable (704 bank-year observations, 23 countries). To see whether host country shocks lead to an increase in deposits for diversified banks, we then regress banks' interbank borrowing or wholesale deposit growth on their diversification (*DIV*), interacted with a dummy equal to one if at least one borrower country is in crisis (*loans in crisis*):

$$\Delta y_{b,t} = \gamma_1\ loans\ in\ crisis_{b,t} + \gamma_2\ diversification_{b,t-1} + \gamma_3\ loans\ in\ crisis_{b,t} \times diversification_{b,t-1} + \phi_b + \tau_t + u_{b,t}. \quad (5)$$

Regressions include bank and bank country*year fixed effects. The latter control for changes in economic conditions in banks' home countries, since we want to isolate the effect of host country financial shocks. We additionally control for bank size, Tier 1 capital ratio, and return on equity in Bankscope regressions. If diversified banks can tap new funds during times of distress, we expect a positive effect of diversification on interbank borrowing and wholesale deposits ($\gamma_3 > 0$). We cluster standard errors at the bank level.

Table 7 shows that diversified banks see a relative increase in interbank borrowing if there is a crisis in a borrower country. For the Dealscan sample, column (1) shows that, for the average bank, interbank (syndicated) borrowing falls during crises. This could reflect that depositors question liquidity or solvency of the bank when parts of its loans are in distress. Looking at interaction terms, we find that diversified banks strongly increase their borrowing during crises. Increasing diversification by one standard deviation leads to an increase in syndicated borrowing of 10.4%. Thus, diversified banks raise new funds in the interbank market when faced with a shock in borrowing countries. The same is true when we replace the dependent variable with a dummy that takes a value of one if a bank sees an increase in total bank-borrowing in a given year (column (2)). To control for unobservable bank characteristics and unobservable shocks to banks' home countries, each regression in columns (1)–(4) includes bank and bank country*year fixed effects. Since Dealscan does not provide balance sheet data, we strengthen identification in columns (3)–(4) by adding fixed effects at the bank size*year level (bank size is defined as quintiles of total bank loan volume in a given year) to better control for unobservable differences across banks of different size. Results narrow slightly in magnitude, but coefficients of interest remain significant at the 5% level.

For the Bankscope subsample, columns (5) and (7) use the change in total bank wholesale deposits as the dependent variable, and columns (6) and (8) the change in the share of wholesale deposits (over total deposits). All specifications use bank and bank country*year fixed effects; columns (7)–(8) add bank controls. Across specifications, diversification has a positive effect on wholesale funding during crises. In column (6), a one-standard-deviation increase in diversification raises the share of wholesale deposits by around 6.3 percentage points. The strong positive

effect of diversification on deposit growth supports the hypothesis that diversified banks can raise new funds during times of distress. All in all, Table 7 provides evidence that diversified banks can raise new funds in the interbank market to maintain lending during local shocks.

Table 7 uses data for a subset of banks to provide direct support for the mechanism. We now use data on the universe of banks extending loans (to nonfinancial borrowers) in the syndicated loan market to further investigate the importance of geographic diversification for access to funding. If banks are financially constrained, they cannot raise new funds when facing a negative shock (Stein, 1997). 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. This is not the case if unconstrained banks can raise new funds, as suggested by results in Table 7. By analyzing changes in loan supply in connected countries, we can provide indirect evidence on banks' access to new funds for *all* banks in our sample.

For illustration, 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 to stabilize lending in Germany while maintaining loan supply in France? The answer to the question has important implications, as the former implies spillover effects to unaffected markets, while the latter does not. To measure spillover effects, we aggregate the data to the bank-borrower country-year level. We define the dummy variable $connected_{b,k,t}$ that equals one for all noncrisis countries k ($\neq j$) in year t, to which bank b is lending in t, if at least one other borrower country j of bank b experiences a banking crisis in t. The coefficient on *connected* shows how bank b, in response to a crisis in j, changes its lending to all *connected countries* k that do not experience a crisis themselves (Giroud and Mueller, 2015; 2019). For example, for a bank that lends to Germany, France, and Italy, but only Germany experiences a crisis in 2005, *connected* takes a value of one for France and Italy in 2005, and zero otherwise. We run regressions of the following form:

$$\begin{aligned}\Delta loan_{b,j,t} = \; & \phi_{b,j} + \tau_t + \rho_1 \, BC_{j,t} \\ & + \rho_2 \, connected_{b,k,t} + \rho_3 \, DIV_{b,t-1} + \rho_4 \, DIV_{b,t-1} \\ & \times BC_{j,t} + \rho_5 \, DIV_{b,t-1} \times connected_{b,k,t} + u_{b,j,t}, \end{aligned} \quad (6)$$

where the dependent variable is loan growth by bank b to all borrowers in country j at t in log differences. *DIV* is our diversification metric at 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 $\rho_2 < 0$.[12] 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 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 new financing during host market shocks. We cluster standard errors at the borrower country (treatment) level to account for cross-sectional dependence across borrowers.

Table 8 shows that globally diversified banks have higher loan growth in crisis countries, and shield connected countries from spillovers. Column (1) reports a negative and significant coefficient on *banking crisis (BC)* which implies that banks reduce lending by 12.3% in affected countries. The negative coefficient on *connected* shows that banks reduce lending by 7% in unaffected countries when another borrowing country experiences a banking crisis. The spillover effect is about two-thirds the size of the coefficient on *banking crisis*. 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 –7% to almost zero. Fully diversified banks are thus able to offset the crisis-induced decline in loan supply both in affected and connected countries. When we control for unobservable characteristics at the borrower country level by including borrower country*year fixed effects in column (2), coefficients decline somewhat in magnitude, but remain qualitatively close to column (1). Effects remain highly significant.

Our argument rests on the assumption that a diversified loan portfolio insures against local crises, so that diversified banks are financially less constrained. To provide further evidence on the mechanism, columns (3)–(6) show that diversification is no longer stabilizing when a significant share of banks' total loan portfolio is in distress. For each bank, we first compute its yearly share of loans extended to borrowers in countries with a banking crisis. We then define *low distress* as bank-year observations for which the share is below the yearly median (i.e., only a small share of banks' total loan portfolio is in distress), and *high distress* those for which it is above (i.e., a large share of banks' asset side is subject to a shock). Results show that diversified banks stabilize lending in crisis countries and connected countries during periods of low distress, i.e., when they are expected to be financially unconstrained (column (3)). During high distress in column (4), there is no stabilizing effect, in line with the hypothesis that financial constraints bind also for diversified banks during "global shocks". As an alternative, we split the sample by the yearly median according to the share of banks' borrower countries in crisis (out of total bank borrower countries). *few (many) crises* denotes bank-year observations for which a small (large) fraction of borrower countries experience a crisis.[13] Results in columns (5)–(6) are similar to those in columns (3)–(4). Diversification is stabilizing

[12] Since we use bank-country-year-level data, note that, for connected countries k, coefficients ρ_2 and ρ_5 reflect the effect on changes in loans by bank b to country k, so $\Delta loan_{b,k,t}$.

[13] Note that in column (4), we restrict the sample to banks with at least some loans under distress. Hence, *banking crisis* always has a value of one and connected value zero, so the coefficients on *diversification, BC*, and

Table 8
Diversified banks mitigate spillover effects.

	(1)	(2)	(3)	(4)	(5)	(6)
			low distress	high distress	few crises	many crises
dep. var.:			Δ loan vol.			
banking crisis (BC)	−0.123***					
	(0.025)					
connected	−0.070***	−0.039***	0.012		0.006	
	(0.016)	(0.013)	(0.011)		(0.014)	
diversification (DIV)	−0.093***	−0.091***	−0.054***		−0.034**	
	(0.020)	(0.017)	(0.014)		(0.014)	
DIV × BC	0.113***	0.039	0.035*	−0.077**	0.055*	−0.072**
	(0.038)	(0.030)	(0.020)	(0.038)	(0.030)	(0.030)
DIV × connected	0.073***	0.053***	0.040**	−0.047	0.034*	−0.065*
	(0.023)	(0.019)	(0.017)	(0.042)	(0.020)	(0.034)
Observations	180,115	180,115	108,545	70,603	108,935	70,180
R-squared	0.120	0.200	0.201	0.310	0.210	0.293
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	–	–	–	–	–
Borrower Country*Year FE	–	Yes	Yes	Yes	Yes	Yes

This table reports results at the bank-firm country-year level. The dependent variable is the log difference 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); and *diversification (DIV)* is banks' geographic diversification across borrower countries, as defined in Eq. (1). *connected* is a dummy with value one for all countries *k* connected to bank *b* that have no contemporaneous banking crisis when *j* has a crisis. *low distress* denotes bank-year observations for which banks' share of loans (out of total bank loans) extended to borrowers in crisis countries is below the yearly median, *high distress* those for which it is above. *few (many) crises* denotes bank-year observations for which banks' share of borrower countries in crisis (out of total bank borrower countries) is below (above) the yearly median. All regressions include bank fixed effects. Column (1) includes year fixed effects, columns (2)–(6) borrower-country*year fixed effects. Standard errors are clustered at the firm country-year level. The sample period is 1995–2012. Values in parentheses denote standard errors. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

during "local crises", but no longer provides benefits during crises that affect a significant share of banks' borrower countries.

Table 8 suggests that there is a difference between *within-country* and *across-country* diversification. We analyze systemic banking crises, i.e., crises that affect a whole country. Diversification *within* one country provides insurance against idiosyncratic local shocks in a given country. It does not provide insurance against a countrywide (systemic) shock. Instead, diversification *across* countries provides insurance even during local systemic crises, as long as only a modest share of banks' host markets is hit by shocks. However, the larger the fraction of borrower markets in distress, the lower the benefits of diversification across countries. We interpret our results in Tables 7 and 8 as evidence that being geographically diversified allows banks to tap into new funds during crises, which reduces the need to withdraw capital from other markets. The ability to raise new funds stabilizes banks' loan growth in the crisis country, but also shields connected markets from negative spillovers.

3.3. Bond diversification

We construct bank diversification based on the allocation of banks' international syndicated loan portfolio and provide evidence that the diversification of a bank's assets allows it to raise funding during local shocks. However, banks are diversified not only on their asset side, but also on their liability side. For example, many banks issue bonds in several financial centers. To investigate how diversification based on syndicated loan market data relates to banks' liability diversification, we collect data on banks' bond issuance across financial centers (provided by Dealogic). Starting from the universe of bonds issued by banks over our sample period (171,672 observations), we construct each bank's outstanding bond issuance as a stock variable, and keep each bond active until it matures (analogous to our deal data). We then aggregate all outstanding bonds to the bank-financial center-year level to obtain the volume of bonds issued by (parent) bank *b* in financial center *c* in year *t*, which we define as a bond observation. Financial center refers to the listing location of the bond. Analogous to *diversification* in Eq. (1), we define banks' *diversification (bonds)* as one minus the Herfindahl index based on the share of a bank's bonds that are issued in each financial center, lagged by one period. We further extract the first principal component (FPC) of both diversification measures, thereby trying to capture an underlying pattern of diversification that is not fully captured by either measure alone. We end up with 121 unique banks and 808,307 bank-firm-year observations.[14]

Table 9, columns (1)–(4), show results for the baseline bank-firm-level regression Eq. (3), with log loan volume as the dependent variable, but for the reduced sample of banks active in Dealogic and Dealscan. All columns include bank*firm and firm*time fixed effects. Column (1) shows

connected are no longer separately identified. The correlation between our distress and crisis dummies is 0.73.

[14] The Online Appendix provides further details. Diversification averages 0.58 based on syndicated loans and 0.33 for diversification based on bond issuance. The correlation between both metrics is 0.20 and highly significant. Despite this positive correlation, around 20% of all bank-year observations have zero bond diversification, but positive diversification based on syndicated loans. In other words, many banks are diversified on their asset side even if they issue bonds in only one financial center.

Table 9
Bond diversification.

dep. var.:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	log(loan vol)				Δ loan volume			
diversification (DIV)	−0.110		−0.110					
	(0.115)		(0.117)					
DIV × BC	0.130***		0.098***					
	(0.016)		(0.030)					
diversification (bonds)		−0.106***	−0.082**					
		(0.033)	(0.033)					
DIV (bonds) × BC		0.068*	0.046					
		(0.034)	(0.042)					
diversification (FPC)				−0.163***				
				(0.056)				
DIV (FPC) × BC				0.125***				
				(0.018)				
exposure					−0.213***		−0.183***	
					(0.040)		(0.041)	
exposure × BC					0.122***		0.095***	
					(0.030)		(0.033)	
exposure (bonds)						−0.130***	−0.082***	
						(0.028)	(0.030)	
exposure (bonds) × BC						0.060	0.018	
						(0.041)	(0.043)	
exposure (FPC)								−0.097***
								(0.029)
exposure (FPC) × BC								0.079**
								(0.032)
Observations	808,307	808,307	808,307	808,307	90,993	90,993	90,993	90,993
R-squared	0.961	0.961	0.961	0.961	0.193	0.193	0.194	0.193
Firm*Bank FE	Yes	Yes	Yes	Yes	–	–	–	–
Firm*Year FE	Yes	Yes	Yes	Yes	–	–	–	–
Firm FE	–	–	–	–	Yes	Yes	Yes	Yes
Country*Year FE	–	–	–	–	Yes	Yes	Yes	Yes

Columns (1)–(4) report results at 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' geographic diversification across borrower countries, as defined in Eq. (1); *diversification (bonds)* denotes bank diversification based on the issuance of bank bonds across financial centers; *diversification (FPC)* denotes the first principal component of *diversification (DIV)* and *diversification (bonds)*. All regressions include firm*bank and firm*year fixed effects and cluster standard errors at the firm-country level. Columns (5)–(8) report results at the firm-year (firm) level. The dependent variable is the log difference of firms' total outstanding loan volume. *exposure* is firm exposure to diversified banks, as defined in Eq. (2); *exposure (bonds)* is firm exposure to diversified banks, based on *diversification (bonds)*; and *exposure (FPC)* is firms' exposure to diversified banks, based on *diversification (FPC)*. All regressions include firm and firm country*year fixed effects and cluster standard errors at the firm level. The sample period is 1995–2012. Values in parentheses denote standard errors. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

that diversification based on syndicated lending has a positive effect on loan supply during banking crises also in the reduced sample (significant at the 1% level). Column (2) shows that the same is true for banks with a more diversified bond portfolio: they supply more credit during local shocks to borrower countries. The effect is significant at the 10% level. Column (3) presents a horse race of the two metrics. While the interaction term of *banking crisis* and *diversification (bond)* enters with a positive sign, but insignificantly, the interaction term of *banking crisis* and *diversification (DIV)* remains highly significant and positive. The latter coefficient is around twice as large as the coefficient on bond diversification. Finally, column (4) uses the first principal component of both measures (*diversification (FPC)*). The interaction term of *banking crisis* and *diversification (FPC)* is positive and significant at the 1% level. In terms of magnitude, the coefficient in column (4) is similar to column (1) on diversification alone.

To investigate whether bank diversification matters at the firm level, columns (5)–(8) show results for the baseline firm level regression Eq. (4), with the log difference of firms' loan volume as the dependent variable. We compute firm exposure based on Eq. (2) for the alternative measures of bank diversification (syndicated loans, bonds, and FPC), based on the matched sample. All regressions include firm and country*year fixed effects. Similar to columns (1)–(4), firms with higher exposure to diversified banks see higher loan growth during banking crises. The effect is significant at the 1% level for exposure based on syndicated loans (column (5)), but insignificant for exposure based on banks' bond diversification (column (6)). The same picture emerges in a horse race in column (7). Finally, column (8) shows that firms with higher exposure based on the first principal component of both diversification measures see significantly higher loan growth during banking crises. All in all, results in Table 9 suggest that both measures capture a common underlying dimension: the overall diversification of a bank's business activities.

It is important to note that a conceptual difference underlies the construction of both measures: Local shocks to borrower countries affect local borrowers. Higher diversification on the asset side provides insurance against these idiosyncratic local shocks and allows diversified banks to maintain lending. However, local shocks to borrower coun-

Table 10
Foreign banks and local affiliates.

	(1)	(2)	(3)	(4)	(5)	(6)
		foreign			affiliate	
dep. var.:			log(loan vol)			
diversification (DIV)		−0.005	0.001		0.001	−0.020
		(0.053)	(0.046)		(0.052)	(0.044)
DIV × BC		0.082***	0.079***		0.043**	0.057
		(0.029)	(0.016)		(0.017)	(0.040)
foreign bank × BC	−0.016	−0.044**	−0.017*			
	(0.017)	(0.020)	(0.009)			
DIV × foreign bank			0.006			
			(0.019)			
DIV × foreign bank × BC			−0.047***			
			(0.011)			
local affiliate × BC				0.054***	0.056***	0.067**
				(0.014)	(0.014)	(0.031)
DIV × local affiliate						0.028
						(0.066)
DIV × local affiliate × BC						−0.017
						(0.036)
Observations	1,656,881	1,656,881	1,656,881	1,656,881	1,656,881	1,656,881
R-squared	0.976	0.976	0.976	0.976	0.976	0.976
Firm*Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm*Year FE	Yes	Yes	Yes	Yes	Yes	Yes

This table reports results at the bank-firm-year (loan) level. The dependent variable is the 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); and *diversification (DIV)* is banks' geographic diversification across borrower countries, as defined in Eq. (1). *foreign bank* is a dummy with value one if bank country and firm country differ. *local affiliate* is a dummy with value one if a bank has an affiliate in the borrower country. All regressions include firm*bank and firm*year fixed effects. As nationality is constant within firm-bank connections, the coefficient on foreign bank is absorbed by fixed effects. Standard errors are clustered at the firm-country level. The sample period is 1995–2012. Values in parentheses denote standard errors. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

tries do not necessarily affect the buyers of bonds. The reason is that investors buying bonds in a given listing place need not be located in the location of the listing place. This conceptual difference could explain why diversification based on bond issuance is statistically and economically less significant than diversification based on syndicated lending. However, the fact that both measures of diversification are strongly correlated and have a positive impact on loan supply broadens the external validity and scope of the analysis.

4. Extensions and robustness

In this section, we highlight the importance of banks' nationality and address potential alternative explanations for our findings. To ensure identification of supply effects, we run variants of bank-firm-level regression Eq. (3).

Foreign banks and local affiliates. Diversified banks lend a significant share of their loans to foreign markets. A large literature stresses that foreign and domestic banks differ during crises, which raises the concern that our classification by portfolio allocation could reflect banks' nationality (Claessens, 2017). Table 10 shows that a categorization of banks by diversification is different from a categorization by nationality. We include a *foreign bank* dummy that takes a value of one if a banks' home country differs from its host country. Column (1) shows that foreign banks reduce lending by 1.6% more than domestic banks during banking crises, but the effect is insignificant. Once we include our diversification metric in column (2), a nondiversified foreign bank significantly reduces loan supply by 4.4%. Diversified banks, on the other hand, are still stabilizing. The coefficient on $DIV \times BC$ remains positive and significant at the 1% level once we control for banks' nationality. This suggests that domestic banks with a diversified portfolio are the most stabilizing source of funding. In column (3) we interact the foreign dummy with diversification and confirm this finding. The triple-interaction effect between *diversification* and *foreign bank* during banking crises is significant and negative. The coefficient on interaction term $DIV \times BC$ ($foreign\ bank \times BC$) remains positive (negative) and significant at the 1% (10%) level. In terms of economic significance, effects differ across bank types. During banking crises, nondiversified foreign banks reduce lending by 1.7%. Domestic banks that are diversified increase their relative loan supply by 7.9%. The intermediate group of diversified foreign banks increases loan supply by 2.2%. Results in columns (1)–(3) suggest 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 relates to findings on the flight home effect (Giannetti and Laeven, 2012) and behavior of gross capital flows during crises (Broner et al., 2013; Schaz, 2019): banks protect their home markets during times of distress.

To further shed light on the role of distance and nationality, columns (4)–(6) repeat the same regressions, but replace the *foreign bank* dummy with the dummy *local affiliate*. *local affiliate* takes a value of one if a bank operates an affiliate or subsidiary in Dealscan in the borrower country, and value zero otherwise. Literature shows that local presence and distance to borrowers matter for

Table 11
Portfolio risk and alternative measures of diversification.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
dep. var.:	risk	risk	GBP	country share	industry share	firm DIV	spread
				log(loan vol)			
diversification (DIV)	−0.045	−0.043	−0.032	0.056	0.009	−0.032	0.013
	(0.064)	(0.060)	(0.076)	(0.045)	(0.066)	(0.061)	(0.009)
DIV × BC	0.165***	0.168***	0.177***	0.182***	0.148***	0.151***	0.001
	(0.011)	(0.015)	(0.025)	(0.041)	(0.015)	(0.018)	(0.004)
portfolio risk (sales) × BC	−0.015***	−0.035***					
	(0.005)	(0.010)					
DIV × portfolio risk (sales) × BC		0.046					
		(0.032)					
int. portfolio (INT)			0.031				
			(0.040)				
INT × BC			−0.016				
			(0.015)				
country share				0.278***			
				(0.064)			
BC × country share				0.008			
				(0.046)			
industry share					0.426***		
					(0.066)		
BC × industry share					−0.096***		
					(0.035)		
DIV × firm DIV						0.038	
						(0.024)	
DIV × BC × firm DIV						0.010	
						(0.024)	
Observations	1,548,327	1,548,327	1,642,260	1,642,260	1,642,260	1,642,260	1,262,046
R-squared	0.975	0.975	0.977	0.977	0.977	0.977	0.975
Firm*Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm*Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes

This table reports results at 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); and *diversification (DIV)* is banks' geographic diversification across borrower countries, as defined in Eq. (1). *portfolio risk (sales)* is banks' portfolio risk, measured as the average standard deviation of borrowers' sales growth in noncrisis times. *int. portfolio (INT)* is banks' portfolio share that is extended to foreign borrowers. *country share* denotes the share of loans by bank *b* to country *c*. *industry share* the share of loans by bank *b* to industry *i*. *firm DIV* denotes firm diversification across lenders. Column (7) uses the interest spread over LIBOR as the dependent variable. All regressions include firm*bank and firm*year fixed effects. Portfolio risk is constant at the bank level and thus absorbed by fixed effects. Standard errors are clustered at the firm-country level. The sample period is 1995–2012. Values in parentheses denote standard errors. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

lending decisions, especially during crisis times (Degryse and Ongena, 2005; De Haas and Van Lelyveld, 2014; Bolton et al., 2016). We find that banks with local affiliates behave similarly to domestic banks: Column (4) shows that banks with local affiliates stabilize lending during host market shocks, relative to banks without local affiliates. Including our diversification measure in a horse race in column (5), we find that diversification still matters for loan supply above and beyond having a local affiliate. Finally, column (6) presents a similar picture as column (3). Diversified banks are stabilizing when we control for whether they have a local affiliate in the crisis country.

Portfolio risk. Banks differ in terms of borrower risk (Neuhann and Saidi, 2018; Levine et al., 2020). If diversified banks extend loans to safer 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 noncrisis years. We consider noncrisis years only, as the stabilizing role of diversified banks during crises could lead to a downward bias in measured volatility. In our sample, firms with low exposure to diversified banks are riskier in terms of volatility of sales growth. In Table 11, column (1), we control for banks' *portfolio risk*, interacted with the *banking crisis* dummy, in column (2) we interact *portfolio risk* with *diversification* and the crisis dummy. Once we include *portfolio risk* interacted with *banking crisis* in column (1), we see that higher portfolio risk reduces loan supply during a banking crisis. However, the main coefficient of interest on *DIV* × *BC* remains positive and significant. Including a triple interaction effect in column (2) keeps the main coefficient stable. We also see that higher portfolio risk reduces loan supply for nondiversified banks. The insignificant triple interaction term indicates that portfolio risk has no differential effect through diversification. Since we absorb borrower characteristics through firm*year fixed effects, this is to be expected. We interpret this as evidence that portfolio risk is not responsible for the stabilizing effect we find.

Alternative measures of diversification. 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, we define banks' international portfolio as the ratio of the sum of all syndicated loans by bank *b* in year *t* to firms located in a different country from the bank's parent over the bank's total loans. Column (3) in Table 11 shows that diversification, not internationality, leads to positive loan

supply effects. Banks with a fully international portfolio reduce loan supply by 1.6% during crises, but the coefficient is insignificant. The positive stabilizing role of diversified banks remains. Columns (4)–(6) control for additional bank specialization metrics. Column (4) introduces banks' *country share*, i.e., the share of loans by bank b to country c in a given year t, out of bank b's total loans in year t. Similarly, column (5) adds banks' *industry share*, i.e., the share of loans by bank b to industry i in a given year t. These columns address the fact that banks might have superior knowledge in certain geographies or industries (De Jonghe et al., 2020). We find that bank diversification still significantly increases loan supply during crises. Column (6) investigates whether firm diversification matters. For each borrower, we construct a (1-Herfindahl index) of its loans (analogous to bank diversification in Eq. (1)). Firms that borrow from multiple banks to a similar extent receive a higher value. We define dummy *firm DIV* that takes on value one if a firm is in the top tercile of borrower diversification in a given year. If diversified firms borrow from diversified firms, our diversification metric reflects that borrowers can switch among lenders. When we interact *DIV* with *firm DIV* and the banking crisis dummy, we find this not to be the case: the coefficient on the triple interaction term is insignificant and close to zero, while the coefficient on $DIV \times BC$ remains positive and highly significant. Column (7) uses the interest spread in basis points as the dependent variable in regression Eq. (3). The effect of diversification on interest rates during local crises is positive, but economically and statistically insignificant. This finding suggests that banks mainly adjust loan amounts on the syndicated loan market, rather than interest rates.

Online Appendix. The Online Appendix presents extensions and further robustness checks to our baseline findings, as well as additional descriptive statistics. We show that diversification based on syndicated loans is correlated with alternative measures of diversification based on a broader array of bank activities. We further establish that our results are robust to excluding all borrowers in finance, insurance, and real estate industries, instead of excluding only nonfinancial firms. They remain robust to excluding the smallest and largest banks; including lead arrangers only; excluding loans with one lender, credit lines, or term loans; and splitting loan shares based on imputation instead of pro rata. We further show that, while diversification affects quantities, its effect on loan maturity is negligible once we control for lender and borrower characteristics. Finally, we show that the significance of our results is insensitive to different levels of clustering.

5. Conclusion

We develop a metric to categorize a large sample of banks according to the geographic diversification of their international syndicated loan portfolio. We establish 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. Our results show that diversification allows banks to raise new funds during times of distress. This not only stabilizes loan supply in affected countries, but also reduces spillover effects to connected markets.

Contrasting our measure with the standard classification by nationality, we find that diversified domestic banks are the most resilient source of financing, while foreign banks provide no insurance. The negative effect of foreign banks increases with the concentration of their portfolio. We also exclude alternative explanations: geographic diversification remains a significant factor contributing to higher stability in lending even after we control for banks' international orientation, industry specialization, or portfolio risk.

This paper contributes to the debate on the costs and benefits of financial integration and bank diversification.[15] Bank diversification based on syndicated lending declined during the Great Financial Crisis and remained depressed thereafter. Our results suggest that the recent retrenchment in financial integration following the crisis is worrisome. While cross-border lending constitutes a potential source of contagion, our findings show that internationally active and geographically diversified banks increase resilience against local shocks.

Supplementary material

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.jfineco.2021.02.004

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[15] A related literature shows that diversification can intensify agency frictions within banks and lower loan quality (Laeven and Levine, 2007; Goetz et al., 2013). While our paper investigates the effects of diversification on loan supply (and not on loan quality), our results suggest that, at least during crises times, diversification enables banks to raise additional funding that they then use to supply additional credit to borrowers.

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